Equity Gilt Study 2015

“If you would be wealthy,
think of saving as well as getting”
Benjamin Franklin

“Save a little money at the end of each month and at the
end of the year you’ll be surprised at how little you have”
Ernest Haskins

“It is a mistake to try to look too far ahead. The chain
of destiny can only be grasped one link at a time”
Winston Churchill

"The art of being wise is the art
of knowing what to overlook"
William James

“Facts are stubborn things, but statistics are more pliable”
Mark Twain

"If you can find a path with no obstacles,
it probably doesn't lead anywhere"
Frank A Clark

“Nothing in life is to be feared, it is only to be understood.”
Marie Curie

Equity Gilt Study: 60th edition

This year marks the 60th anniversary of the *Equity Gilt Study*. The publication was initially intended to provide consistent data and analysis on long-term asset returns in the UK and the US. The UK data go back to 1899, while the US data – provided by the Centre for Research in Security Prices at the University of Chicago – begin in 1925. Over the years, the *Equity Gilt Study* has evolved also to provide in-depth analysis of medium- and long-term economic and market issues across regions and asset classes. This year's edition is richer than ever, building on themes we have addressed in the past, such as demographics and long-term dynamics in interest rates and returns on emerging markets assets, as well as introducing new themes, such as the impact and future of oil prices and the rise of India.

Chapter 1 argues that the world is on the cusp of a demographic inflection point that stands to reverse the strong secular factors that have kept asset prices well-supported – and real interest rates correspondingly low – for the past 30 years. Since the early 1980s, demographic trends have put upward pressure on saving rates (and, by extension, asset prices), as rising old-age dependency ratios have been more than offset by a growing share of mature, high-saving workers. However, the demographic boost to saving has peaked and will turn markedly less supportive.

Chapter 2 constructs a model to assess the sustainability of lower oil prices and their effects on the global economy and markets. The medium-term drivers of the model suggest that lower oil prices are likely to persist, as will relatively lower bond yields. Demand growth is slowing, driven by energy efficiency and lower aggregate growth globally. Moreover, oil should remain a well supplied market, with US tight oil keeping OPEC in check.

Chapter 3 looks at the evolution of EM economies since the start of the boom years in the early 2000s. It argues that the external backdrop for emerging markets has grown tougher since 2011 and will likely remain so over the next few years. However, looking at EM in the context of a global portfolio, the gap between EM and DM risk premia is significant, suggesting that allocations to EM assets make sense even if asset returns are likely to be much lower than in the boom years.

Chapter 4 looks at the trends in global potential growth in the wake of severe recessions and financial crises. It shows that potential growth in developed economies has fallen by 1.5pp since 1999. The effects of the recession accounted for about two-thirds of the decline, with the remaining one-third pre-dating the global recession. Policymakers' efforts to stem the tide have been effective, but are unlikely fully to reverse the slowing in trend output growth before the end of the decade.

Chapter 5 considers the broader implications of regulatory changes intended to make future financial crises less likely. Although the actions taken to date have materially improved the safety of the banking system, they have also reduced the size of the repurchase agreement market and made fixed income markets less liquid. The reduction in the supply of short-dated safe assets has resulted in a transfer of fire-sale risk from traditional sources of liquidity to less traditional ones, exposing end-investors to run risk.

Chapter 6 looks at the remarkable turnaround in India's economy and argues that the takeoff is buoyed by multiple structural and cyclical tailwinds. Finally, Chapter 7 considers the benefits of FX hedging in international multi-asset portfolios.

We sincerely hope that you find the data and the essays interesting, as well as useful inputs to your investment decisions.

Larry Kantor
Head of Research, Barclays

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CHAPTER 1

Population dynamics and the (soon-to-be-disappearing) global 'savings glut'

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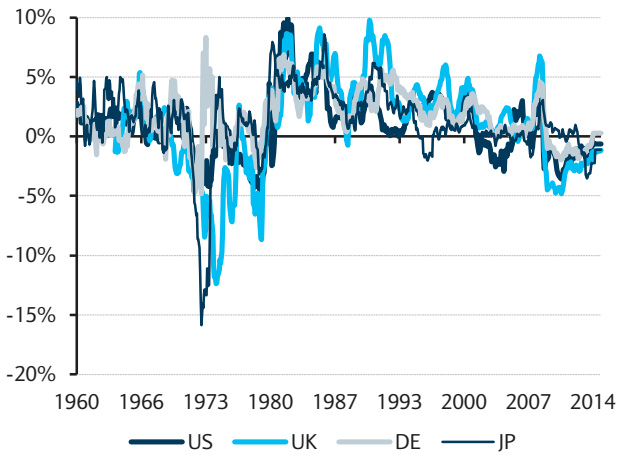
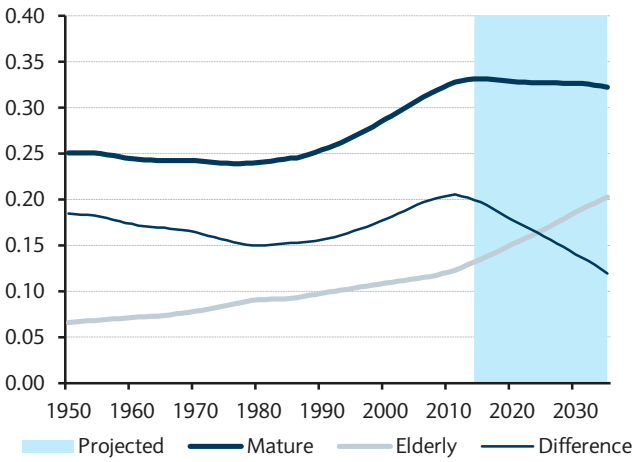
- **Transitory, loosely-speaking 'cyclical' factors are almost certainly contributing to the existing very low interest rate environment. But world interest rates have been fluctuating around a strongly declining trend for more than 30 years. It is a question of no minor significance whether asset markets will remain so well-supported – and real interest rates correspondingly depressed – in the decades ahead. Bond markets are pricing historically low real interest rates for the foreseeable future. But we think that a key secular driver of world asset markets has peaked and will be fading strongly in the years to come.**
- **While other forces have also been at work, we believe (and present some evidence) that demographic pressure on world saving has been an important secular driver of upward pressure on asset prices – and downward pressure on interest rates – in recent decades. Since the early 1980s, demographic trends have put upward pressure on saving rates (and, by extension, asset prices) in every systemically important region of the world except Japan, as rising old-age dependency ratios have been more than offset by a growing share of mature, high-saving workers.**
- **In the past 20 years, the country with the largest such shift was China, with Korea a fairly close second. This suggests that demographic pressures have been a major driver of the boom in emerging Asian, and specifically of Chinese savings.**
- **However, the world is on the cusp of a demographic inflection point. Demographic pressure on saving has peaked and is turning markedly less supportive of saving in every country or region that we examine except India, Brazil and Mexico (individually and collectively too small to offset developments in China and the advanced economies). This includes China, which has grown into an immensely important part of the global saving and investment balance. Demographics are thus likely to generate a strong secular headwind for asset prices in the coming decades, as they have generated tailwinds in the past two decades.**

FIGURE 1
Real interest rates have been trending down since the early 1980s.



Note: Short term interest rate deflated by forward 12-mo rate of CPI inflation.
Source: Barclays Research

FIGURE 2
Demographic support for saving has recently been growing since the 1980s, but is on the cusp of a profound reversal



Note: As we explain below, we use the difference between population share of mature workers (40-64) and the elderly (65+) as an indicator of demographic support for saving. The world average is weighted by 2014 GDP.
Source: Barclays Research

Markets embraced 'secular stagnation' in 2014

Although overshadowed by the oil price collapse, the 2014 bond market rally seems to have marked a fundamental rethink about the outlook for asset markets

Were it not for the historic collapse in the price of oil that began in mid-2014, the year would likely be remembered as the one in which financial markets began to price something like secular stagnation into global financial markets. In light of the cyclical headwinds that became apparent in Europe, Japan, and China during the first half of 2014, it is not surprising that the short end of many yield curves priced lower interest rates. Certainly, the 2014 rally in global bond markets has been validated by the dovish monetary policy actions of recent months, including the launch of full-blown quantitative easing by the ECB, the establishment of negative deposit rates in the euro area, Switzerland, Sweden and Denmark, and more conventional forms of easing in China, India, and many smaller economies.

What we find more striking about the 2014 bond market rally is the degree to which it extended to the long end of real interest rate curves. In the US, the 5y5y forward TIPS rate has fallen from nearly 2% at end-2013 (itself low by historical standards) to less than 0.4% in January 2015 (Figure 3). The collapse in the UK 5y5y real rate is even more extreme, leaving it at an unprecedented negative 0.7% from around 1% a year earlier and much higher in previous years.

Moreover, the collapse in forward rates has not been limited to the 5-year point. Inflation-linked swap markets are now pricing strongly negative real rates beyond 10 years in the euro area and the UK. 10-year forward real rates are positive for the US and Japan, but at historically abnormally low levels (Figure 4).

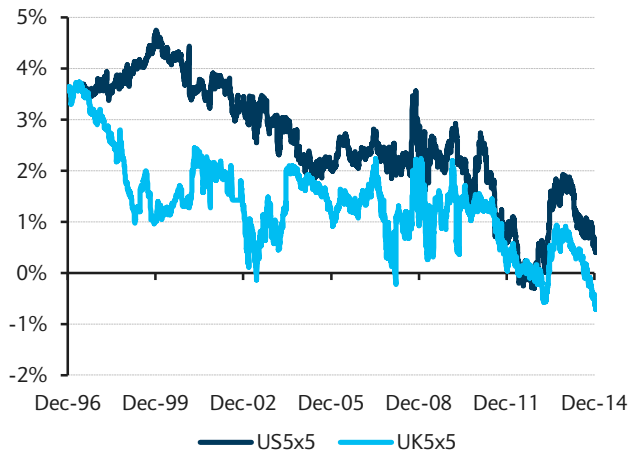
Bond markets are pricing unusually low real interest rates into the very distant future

These abnormally low forward rates likely reflect, in part, negative term-risk premia, as bond duration in the US, UK, 'core' Europe and Japan has established itself as a negative-beta, safe-haven asset class. But it seems unlikely that the term premium is sufficiently negative to generate an implied rate forecast anywhere near historically normal real interest rates. One interpretation of current bond market pricing is that participants are expressing the view that real interest rates are likely to be abnormally low for a very long time – much longer than it takes for transitory or, loosely-speaking, 'cyclical' developments to play out. In this article, we take issue with this view.

Growth and real rates – sifting cyclical from secular

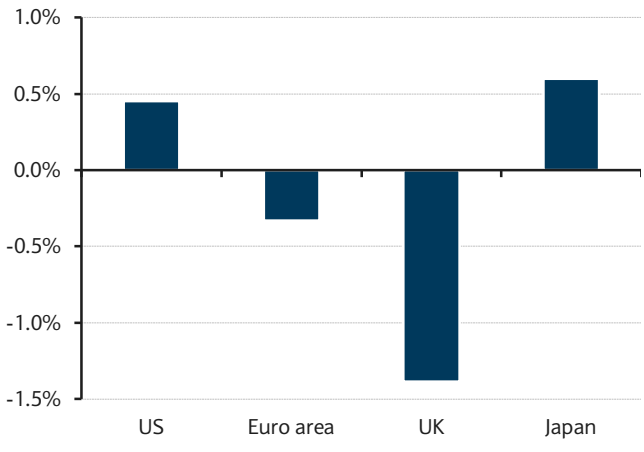
In our view, the most plausible catalysts of the 2014 bond market rally were downward revisions to growth expectations on a weather-related hitch in the US recovery, the adverse

FIGURE 3
Forward real interest rates plummeted in 2014



Note: 5y5y forward real interest rates computed from inflation-linked bond market. Click *here* to view an interactive Barclays Live Chart Source: Bloomberg, Barclays Research

FIGURE 4
10-year forward rates suggest low real rates 'forever'



Note: 10-year forward real interest rates from inflation–linked swap market. Source: Barclays Research

economic response to April's tax hike in Japan, a fading of the weak recovery that had seemed to be in place in Europe, and growing evidence that Chinese demand was decelerating faster than expected. Weak inflationary pressures likely contributed to the rally, but should probably be viewed more as a reflection of the weak cyclical context than as an independent driver.

Disappointment in 2014 global growth may have been a catalyst for the bond market rally…

However, although growth disappointed, the bottom did not fall out of the world economy in 2014. From end-2013 to the present, for example, Barclays' forecasts of 2014 and 2015 world GDP growth have fallen by 0.3pp; it would surprise us if consensus forecasts fell much further. This raises the question: Why would so modest a deceleration, which likely reflects cyclical developments, at least in part, have affected investors' assessment of the long-run outlook enough to generate such a strong bond-market response? A reasonable answer, in our view, is that the coincidence of sluggish output growth with robust labor market recoveries (in the US and UK) or stable labor markets (as in Japan and China) led investors to buy into the view that sluggish output growth in the recent economic recovery reflected a weak 'secular' outlook, attributable to some combination of demographic and productivity-related factors. For what it's worth, we have a lot of sympathy with the view that trend growth has slowed significantly in most systemically important economies, a view that is laid out in convincing detail in Gapen (2015).

If a downgrade of market participants' assessment of the secular outlook for growth was indeed a market theme in 2014, the relevant question would seem to be what sort of downgrade seems plausible and how large the impact on asset prices might be in the long run. We think this is not quite the right question, and are not going to address it here.

It is true that some basic economic theory provides reason to believe that the economic growth rate and the real interest rate are positively related, although the strength of the theoretical relationship is sensitive, in particular, to assumptions about how savings are determined. But the same theories suggest that, even if we abstract from 'cyclical' and focus on 'secular' drivers of interest rates, as we wish to do here, interest rates and asset prices are also influenced by many other factors.

But we do not think that a slowdown in trend growth provides a fully convincing explanation for low real interest rates.

Experience suggests that these other factors loom large in practice and, as a result, that the empirical relationship between economic growth and real interest rates is not strong. In two recent analyses of US economic history, for example, Bosworth (2014) found a weak link between economic growth and real interest rates, while Hansen and Seshadri (2013) found a negative long-run relationship.[1] We suspect that the intuitive presumption of a strong link between trend growth and the real interest rate is at least partly due to a failure to distinguish completely between 'cyclical', mainly demand-related, fluctuations in the rate of growth and 'secular' variations, which are longer-lasting and driven predominantly by the economy's capacity to supply output. A boom in demand will naturally elicit a rise in the rate of interest; it is far less clear that rapid trend growth in supply capacity has the same implication.

International comparisons also provide weak evidence, at best, that variations in trend growth are a powerful driver of the equilibrium real interest rate. Interest rates have (for example) been consistently high in Brazil, and low in China and Korea, even though trend growth has been substantially higher in China and Korea. The key difference, in our view, is that in Brazil, domestic saving is very low compared with underlying investment demand; in China and Korea, the opposite is true.

Thus, we think a more promising approach to understanding the outlook for real interest rates (and asset prices more broadly) is to focus on the drivers of world saving and investment. (Of course, the trend rate of growth can be introduced into this framework as one driver of saving, investment, and asset prices.) This is conventional; for example, the IMF recently adopted a broadly similar framework.[2] Our analysis differs from the IMF's in its more concentrated focus

[1] Barry Bosworth "Interest Rates and Economic Growth: Are They Related?", 2014, Brookings Institution, and Bruce Hansen and Ananth Seshadri "Uncovering the Relationship Between Real Interest Rates and Economic Growth, 2013, University of Michigan".
[2] "Perspectives on Global Real Interest Rates", in IMF *World Economic Outlook, April 2014*.

on the systemically significant economies of the world and on what we think is a particularly powerful driver of the recent and prospective savings/investment balance: the evolution of population structures globally. We think this more sharply focused discussion is warranted by the powerful and, we suspect, still under-appreciated, influence that population dynamics have had and may have on financial markets in the decades ahead.

For 30 years, an increasingly supportive demographic context has combined with other drivers to deliver ever-lower real interest rates.

This is not, of course, to suggest that demographic trends are the only relevant drivers of interest rates and asset prices. In the immediate future, the weak cyclical backdrop associated with the rebalancing in China, de-leveraging and reflation in the euro area, and still incomplete recovery from the 2008-09 financial collapse, will continue to exert a powerful influence over monetary policy and real interest rates around the world. Some longer lasting, more 'secular' drivers also point toward low interest rates, at least on high-quality, liquid, 'safe haven' assets. Indeed, we have addressed some of these drivers in recent editions of the *Equity Gilt Study*. (On the so-called 'safe asset shortage', see for example Gavin, Ghezzi, Brown and Gregory (2012) and Gapen (2013).)

But demographic support for asset markets has peaked, and demographics will turn decisively less supportive in coming decades.

But during the past 30 years, powerful demographic trends have combined with these other drivers, providing steadily increasing support for asset markets and downward pressure on interest rates. The reversal of this demographic support for saving and, by extension, asset markets is at hand. Although it will be slow-acting, we believe that the ebbing demographic tide will transform the investment landscape as powerfully as the 'global savings glut' shaped the landscape of recent decades.

Global saving and investment: The 21st century landscape

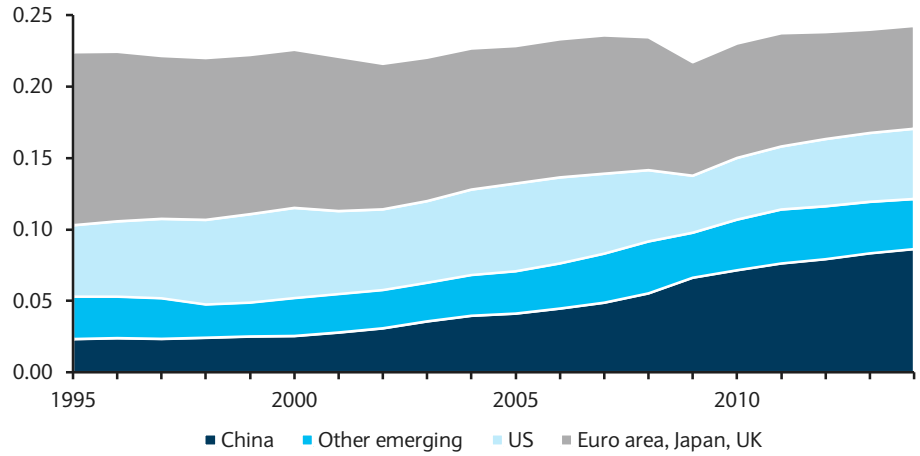
We set the stage with a quick review of global saving and investment. In the past 20 years, the economic and financial landscape has been transformed by the rise of emerging Asia, and, above all, China, as a systemically important part of the world economy. Nowhere is this more evident than in calculations of global saving and investment. The magnitude of the transformation has not lost its capacity to startle and deserves some attention.

Real investment has trended higher, driven predominantly by China

International comparisons of production and demand are complicated by index-number problems created by changes in relative prices (in this case, changes in real exchange rates and in the relative price of investment goods). In Figure 5, we construct a measure of real investment that is as closely tied to the rate of physical capital formation as we can make it.[3] This measure of real investment has risen from roughly 22% of world real GDP in 1995 to

FIGURE 5

Real investment has risen faster than real GDP in the past two decades, led by China



Note: Real investment as share of world real GDP. Source: Barclays Research

[3]We begin with real investment as published by the national statistical office, for example, bn 2005 JPY for Japan. We then transform this series into 2014 local-currency prices using the deflator for investment spending (except in China, where this is not published and we use the GDP deflator). This is a level adjustment only, and leaves growth rates unchanged. We then transform 2014 local currency data into USD using the 2014 USD exchange rate.

just over 24% in 2014. During the same period, real investment in China has increased from roughly 2.5% of world real GDP to almost 9%. In absolute terms (ie, constant 2014 USD), the two-decade expansion of real investment in China accounts for more than 60% of the growth in world investment during the same period.

It might once have been reasonable to confine an analysis of global savings and investment trends to the advanced economies, but whether one is seeking an explanation for recent developments or to make assessments of the future, this is no longer at all possible.

As investment in China has boomed, investment in the rest of the world has declined as a share of world GDP (and, in Japan, in absolute terms). This decline has been concentrated in Europe and Japan, where investment rates have fallen and economies now account for a smaller share of the world economy. Indian investment has grown rapidly, but from such a small base that it still comprises only about 1% of world GDP, substantially smaller (for example) than China's in 1995.

China has played an even more central role in the 'global saving glut'

Globally, saving is necessarily equal to investment, so it is no surprise that our measure of world saving has risen over the same period (Figure 7). Chinese savings have risen by even more than Chinese investment, as reflected in the fact that China's current account surplus (the difference between domestic saving and investment) has grown from rough balance in the late 1990s to about 2.5% of GDP in the past five years (and a peak of roughly 10% of GDP in 2007 and 2008). Meanwhile, the rate of saving in the rest of the world has declined.

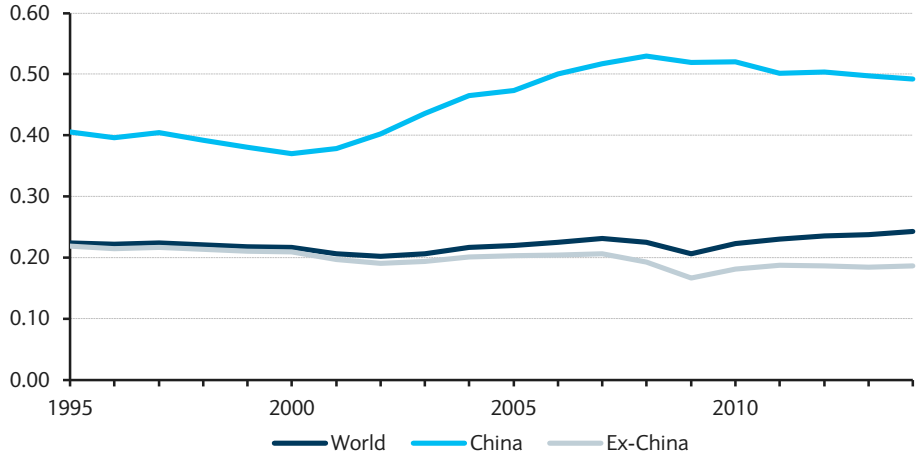
FIGURE 6

Real investment has risen strongly in the past two decades, led by China

2014 USD	1995	2000	2005	2010	2014
US	1,628	2,494	2,806	2,226	2,802
China	755	1,000	1,875	3,691	4,929
Euro area	2,221	2,717	2,825	2,743	2,579
Japan	1,172	1,121	1,069	918	1,007
UK	561	542	505	477	525
India	na	174	295	494	577
Korea	255	277	336	387	408
Brazil	212	225	231	371	371
Mexico	106	185	211	234	263
Russia	272	201	293	352	390
TOTAL	7,182	8,935	10,445	11,894	13,851
Share of world GDP	**1995**	**2000**	**2005**	**2010**	**2014**
US	5.0%	6.3%	6.1%	4.3%	4.9%
China	2.3%	2.5%	4.1%	7.1%	8.6%
Euro area	6.8%	6.9%	6.2%	5.3%	4.5%
Japan	3.6%	2.8%	2.3%	1.8%	1.8%
UK	1.7%	1.4%	1.1%	0.9%	0.9%
India	na	0.4%	0.6%	1.0%	1.0%
Korea	0.8%	0.7%	0.7%	0.7%	0.7%
Brazil	0.6%	0.6%	0.5%	0.7%	0.6%
Mexico	0.3%	0.5%	0.5%	0.5%	0.5%
Russia	0.8%	0.5%	0.6%	0.7%	0.7%
TOTAL	22.0%	22.6%	22.8%	23.0%	24.2%

Source: Haver Analytics, Barclays Research.

FIGURE 7
China's contribution to global saving has been even more significant



Note: Ratio of regional saving to regional GDP. In all cases the rate of national saving is measured as the rate of investment plus the current account surplus. Source: Barclays Research

Demographics and saving – Concepts and measurement

The hump-shaped behaviour of saving over the life cycle suggests that the national rate of saving should be correlated with age structure.

There is much that conventional models of national saving do not fully explain. But one prediction of basic 'life-cycle' theories of consumption is generally borne out by the data. This is that individual saving rates tend to be hump-shaped, rising from a fairly low level in young adulthood to a peak in late adulthood, then declining after retirement. This pattern creates a presumption that national savings rates may be correlated with the national age structure.

To explore this idea, we need to quantify the demographic structure of a population. The age composition of a population is a distribution, not a number, and for purposes of discussion or statistical analysis the distribution needs to be condensed into a reasonably compact set of numbers. This involves compromises and arguably a degree of over-simplification. Here is how we approached the problem:

We expect that mature workers save a lot, and the elderly population saves less.

The interplay between the high saving of mature workers and the lower saving of the elderly population is the central theme of this article, so we start with measures of the share of mature (presumably high-saving) workers and elderly (presumably lower-saving) people. It is conventional to identify 'the elderly' with the share of the population aged 65 and older. We adopt this conventional measure, which seems sensible and allows us to compare our results with the many other studies that include the ratio in their analysis. But we should bear in mind that the measure may be culture-bound (since not every society has a conventional retirement age of about 65) and obscures potentially important variations of saving rates within the population that we categorize as 'elderly'.[4]

We identify 'mature workers' as those aged 40-64, roughly corresponding to the second half of a typical individual's working life. This division is equally arbitrary and also obscures likely differences in saving behaviour within the categories 'young worker' and 'mature worker'. Thus, these ratios should be viewed as indicators of broad trends in population dynamics, not precise measures that capture every relevant detail of the demographic structure.

Having simplified a complex reality by focusing on these two ratios, it will be useful in much of the ensuing discussion (eg, in most of the graphical analysis that follows) to simplify it even further with a single number that summarizes the overall effect of the two interacting demographic terms. We do this as follows:

[4] For example, Poterba, Venti and Wise (2011) find that retired households tend not to draw down their housing or other assets to support consumption in the early years of retirement, and seem to do so in response to health-related shocks later in retirement.

The underlying idea is that the saving rate of economy 'i' in period 't' is something like:

$$S_{it} = a + b\,M_{it} - c\,E_{it} + other\ drivers_{it}$$

Here M_{it} is the share of mature workers and E_{it} is the share of the elderly in the population.

This bivariate approach is fine for statistical analysis of the sort that we report in the appendix. One obvious way to estimate the overall effect of the population structure on saving propensities would be to estimate the parameters 'b' and 'c' (or use estimates from existing studies, if available) and compute a synthetic measure: $D_{it} = \hat{b}\,M_{it} - \hat{c}\,E_{it}$. The problem with this is that the proposed measure of demographic pressure is too dependent on a necessarily incomplete and fallible empirical study.

For graphical analysis, we use the difference between the shares of mature workers and of the elderly in the total population.

If the coefficient 'b' is not much different from 'c', then the difference between the share of mature workers and of the elderly is a natural measure of overall demographic pressure on saving: $D_{it} = (M_{it} - E_{it})$. There is no theoretical reason to believe that this should be the case, but in our statistical analysis we find that it is a very reasonable approximation. So, in what follows, we take a two-track approach. In the scatter charts with which we illustrate relationships and in order to structure the subsequent discussion of historical and prospective trends, we use the difference between the shares of mature workers and of the elderly as a measure of overall demographic pressure on saving. In the more formal statistical work that is reported in the appendix, we analyze the separate influences of the two ratios.

Demographics and saving – How strong is the link?

Existing studies have focused on the old-age dependency ratio, and generally find that an increase in this ratio is associated with lower saving.

There are many studies of the determinants of national saving and some of these introduce demographic factors as a potential driver. (A number of these studies are discussed in the appendix to this chapter. The old-age dependency ratio is included far more often than a measure of high-saving, mature workers.) But there is no consensus on the strength of the link between age structure and saving. Thus, we begin with a look at 10 systemically important economies that comprise the lion's share of global output, saving, and investment.

With no strong empirical consensus on the strength of the link between age structure and saving, we examine 10 systemically significant regions

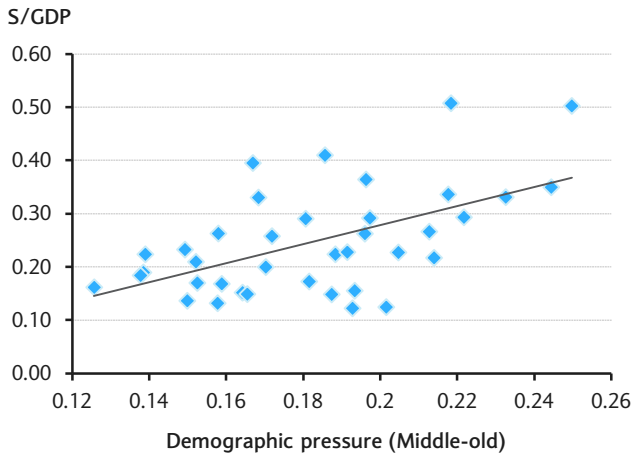
The economies that we included in our analysis are the US, the euro area, China, Japan, the UK, India, Korea, Brazil, Mexico, and Russia. We generally split our 20-year sample (1995-2014) into four five-year subsamples to smooth out some high-frequency fluctuations and, perhaps, measurement errors, that may contaminate annual data. Not all of the countries provide complete estimates of the income side of the national income accounts, so we have estimated national saving as the sum of domestic investment and the current account balance.

In Figure 8, we plot for each of these four periods and 10 economies the rate of saving against our measure of demographic pressure on saving. There is clearly much about national saving that is not explained by this measure of demographic pressure, but there is also a strong, positive relationship, as the simple theory would suggest.

In fact, the size of the simple co-movement between demographics and saving illustrated by Figure 7 is suspiciously large.[5] This turns out to be caused by a very strong correlation between demography and saving across our 10 economies. (Figure 9) We view the magnitude of this cross-economy co-movement with some skepticism. The long-run cross-country correlation is driven largely by China and Korea (the highest-saving observations in the upper right portion of Figure 9), where savings have likely been high during the past 20 years for other reasons in addition to demographics. With such a small number of economies in the analysis, the possibility of at least partly spurious, or accidental, correlation is strong.

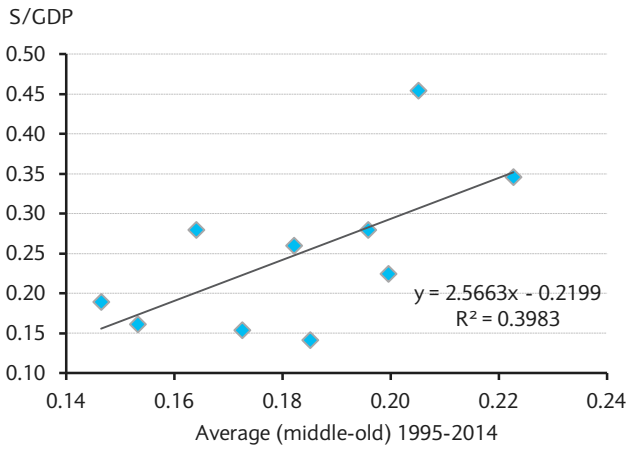
[5] In theory, the slope of the trend line should be something like the difference between the saving rates of mature workers and of the elderly.

FIGURE 8
Demographic pressures are correlated with national saving rates



Note: We split the 1995-2014 period into four 5-year sub-periods and show the national saving rate and a measure of demographic pressure on saving for each sub-period in each of the 10 regions. Source: Barclays Research

FIGURE 9
20-year averages show an exaggerated (and likely spurious) co-movement



Note: Averages for 1995-2014 . For reasons of data availability, the Russian data refer to 2005-14. Source: Barclays Research

One way to reduce this problem is to subtract the long-run average from all data from each of the five-year sub-periods. This removes persistent cross-country differences from the analysis, which is then driven by variation over time within each economy.[6]

We find a strong co-movement between age structure and saving, although other drivers are also important

Figure 10 illustrates that the co-movement between demographics and saving remains strong after removing these economy-specific 'fixed effects' from the data. (For readers interested in a more formal quantitative analysis, the statistical results that correspond to this illustrative chart are given in columns 2 and 3 of Figure 28 in the appendix.) The numerical analysis suggests that a one percentage point increase in our measure of demographic pressure is associated with an increase in national saving of about 0.7pp. This is plausible, in light of the theory, and broadly consistent with our reading of the evidence from other studies. The multipliers are larger if we estimate the effects of mature workers and elderly people separately, and the negative impact of a rising share of elderly appears somewhat larger than the positive impact of mature workers. But the difference between the constrained and the unconstrained estimates is not statistically significant, nor does it alter the qualitative discussion of the outlook, below.

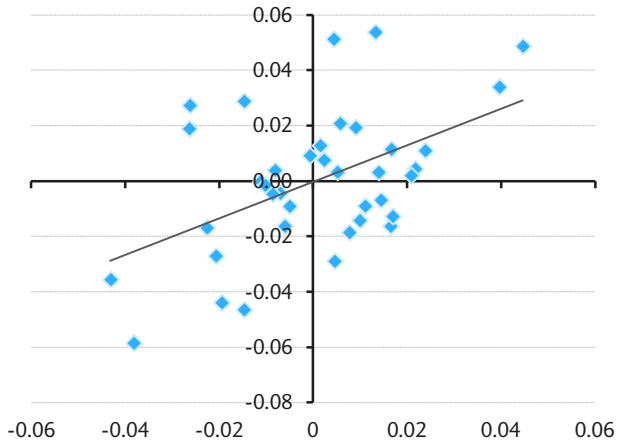
The idea that population structure mainly influences saving is supported by the correlation between age structure and the current account balance.

If demographic pressures affect national saving, they should also affect the current account. Figure 11 shows that the current account has in fact been positively correlated with our measure of demographic pressure on saving (see also columns 4 and 5 of Figure 28 in the appendix). The evidence is a little more tenuous here, which is not surprising given the importance of shocks to the terms of trade, economic policy, and other sources of high-frequency fluctuations, as well as the fact that the current account depends not only on developments at home, but also in key trading partners. Still, the positive association between demographic pressure and the current account is congruent with the view that demographic pressures exert upward pressure on saving.

We have so far focused on the level of the saving rate, either in absolute terms or relative to the economy's long run (1995-2014) average. As a test of robustness, we can also explore whether *changes* in demographic factors explain *changes* in the national or regional saving rate. This is relevant for the forward-looking discussion that follows because we are ultimately interested in understanding potential changes in saving behaviour that may be implied by forecast changes in demographic structure in the coming 10 or 20 years. In

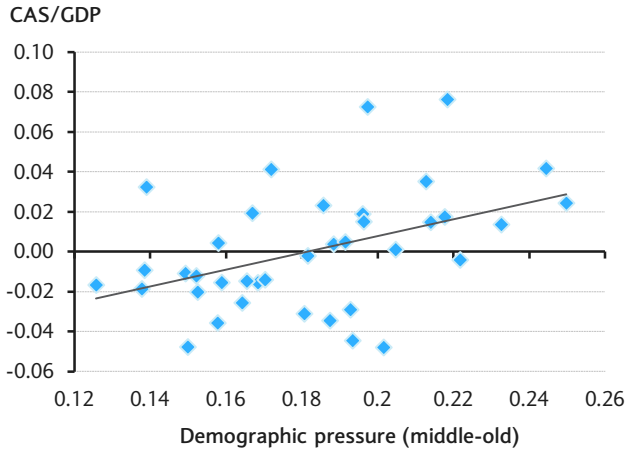
[6] In the statistical work described in the appendix, we do this with a fixed-effects estimator. In the scatter plot in Figure 10 we subtract the country-specific 1995-2014 averages for saving and demographic pressure from each observation.

FIGURE 10
Co-movement of saving and demographics is also strong after removing economy-specific 'fixed effects'



Source: Barclays Research

FIGURE 11
Demographic pressure on saving is also associated with a current account surplus



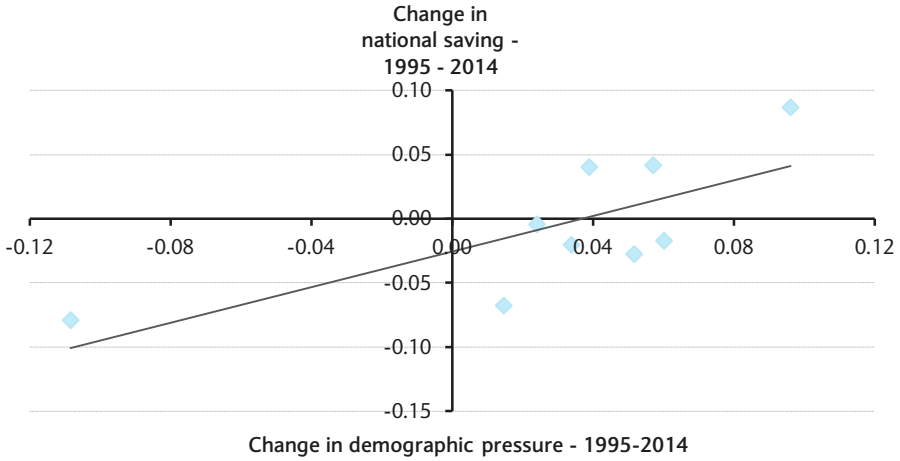
Source: Barclays Research

Demographic forces help explain the large decline in Japanese saving and the boom in Chinese saving of the past 20 years.

Figure 12, we show the relationship between the change from 1995 to 2014 in our measure of demographic pressure and the change in national saving over the same period.

One drawback of viewing the data this way is that we are left with only nine observations,[7] which makes the correlation potentially sensitive to outliers. But for what it is worth, the resulting correlation is consistent in magnitude with the previous, arguably more robust analysis.[8] It also highlights that demographic pressures go a long way toward explaining the change in saving in the country with the largest decline (Japan, in the lower left of Figure 12) and the one with the largest increase (China, in the upper right).[9]

FIGURE 12
Long-term changes in demographic structure have been correlated with changes in national saving rates



Source: Barclays Research

It probably comes as no surprise to most readers that Japan has been the most demographically challenged of the major economies during the past two decades. We have the impression that the exceptionally strong demographic backdrop in China has figured

[7] We have no measure of saving for Russia in the early years of our sample, so Russia is not included in Figure 12.
[8] The co-movement in Figure 12 suggests that a 1pp increase in our measure of demographic pressure would be associated with a 0.73pp increase in savings demand, similar to the results of the preceding analysis.
[9] We note that the observed relationship is not driven by these two observations, which remains broadly similar if the China and Japan are excluded from the sample. However, as observations are dropped from an already small sample, the uncertainty surrounded the estimated co-movement naturally rises. In any event, while it is reassuring that the co-movement is not overly sensitive to their inclusion, we no strong reason to exclude China and Japan from the sample.

less prominently in academic and market analyses of China's recent history. In our view, prospective demographic developments in China are likely to have a profound effect on global savings and world asset markets, as we discuss below.

The outlook: A disappearing 'global savings glut'?

Demographic pressure on saving has peaked and are in the early stage of a profound reversal

Our data seem to be consistent with the idea that savings tend to be positively correlated with a demographic structure concentrated in mature workers, and negatively correlated with a high proportion of the elderly. We take a closer look at recent historical and prospective developments in the world as a whole and within the systemically most important countries and regions. The discussion highlights the role of population trends in the development of a global 'savings glut' in recent decades, and suggests that demographic pressures on saving (and, by extension, on asset markets) have peaked and are in the process of a potentially momentous reversal.

Rise and fall of emerging Asia's 'savings glut'

The special role of China in the global saving and investment landscape suggests that we should place it at the forefront of our discussion. Figure 13 shows historical estimates and projections of the demographic factors that we have been emphasizing. For comparison, Figure 14 shows the same demographic variables for the 'world' excluding China, where each country is weighted by 2014 USD GDP.

The boom in Chinese saving of the past 20 years was associated with a surge in demographic pressure

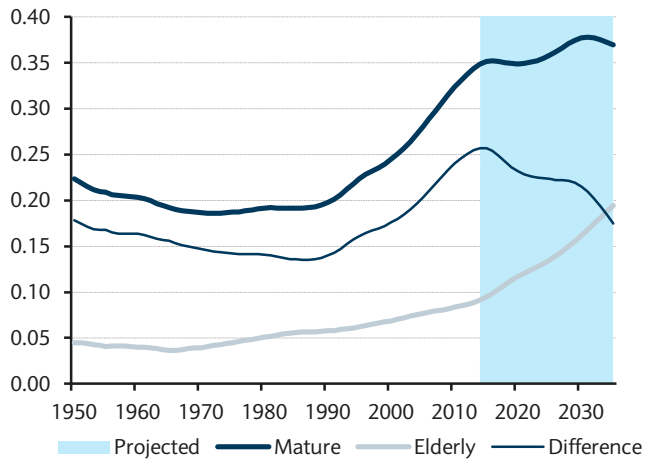
Both China and the rest of the world experienced strong upward demographic pressure on saving after the early 1980s. But the Chinese experience stands out for the magnitude of the swing, which, at more than 10pp, is more than twice the change experienced by the rest of the world. The demographic swing in China is also more recent than in the rest of the world, dating from the early 1990s, compared with the early 1980s elsewhere.

To put this swing in a rough quantitative context, we can attach the multiplier of about 0.7 suggested by the statistical work summarized above to the roughly 10pp increase in the measure of demographic pressure from 1995 to 2014, which suggests that roughly 7pp of the 10pp swing in the measured rate of Chinese saving may plausibly be attributed to the marked shift in the demographic context.

This suggests a perspective on the post-2000 investment boom in China that emphasizes a demographically induced surge in saving as the primary driver of the episode, rather than policy distortions or other drivers of investment demand. A saving-driven interpretation is supported by the contemporaneous surge in the current account surplus.

FIGURE 13

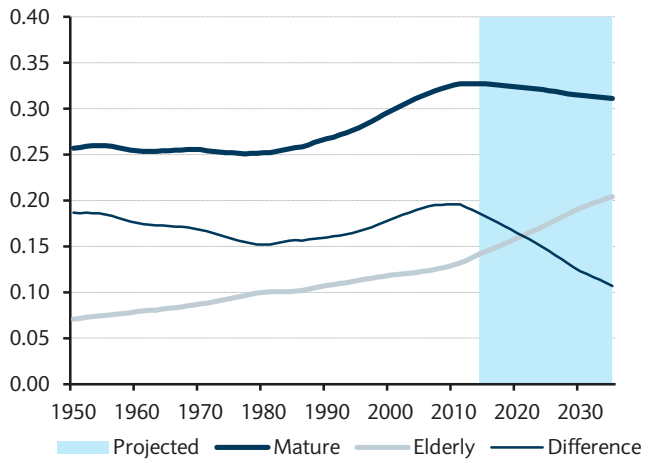
Demographic pressures help explain the Chinese saving boom, but are poised to fade in the decades to come



Source: Barclays Research

FIGURE 14

The rest of the world also experienced upward demographic pressure on saving since 1980, though smaller than China's



Note: Average for US, Euro area, Japan, UK, India, Korea, Brazil, Mexico, and Russia, weighted by 2014 USD GDP. Source: Barclays Research

Demographic support for Chinese saving is beginning to fade…

Looking ahead, China's pro-saving demographic evolution is set to reverse, starting about now, because of a projected acceleration in the share of the elderly population, combined with a sharp deceleration of growth in the share of the mature workforce.

… but not as fast as in the rest of the world.

The rest of the world is in the midst of a similar, but more complete, reversal of the demographic trend of the past two decades. Whereas China's demographics in the next two decades are projected to remain more saving-supportive than in the 1980s and early 1990s, in the rest of the world the demographic structure is projected to shift to a substantially more saving-unfriendly composition than at any time in its post-war history. What this suggests to us is that China is likely to remain a net supplier of world savings in the years to come, but in a world where savings overall are becoming ever scarcer.

Korean demographic trends help explain the large current account surpluses of recent years, and point toward a very sharp reversal in coming years.

Although much smaller and systemically less significant than China, the other countries of emerging Asia that we consider here provide an interesting contrast. Korea is one of the fastest-aging societies in the world, and its age structure is projected to turn very rapidly from one of the most pro-saving in the world, to one of the least. Like China, upward demographic pressure on saving has been building rapidly in recent decades, although the surge has been less abrupt, dating from the 1970s rather than the 1990s (Figure 15). By 2035, however, the share of the elderly population is projected to rise from a moderate level by international standards to a level even higher than Japan's, and only marginally below that of the other demographic pioneer, Germany. At the same time, the share of the population in the high-saving middle-age years is projected to decline sharply. Our summary measure of demographic pressure on saving is thus projected to drop from one of the highest in our sample of 10 economies (essentially tied with China in 2015) to one of the lowest (essentially tied with the UK and US, and only marginally more savings-friendly than Japan, by 2035).

This provides a useful context for Korea's very large recent current account surpluses, suggesting that they may be associated with demographic pressures created by a rapidly aging population that is saving to provide for its imminent retirement.[10] If so, upward pressure on saving and the current account balance is likely to plummet in the years ahead as the generation now saving for its retirement enters its lower-saving elderly stage of life.

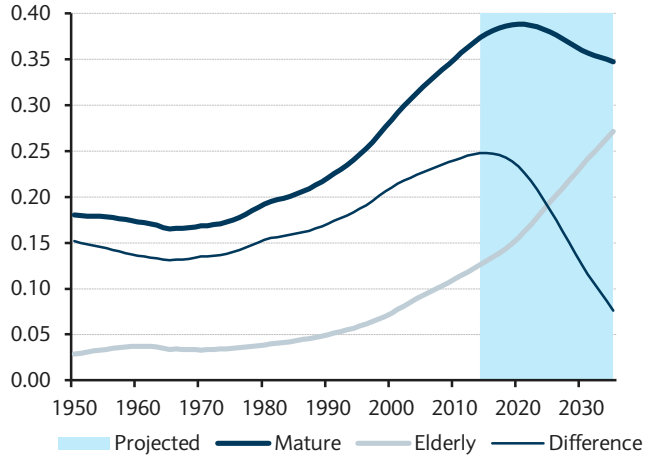
India is the only country of the 10 we examine where demographic support for saving is projected to rise significantly in coming decades.

India provides a stark contrast and, of the countries that we discuss here, is the only exception to the global demographic norm. As in the rest of the world, the share of India's elderly population is rising (from a very low level – Figure 16). But a relatively high birth rate ensures that a large cohort of children and young people will be entering their high-saving mature working years for decades to come. The net result is that India's demographic structure – uniquely among the 10 economies that we discuss – will become gradually *more* savings-friendly. In fact, by 2035, India's demographic structure is projected to be more saving-friendly than any other region in our sample, including China. This suggests that India may be transformed into a net supplier of global savings in the decades to come, and that the current account deficits of the past may be replaced by structural surpluses.

However, from the perspective of the global 'savings glut' and world asset markets, India's savings-friendly demographic backdrop is unlikely to provide a major offset to the unfavourable demographic trends in most of the world. In 2014, Indian investment comprised roughly 1% of world GDP (and Indian saving even less), compared with China's 2.5% in 1995 and nearly 9% in 2014. Therefore, it is likely to be a long time before India's saving is large enough to provide a meaningful offset to developments in China and the advanced economies.

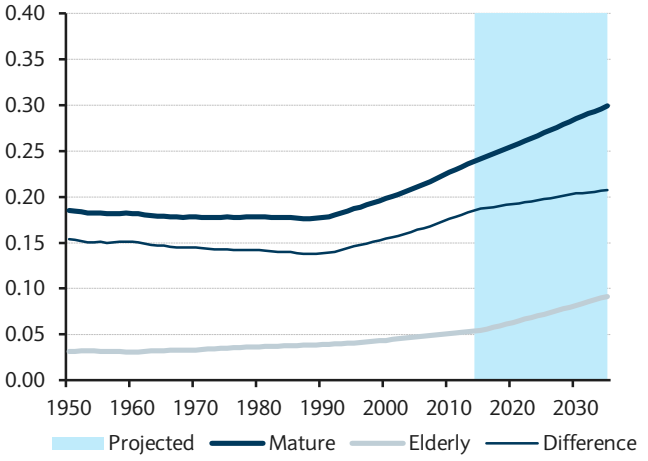
[10] Korea's trading partners have been aging rapidly as well. Our point is that the associated demographic pressure on saving has been larger in Korea than in any other large economy, save China.

FIGURE 15
Korean demographics are poised for a very sharp reversal



Source: Barclays Research

FIGURE 16
India is a rare exception to the global demographic norm



Source: Barclays Research

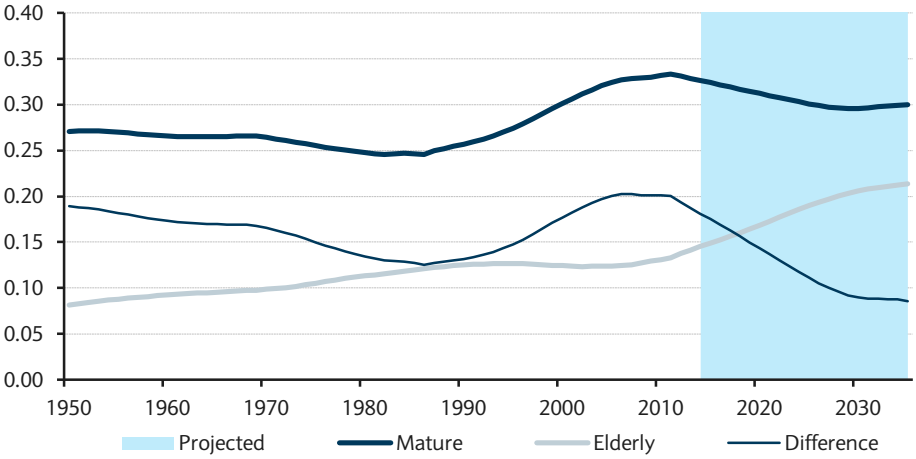
A declining demographic mainstream: the US, UK and euro area

Demographic support for saving is also projected to decline sharply in the US, UK, and euro area.

Emerging Asia looms very large in the 21st century saving/investment balance. But the US, UK, and the euro area still comprise the majority of the world's output, saving, and investment. What happens in these economies still matters, and will continue to matter for decades.

Their demographic patterns are broadly similar. In all three advanced-economy regions, the share of the elderly is projected to rise more rapidly, while that of the mature workforce has either started to fall (US, UK) or is projected to do so soon (euro area).

FIGURE 17
US demographics have only recently turned less savings-friendly

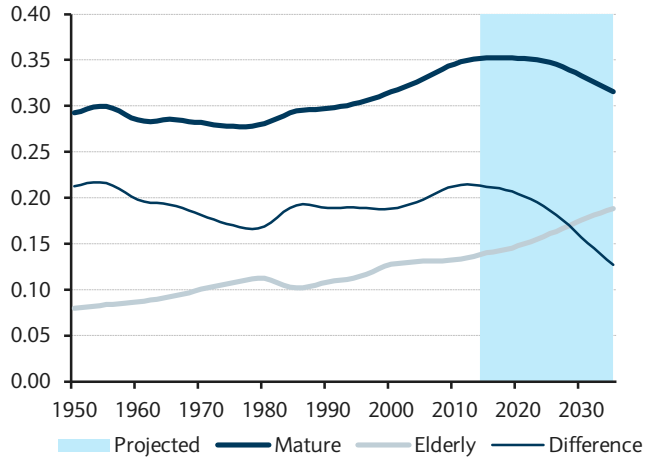


Source: Barclays Research

As a result, after a 25-year surge in demographic support for saving, population structures are becoming strongly less saving-friendly in all three areas. Within two decades, the age structure is projected to become markedly less savings-friendly than it was in 1980.

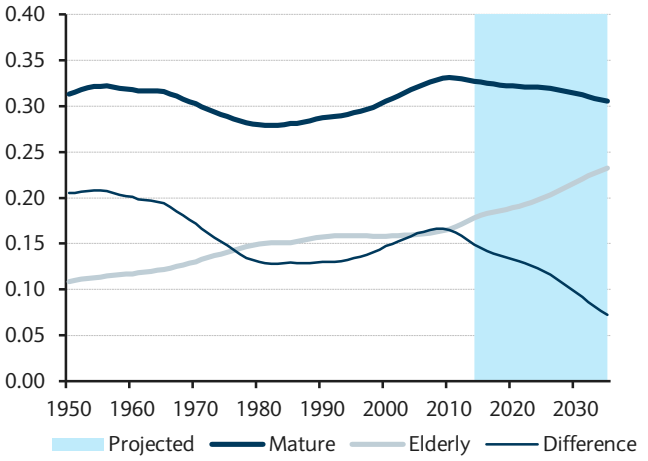
With saving rates as low as they are in the US and UK, it is not easy to imagine a large, sustained decline from current levels. Then again, we have limited experience with demographic structures like the ones that face the advanced economies, and it may be that we will simply have to adjust our idea of what's normal.

FIGURE 18
Euro area population dynamics are similar to the US



Source: Barclays Research

FIGURE 19
UK demographics are also projected to turn sharply less saving-friendly in the next two decades



Source: Barclays Research

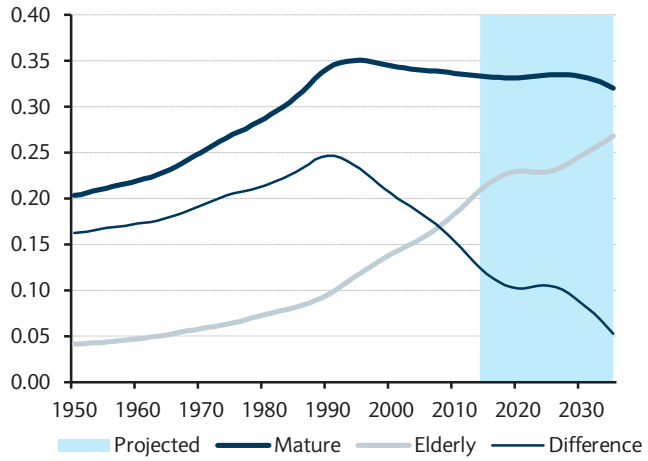
The demographic vanguard: Japan and Germany

In any discussion of demographics, Japan and Germany deserve special attention because they are so far advanced in their demographic transitions. Both countries have long been coping with a shrinking workforce. But there are important differences in their demographic developments, as well.

Demographic support for saving in Japan peaked in the early 1990s, and has faded substantially since then, with the expected effect on saving and the current account.

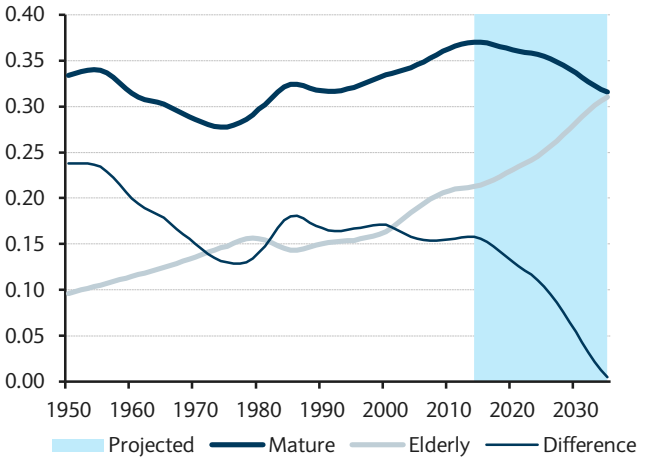
Japan is sometimes cited as evidence for the view that demographics affect market valuations, because the post-war financial market boom that reached its climax at the end of the 1980s coincided with a boom in demographic support for saving (Figure 20). Both market valuations and demographic support for saving declined sharply after the early 1990s. One need not buy the idea that demographic forces fully explain the 'bubble economy' of the 1980s and Japanese markets' subsequent, protracted, correction, to accept the idea that pro-saving demographic factors may have set the stage for the high market valuations of the late 1980s, and provided an impetus for normalization thereafter.

FIGURE 20
Japanese demographics supported a saving boom into the early 1990s, and reversed sharply thereafter



Source: Barclays Research

FIGURE 21
In Germany, the demographic structure is only now becoming less supportive of saving



Source: Barclays Research

From a macroeconomic perspective, we think it is no coincidence that Japanese saving rates have fallen sharply (from roughly 30% of GDP in the mid-1990s to about 22% now), as has the Japanese current account surplus, as demographic support for saving has receded.

Germany's rise in saving (and decline of investment) since 2000 is not explained by the demographic drivers that we identify, which have been broadly stable for the past 30 years.

Germany fits less neatly into the paradigm that we have been discussing in this note. The demographic factors that we have highlighted explain neither the increase in the German rate of national saving since the early 2000s, nor the (even larger) decline in the rate of investment. Our measure of demographic pressure on saving has become marginally less saving-friendly during this period (Figure 21). Germany thus illustrates that factors other than demographics do drive saving, and that, when changes in the demographic driver are relatively small, other factors will predominate. Whether German savings can remain resilient to the very sharp decline in demographic support projected for the coming 20 years is an interesting question with non-negligible implications for the European and world economy.

The global outlook

The projected decline in demographic support for saving is very large

In the coming 20 years, our proposed summary indicator of global demographic support for saving is projected to decline by about 8 pp. Our statistical results suggest that this could be associated with a decline in desired saving (at any given interest rate, which is to say a leftward shift of the saving supply schedule) of nearly 6 pp of world GDP, or about 25% of world saving. Of course, we are unlikely to see world saving and investment fall by the full 25%. The effect of this leftward shift of the saving supply schedule on actual saving/investment and the real interest rate will depend upon the slopes of the investment demand and the saving supply curves, among other things. With no strong view on the magnitude of these slopes, we are not in a position to provide an estimate of the impact on asset prices and interest rates. Suffice it to say that this would be a very large shock to the balance between saving and investment if it were half the size. It compares, for example, with an increase of about 5 pp in demographic pressure during the 1980-2015 period of strong secular support for asset markets, and downward pressure on interest rates, which reflected an increase of nearly 12 pp in China and about 3.5 pp in the rest of the world.

Demographics and asset prices

Do demographic drivers affect asset prices as their impact on saving suggests?

We have suggested that demographic factors have been a key driver of the global 'savings glut' of the past 20 years. Intuition and economic theory suggest that a demographically induced bulge in saving should be associated with an increase in asset prices (and a corresponding decline in the real interest rate).[11] When society's need to save is high, the price of saving vehicles will be bid up and the expected returns to saving will be depressed. It is tempting to explore whether the demographic factors that have been shown to be associated with high world saving are also associated with high asset prices. In this section, we succumb to this temptation and consider a measure of the real interest rate and equity valuations.

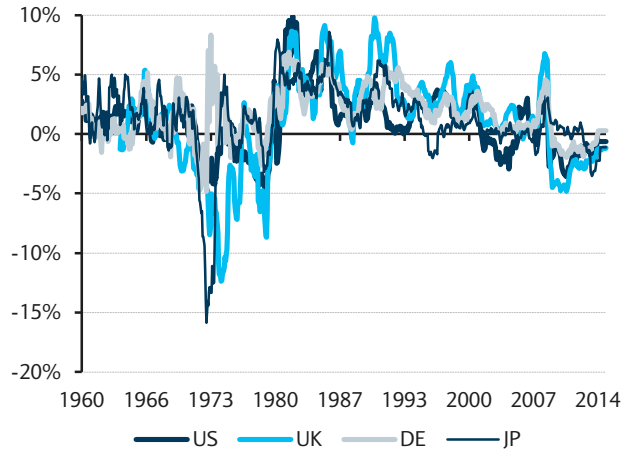
Real interest rates and demography

Integrated capital markets direct our analysis to the world interest rate; cross-national differences in interest rates are very unlikely to be caused by the 'secular' forces that concern us.

With highly integrated capital markets, and over the extended periods that concern us here, real interest rates and other asset prices should be equalized to a very substantial degree. We are therefore led to focus on a measure of the world interest rate as the appropriate object of analysis. Figure 22 shows a measure of the real short-term interest rate in the US, UK, Germany and Japan. There are occasionally very sharp divergences among them, but longer-term trends appear highly correlated. (There is also almost certainly a large element of measurement error related to the high and volatile inflation rates of the 1970s and early 1980s.) In what follows, our measure of the 'world interest rate' is the simple average of the real interest rates depicted in Figure 22.

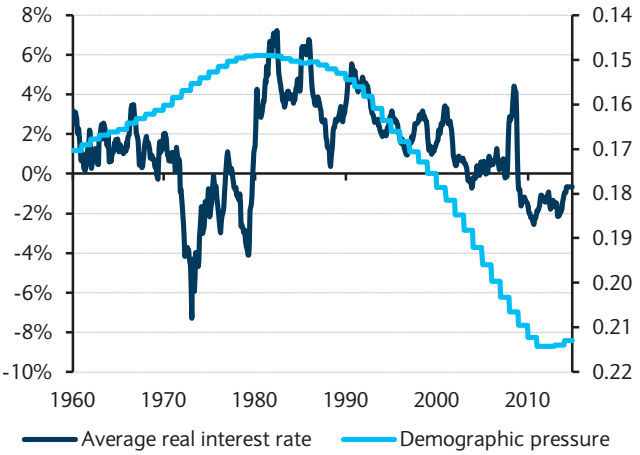
[11] One fully articulated theoretical model of a demographic 'cycle' is in Geanakoplos, Magill, and Quinzii (2004), which also provides evidence that US stock valuations have been positively correlated with the ratio of high-saving mature workers. Poterba (2004) also documents that real US interest rates tend to be depressed when the share of the population aged 40-64 is high, while a high share of the elderly is associated with a rise in real interest rates, although he characterizes the correlation as weak. Bond (2009) also suggested that demographic trends would put upward pressure on real interest rates and downward pressure on equity valuations in the US and the UK.

FIGURE 22
A measure of the short-term real interest rate



Source: Barclays Research

FIGURE 23
Long-term trends in world interest rates and demography



Note: Demographic pressure is on the right axis, with scale inverted.
Source: Barclays Research

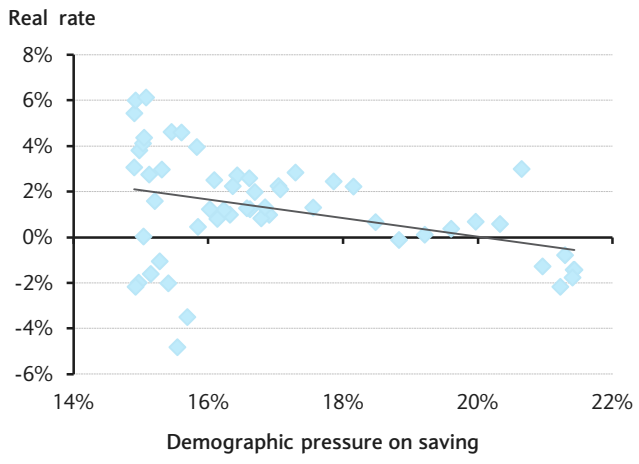
By the same token, asset prices in the financially integrated regions of the world should be influenced by global demographic developments, rather than national. This means that there is little to be learned from cross-country variations in real interest rates and demographics, or other national economic drivers. We have little choice but to evaluate the historical co-movement of the world real interest rate and global demographic trends. With only a few decades of postwar experience available for study, the available history provides us with quite limited variation in the slow-moving demographic driver; we must therefore interpret historical co-movements with some caution.

There is a strong historical co-movement between the global age structure and the real interest rate.

Figure 23 shows how our measure of the real interest rate and global demographic pressure on saving have evolved since 1950, and highlights the fact that history provides us with only one long, slow, instance of deterioration in demographic pressure on saving (1950-early 1980s) followed by a long, slow increase in demographic pressure on saving, which is only very recently beginning to reverse. This reinforces the case for a cautious interpretation of the statistical correlations.

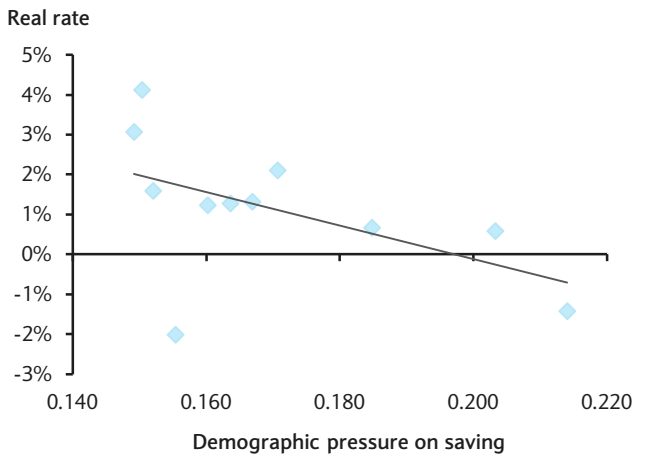
Caveats aside, the fact is that the historical co-movement has been strong. This is more clearly seen in Figure 24, which plots annual versions of the demographic data and real interest rates shown in Figure 23 against one another. There is a lot of noise around the

FIGURE 24
The real interest rate has been negatively correlated with demographic pressure on saving (annual data)



Source: Barclays Research

FIGURE 25
Real interest rate and saving (smoothed data)



Source: Barclays Research

trend line, reflecting other short-term drivers of real interest rates and almost certainly a lot of measurement error in the high-inflation era, but the relationship is statistically and economically significant; the demographic pressures that we have found to promote saving have also been associated with lower real interest rates.

For what it is worth, the statistical evidence presented in the appendix (Figure 29) suggests that a 1pp point increase in the share of mature workers has been associated with a 0.75pp decline in the world real interest rate. A 1pp increase in the share of the elderly has been associated with a 1.15pp increase in the real interest rate. (The estimated impact of shift in the age structure and the real interest rate is considerably smaller if the separate effects are constrained to be equal and opposite in sign, as is implicitly done in Figure 24.)

Annual data are contaminated by short-term fluctuations that have nothing to do with secular trends and by potentially large errors in the measurement of expected inflation. In Figure 25 we have tried to reduce these problems by sorting the data on demography, then averaging over groups of five annual observations apiece. 'Smoothed' in this way, history suggests a negative relationship between the real interest rate and age structure that is quantitatively similar to but less 'noisy' than the one in Figure 24. The relationship does not seem to be driven by a single outlier or cluster of outliers; if anything, the outlier seems to be attributable to the monetary disorder of the late 1970s, when demographics were unfavourable yet our measure of the world real interest rate was very low. We think it makes more sense to view this outlier as the result of monetary policy mistakes and measurement error than as a counter-example to the generally negative co-movement between of demographic pressure and the real interest rate. Eliminating this observation would considerably strengthen the observed historical co-movement between real interest rates and age structure.

Demographics and equity valuations

The historical correlation between equity valuation and demographic structure is also strong, although we do not consider the historical experience useful for forecasting purposes.

The same theory that suggests that demographic pressure on savings should reduce the real interest rate also suggests that it should support equity valuations. This is because increased demand for saving vehicles should push all asset prices up (and expected returns down), with the additional possibility that an aging population may shift its asset allocation in the direction of less volatile, 'safe haven' fixed-income assets, resulting in a higher equity risk premium.[12] Here, we focus on the US cyclically adjusted PE (CAPE) ratio as one plausible and easily computed valuation metric. Partly to minimize (although, as we shall see, not eliminate) problems created by the exaggerated level of equity valuations in the late 1990s bubble, we analyze the cyclically-adjusted earnings ratio, which is simply the inverse of the CAPE.

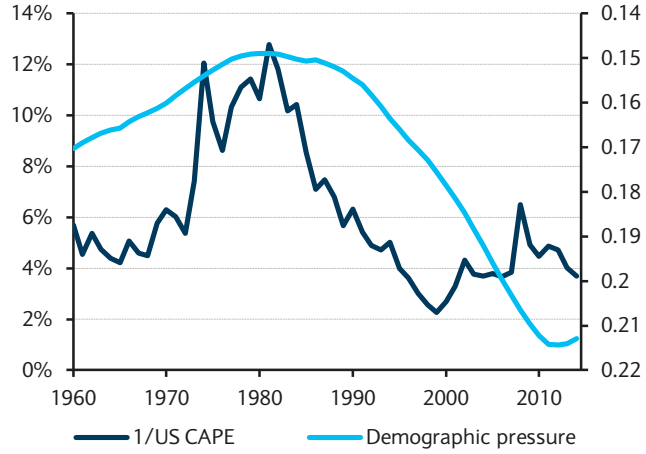
Although the historical co-movement of demography and asset prices likely offers a weak guide for forecasting, it is reassuring that the historical experience is consistent with the saving approach.

Figures 26 and 27 illustrate that, as a purely statistical matter, equity valuations have been rather strongly correlated with our measure of global demographic pressure on saving. (The corresponding statistical analysis is given in Figure 29 of the appendix.) A literal reading of Figure 27 suggests that this relationship could be non-linear; indeed, a nonlinear relationship does a much better job of 'explaining' the data. However, we suspect that conclusions like this would be pushing the analysis beyond what the data can support. In this analysis we rely entirely on a relatively brief (in demographic time) time series of information, during which two events dominate the valuation experience: the monetary disorder of the late 1970s and its subsequent correction (when equity valuations were exceptionally low and demographic support for saving happened to be rather weak), and the equity market bubble of the late 1990s and early 2000s (when demographic support for saving happened to be strong).

This does not mean that demographic pressures have not contributed to equity valuations in recent decades, but they were clearly not the only influences at work. Although it fits neatly with our view that demography has exerted a powerfully supportive influence on the investment climate in recent decades, we would not take the observed historical co-movement between age composition and equity valuations as a strong guide to the future until the impacts of these other factors been more convincingly controlled for than we have been able to do here.

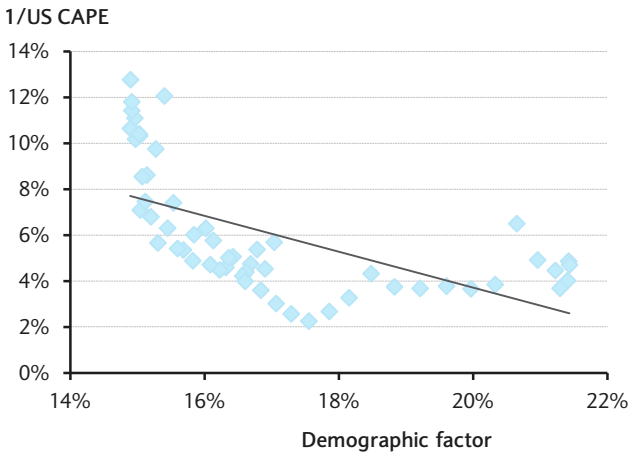
[12] See, for example, Gapen (2013).

FIGURE 26
US equity valuations have been correlated with global demographic pressures on saving



Note: Demographic pressure is on the right axis, with scale inverted.
Source: Barclays Research

FIGURE 27
Strong co-movement between equity valuations and demographic pressure on saving



Source: Barclays Research

Despite these limitations of the analysis, it remains noteworthy that, in the post-war period, asset prices seem generally to have had the association with demographic trends that would be expected if demographic pressure on saving were a key secular driver of asset markets.

Conclusions

Demographics are not the only drivers of world savings, investment, and asset prices, but they seem to us to be among the most powerful. Moreover, we are living through a demographic inflection point with potentially profound implications for asset markets – implications that have been overshadowed by the existing demographic structure and the weak cyclical context, both of which have contributed to abnormally low real interest rates. We think it is a mistake for market participants to extrapolate current circumstances into the distant future to the extent that they seem to have done.

Demographic fundamentals have become highly supportive of world savings, and by extension asset prices, since 1980, particularly in the past 20 years. This is because the impact of a steady rise in the share of the elderly has been more than offset by a rise in the share of mature workers who save a lot. This has been a global phenomenon, with Japan the only significant exception, and has been particularly powerful in China, bedrock of the 'global savings glut'.

But demographic support for global saving is peaking, and it will be getting steadily and substantially less supportive in the decades ahead. When this happened to Japan in the early 1990s, the Japanese saving rate fell, as expected, although asset prices in Japan and globally continued to be supported by a surge in saving in the rest of the world. It seems likely to us that, as demographic support for savings recedes in the US, Europe, UK, China, and Korea, the global 'savings glut' will similarly be reversed. Although the demographic tide will ebb gradually, the impact on financial markets could be very large. Our statistical analysis suggests that the decline in demographic support for saving could shift the global saving supply schedule back by almost 3% of global GDP (more than 15% of world saving) in 10 years, and nearly 6% of world GDP (roughly 25% of world saving) in 20 years. This would be a substantial dislocation of the balance between world saving and investment if it were half the size.

The fading of the 'global savings glut' seems very likely to put upward pressure on interest rates and downward pressure on asset prices around the world. Although we think that they should not be taken as strong guides to the impact of future, our statistical analysis of the historical co-movement between demographic pressures and asset prices corroborates this view, which seems quite inconsistent with market pricing of very low or negative 5-year and even 10-year forward interest rates.

Appendix

This appendix discusses the underlying conceptual framework, and numerical results of the statistical analysis that is illustrated graphically in charts, above. We also provide some background on related studies. The literature is enormous, and we cannot possibly provide a comprehensive survey in the space available. We have attempted to put our discussion within the context of existing studies that we consider representative.

A framework: Saving, investment and global imbalances

The underlying framework of analysis is simple and conventional, and requires no extended discussion. People invest to build a stock of capital for profitable production. Investment is generally thought to be a decreasing function of the real interest rate, reflecting the fact that higher real interest rates raise the opportunity cost of investment, and that higher rates of investment lower the marginal productivity of capital.

People save for many reasons, eg, to finance retirement; to self-insure against the possibility of an adverse shock to labor income, or of a potentially expensive medical event; or to leave a bequest. The supply of saving is generally taken to be positively related to the real interest rate, although theory admits the possibility of a negative relationship.[13]The real interest rate is the price that equates desired saving with desired investment. Although we emphasize identifiable 'shocks' to the supply of saving, the underlying theory relies upon the interaction of investment and saving.

At the global level (or, in an economy that neither lends nor borrows from the rest of the world) savings are necessarily equal to investment. Therefore, if we find a consistent co-movement between some fundamental driver (such as, in our case, demographic structure) and world savings, it will show an identical co-movement with world investment. The only way to tell whether the fundamental driver is shifting the saving or investment curve is to observe the impact on the real interest rate. This is certainly possible, and we take a look at co-movement between demographic trends and asset prices in the body of this article. But there are limitations of this analysis. The real interest rate is not easy to measure, especially in the years of volatile inflation before inflation-linked bonds existed. Furthermore, because major financial markets are well integrated, national interest rates are tightly linked, meaning that there is not much to be learned from cross-country variation in asset prices and demography, and there is only one historical record to rely upon.

We can learn more from economy-specific movements in the fundamental driver of saving and investment, if there is enough independent variation across countries in the underlying (demographic) driver. In the limiting case of a financially integrated economy that is too small to affect the world interest rate, a country-specific increase in saving will leave the world (and therefore the domestic) interest rate unchanged. Domestic saving would increase *pari passu* with the shift in the savings curve, investment (which, in this simple theory depends upon the rate of interest) would be unchanged, and the current account surplus would increase one-for-one with the increase in saving.

This is very helpful because it means that, as long as we split the world economy into reasonably small units of analysis, we can learn from cross-country experience about the co-movement between national demographic factors and national saving propensities. Partly for this reason, we consider the observed co-movement between savings and demography to be stronger evidence on the impact of demography than the direct link between world demographic factors and asset valuations.

[13] The most recent and comprehensive analysis of global saving of which we are aware (Grigoli et al, 2014) finds a modest positive relationship between the rate of saving and the real interest rate. Many empirical studies have found no relationship between real interest rates and saving. For our purposes, the sensitivity of saving to the interest rate is not important, unless saving is so negatively related to the interest rate that the saving function is negatively sloped and flatter than the investment function. This leads to paradoxical results that seem implausible to us, so we leave it aside.

The theory also offers some guidance on the question whether countries like Brazil, India, and China should be considered part of 'the world' for purposes of this analysis. Those countries maintain sizeable barriers to and regulation of portfolio capital flows, which prevent full equalization of expected returns on otherwise similar financial securities, as we would expect among the advanced financial markets. However, all of these countries experience large fluctuations in their current account balances. If a 'shock' to saving or investment in one of them affects their own current account, the current account of the rest of the world must of necessity be affected equally and in the opposite direction. This will require an adjustment of the world interest rate (and, in the background, real exchange rates), even if there is no direct arbitrage between national financial markets.

The role of demographics

There is a large theoretical and empirical literature on the age composition of the population and saving, and on asset prices. It is grounded in two main ideas. The first is that savings tend to rise as workers enter their mature working years, and (eventually) decline after workers pass their peak earning years and retire. This pattern follows from the permanent-income (PIH)/life-cycle hypothesis of saving, but can be viewed as an empirical phenomenon, not dependent on the precise validity of the PIH or necessarily undermined by the fact that specific versions of the PIH do not completely explain saving behaviour at the aggregate or the individual level. The second idea is that when savings increase, asset prices rise and the prospective return to saving vehicles (which we call 'the real interest rate' in this note) falls.

Cross-country empirical studies of saving very often include the old-age dependency ratio (conventionally defined as the share of the population aged 65 or older) as a potential driver of national saving. They generally find that an increase in the share of the elderly population significantly reduces national saving.[14] A typical finding from these studies is that a one-percentage point increase in the old-age dependency ratio lowers the national rate of saving by 0.5-0.75pp. The impact of mature, high-saving workers is less consistently explored and when it is, it is measured in different ways that are difficult to compare across studies. For example, Callen, Batini and Spatafori (2004) found that national savings are negatively correlated with the old-age dependency ratio and positively correlated with the share of the working age population, but they did not distinguish between mature and younger workers. The absence of a stylized result is one of the reasons we explored the statistical relationship between saving and demography in our sample of systemically significant economies, despite the existence of so many previous studies.

There is also existing literature on the impact of demographic change on asset prices. In the early 2000s, a number of theoretical studies appeared, including Abel (2002) and Geanakoplos, Magill and Quinzii (2004). Among other things, these studies addressed the intuitively plausible objection that the age structure of a population, being forecastable, should not affect asset returns as it evolves, but should instead be priced into markets far in advance. Geanakoplos et al also argued that their measure of demographic pressure on saving (the ratio of mature workers to young workers) bore a strong positive relationship to US equity valuations in 1945-2002, and to a measure of the real interest rate after 1965 (but not before). In a purely empirical analysis of US data, Poterba (2004) found evidence that the real return on Treasury bills and bonds is positively related to the share of the elderly in the population, and negatively related to the share of middle-aged (40-64 years old) workers, in line with the simple theory, although he characterized the correlation as weak. He found stronger correlations between equity valuations (specifically, the price-dividend ratio) and demographic variables, with the share of the population in the 40-64 bracket being associated with a substantial rise in equity valuations. In the 2009 edition of this Study, Tim Bond found a strong correlation between US and UK Treasury yields and demographic factors akin to those that we discuss here, and on the basis of national demographic trends, predicted a strong rise in US and UK bond yields.

[14] For recent examples of this type of analysis, see Grigoli et al (2014) and Furceri et al (2014). Grigoli et al provide a summary of 16 previous panel studies of national saving behavior.

Statistical results

All statistical results reported here are based upon a sample of data that includes the US, China, the euro area, Japan, the UK, India, Korea, Brazil, Mexico and Russia. We compiled data for 1995-2014, and computed five-year averages of the data to reduce the influence of high-frequency 'cyclical' influences and measurement error. Data for 2014 were estimated using the four quarters through 2014:Q3 in every case except China, where we used Barclays estimates. Savings were estimated as the sum of the broadest available definition of investment and the current account surplus. Saving, investment, and the current account were all normalized by GDP. Missing data for Russia in 1995-2005 reduced our sample from 40 to 38 data points.

FIGURE 28

Co-movement of national saving and current account balances with national demographic indicators

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Saving	Saving	Saving	CAS	CAS
Middle (40-64)	1.90	0.684		0.41	
	(4.40)	(3.03)		(2.75)	
Old (65+)	-2.57	-0.962		-0.33	
	(-4.65)	(-2.17)		(-1.73)	
Middle - Old			0.6681		0.41375
			(2.99)		(2.92)
Number of observations	38	38	38	38	38
Adjusted R2	0.356	0.951	0.931	0.153	0.169
Fixed effects	No	Yes	Yes	No	No

Note: t-statistics are in parentheses. Source: Barclays Research

Column 1 of Figure 28 shows the simple relationship between the demographic variables that we emphasize and the rate of saving. (This is numerical analogue of the scatter plot in Figure 8, except that the impact of mature worker and the elderly are not constrained to be equal and opposite in sign, as they implicitly are in the scatter plot.) The estimated coefficients are statistically significant at standard significance levels, and the signs are in line with the theory. As we discuss in the text, the coefficients are larger than seem plausible, in light of the theory. We think that this arises from unobserved country-specific influences on saving that happen to be correlated with the demographic variables, biasing the estimated coefficients.

To mitigate this problem, we introduce country fixed effects in column 2 and 3. These fixed effects explain much of the variation in national saving rates, but the coefficients on the demographic variables remain statistically significant and of the correct sign. In these regressions, the values of the coefficients seem more plausible in light of the theory. Column 3 is the numerical analogue of the scatter plot in Figure 10.

In columns 4 and 5 we explore the relationship between demographic variables and the current account. The coefficients are of the expected sign and statistically significant, although the demographic variables explain less of the variation in the current account than of the domestic saving rate.

In our exploration of the observed historical co-movement between demography and asset prices, we had first to compute a world real interest rate. For each of the US, UK, Germany and Japan, we used the money market or T bill rate as reported by the IMF *International Financial Statistics*. As our measure of expected inflation, we used the actual 12-month forward rate of inflation. This almost certainly led to important measurement error, particularly in the late 1970s when inflation accelerated rapidly and likely included a strong unexpected component. The world real interest rate was defined as the simple average of

the four national rates. Data are annual, and the statistical analysis includes the years 1960-2014. We note that the world demographic variables are constructed using 2014 GDP weights. This grossly over-emphasizes the role of China for most of the period in question, and it may be possible to improve the results by constructing an index whose weights vary over time in line with the shifting roles of regional economies. This would, however, not address the more basic limitations of the limited information in the time series that we discuss in the text.

FIGURE 29

Co-movement of the real interest rate and equity valuations with world demographic indicators

	(1)	(2)	(3)	(4)
Dependent variable	Real interest rate		Cyclically adjusted earning yield	
Middle (40-64)	-0.750		-1.167	
	(-2.53)		(-3.38)	
Old (65+)	1.147		1.423	
	(2.28)		(2.52)	
Middle - Old		-0.491		-1.000
		(-2.07)		(-3.79)
Number of observations	55	55	55	55
Adj R2	0.1342	0.118	0.402	0.401

Note: t-statistics are based upon Whitney-West heteroskedasticity and autocorrelation consistent standard errors. The cyclically adjusted earnings yield is the inverse of the Shiller US (SPX) CAPE. Source: Barclays Research

The historical co-movement between demographic variables and the real interest rate points to very large effects. To illustrate, if we apply the coefficients in column 1 to the changes in age structure projected for the coming 10 and 20 years, the equation would imply an increase in the real interest rate (relative to 2014) of nearly 4.5% in 10 years and 9% in 20 years.

We think there are good reasons not to take these estimates as reliable guides to the impact of future demographic change on the real interest rate, as we discuss in the text. The calculation serves to illustrate, however, that the historical co-movement between real interest rates and age structure is not only statistically, but economically very significant. The results do not, in our view, provide a convincing forecasting framework. But they do corroborate the implication of the results on saving propensities that demographic forces comprise a slow-moving but potentially very powerful influence on asset markets.

The numerical analysis of equity valuations points in the same direction, and comes with the same limitations.

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CHAPTER 2

Adjusting to a world of lower oil

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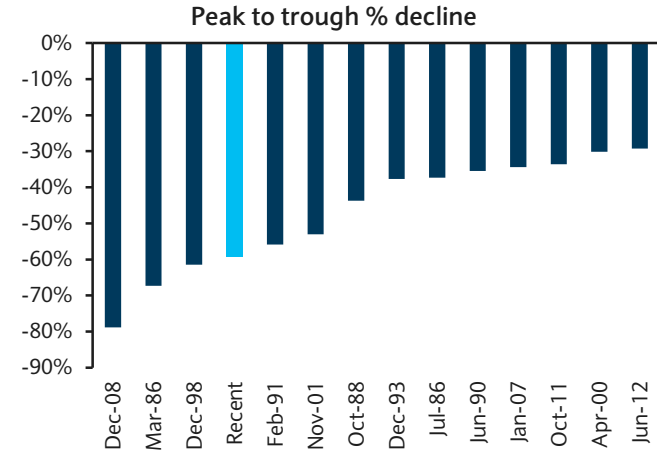
- **The magnitude and speed of the collapse in oil has roiled markets; only the selloffs in 1997-98 (61%), 1986 (67%) and 2008 (73%) were larger than the recent one (60%). In order to assess the sustainability of lower oil prices and their effects on the global economy and markets, we construct a model to explain real WTI oil prices based on the global demand-supply balance for oil, global IP, OPEC market share and real US power prices. The model explains 89% of oil price moves since 1991, including the boom, and, importantly, the collapse since June; oil prices fell more than the drivers implied but recovered some losses recently. The US dollar and speculative positioning provide additional explanatory power.**
- **The medium-term drivers in our model suggest that lower oil prices are likely to persist. Demand growth is slowing, driven by energy efficiency and lower aggregate growth globally. Moreover, oil should remain a well supplied market, with US tight oil keeping OPEC in check.**
- **Inflation expectations and, thus, bond yields have reset lower in response to the collapse in oil. Our findings suggest that emerging market inflation will be affected more than developed market inflation. Headline inflation volatility should be lower, all else equal, with lower energy weights in CPI on sustained lower oil. Importantly, the fall in bond yields (US 10y) that is typical in oil selloffs tends to be fairly sticky, with yields settling 15% below the higher levels prior to the oil selloff.**
- **Global growth should get a 0.1pp boost for every 10% drop in oil prices based on our model, or 0.4-0.5pp in 2015 if oil prices stay in the current range. As the growth benefits tend to manifest with a 2-3 quarter lag, the market also prices the benefits with a lag; the S&P 500 rallies 12% on average the year after oil troughs.**
- **The fall in Brent is a $1.5-2.0trn annualized redistribution from oil producers to oil consumers and is equivalent to more than 2% of global GDP. Sector beneficiaries of lower oil, such as consumer discretionary, should continue to outperform, particularly since both earnings forecasts and relative valuations do not reflect the upside. Asia disproportionately benefits as it is the largest net importer of oil and equity valuations are still in line with the rest of EM.**
- **Current accounts and terms of trade will be profoundly affected by sustained lower oil. A narrower US petroleum deficit should ease the impact of oil price moves on the dollar. The currencies of oil exporters have largely adjusted, but we think Asian currencies that benefit from the terms of trade shock have further to run (eg INR, KRW).**
- **Financial stress often follows periods of oil weakness. However, key differences in country fundamentals and market dynamics suggest the risks to financial stability are lower this time. That said, risk premiums for energy-related assets should remain elevated in an environment of sustained lower oil.**

From boom to bust: Understanding how we got here

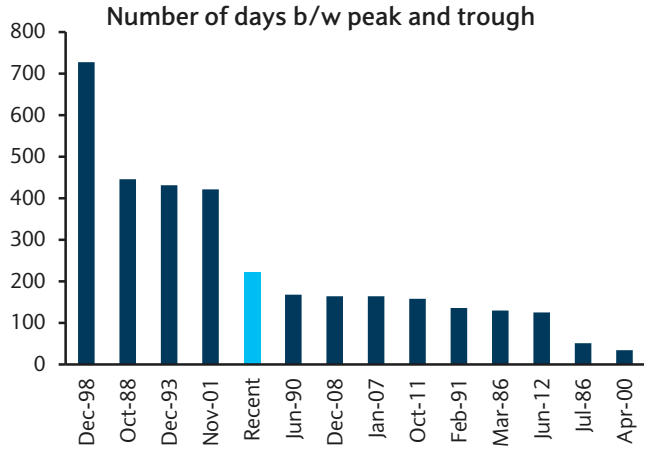
The impact of lower oil on the global economy and asset prices depends on how low oil prices are likely to stay and for how long. To better understand the potential path of oil prices and using oil data going back to 1985, we set out a macro model for explaining oil prices based on four key fundamental drivers. This helps to put past moves into perspective and provides a framework for oil prices in the medium term. We also overlay the dollar and speculative positioning to improve the model.

FIGURE 1
The recent oil selloff was near historical extremes



Source: Haver, Barclays Research

FIGURE 2
A few oil selloffs have been longer



Source: Haver, Barclays Research

- First and foremost, crude stock changes drive oil prices: when demand is greater than supply, oil prices rise (and vice versa).
- Second, the global business cycle explains much of the movement in oil prices not explained by stock changes. When global industrial production (IP) is growing above trend, oil prices rise even faster as supply tends to lag.
- Third, OPEC is an important driver of oil prices. A higher OPEC share of crude supply has coincided with higher oil prices.
- Fourth, power prices help to explain oil spikes when oil is burned to meet unanticipated, peak power demand. Moreover, we believe power prices also capture the potential long-term threat to oil from energy substitutes such that investment responds when oil prices go well above the alternative cost of energy like we saw this past cycle.
- Finally, the US dollar and speculative oil positions affect oil prices on a shorter horizon.

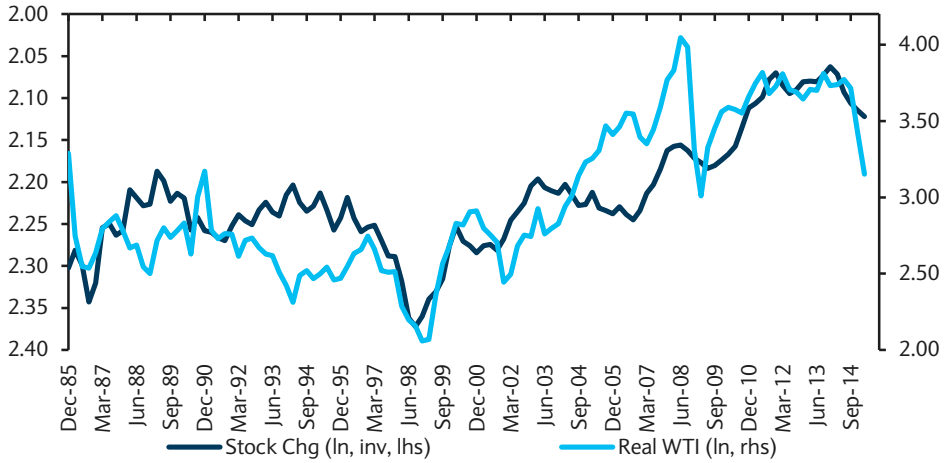
Coming out of the EM crises of the late 1990s and the US recession of 2001, the global economy embarked on a synchronized and unparalleled growth cycle fueled by credit. Against a backdrop of surging aggregate and energy demand, oil supply growth lagged notably after years of underinvestment amid weak oil prices. In particular, OPEC supply failed to react to much higher prices, sowing the seeds of the structural trends that are now in place, including energy efficiency, US tight oil supply growth, and oil substitution.

Demand-supply balance explains 67% of oil price moves since 1986

Academic literature on oil markets is extensive, and measures of oil inventory are seemingly among the more robust and often-mentioned variables.[1] In line with the literature, we find that crude stock changes explain 67% of the movement in real oil prices since 1986 (Figure 3). Using IEA data, we scale stock changes (supply-demand) by demand and create an index for the balance over time. After the 1986 plunge in oil prices following Saudi Arabia's decision to expand production, demand exceeded supply in 1987 and 1988. As competitive dynamics eventually took hold, oil markets were fairly balanced and oil prices remained range-bound until the Asian crisis of 1997, when supply started exceeding demand.

[1] Ye, Zyren, Shore (2002). "Forecasting Crude Oil Spot Price Using OECD Petroleum Inventory Levels." International Advances in Economic Research.

FIGURE 3
Demand-supply imbalances explain the majority of oil price moves



Source: IEA, Haver, Barclays Research

From the 1999 OPEC decision to adhere to a quota until 2011, demand considerably outstripped supply and real oil prices more than doubled. Even though OPEC producers have the vast majority of the world's recoverable reserves, OPEC supply rose from 34mb/d in 2004 to 36mb/d in 2013, a CAGR of just 0.5%.

The recent fall in oil prices has been larger than supply-demand imbalances would have suggested

US crude production began to surge in 2012, rising by an extraordinary 3mb/d in about two years to more than 9mb/d in 2014. It took about two years for US supply to get back to 1985 levels, the point at which Saudi Arabia abandoned the quota. Middle East disruptions offset much of the supply growth until 2014, when Libya came on line, demand weakened, and OPEC decided not to cut its production. At 2mb/d y-o-y, non-OPEC supply grew at a record level and at three times the rate of demand growth in 2014. Accordingly, the fall in oil prices has been notable since mid-2014, but larger than recent supply-demand imbalances would have suggested.

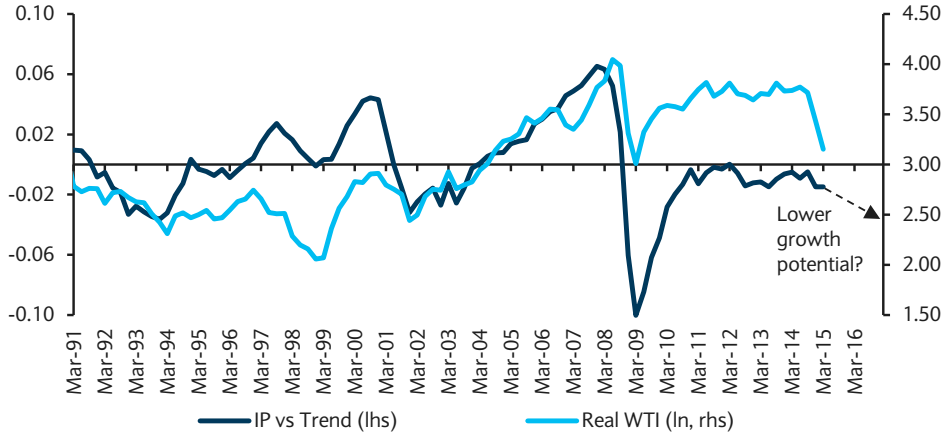
Growth relative to trend is a key driver of oil prices

From 2002 to 2008, oil prices surged as global IP grew at an above-trend rate in a synchronized global recovery

A Fed paper in 2011[2] highlighted the significance of global industrial production (de-trended) in explaining crude prices. Global IP that is growing faster than trend means that oil demand is likely growing faster than trend, which has a big impact on prices because supply tends to adjust more slowly. In our analysis, we also find that global IP in log terms and de-trended explains much of the residual from the demand-supply balance variable mentioned above (Figure 4); the trend growth rate from 1991 to 2013 is 2.8%. The coefficient for global IP is highly significant and sizeable in a joint regression. From 2002 to 2008, global IP grew at an above-trend rate for more than six straight years in a synchronized global recovery and, accordingly, oil prices surged. Since the world has recovered from the financial crisis, global IP has grown at essentially trend rates and oil prices have remained relatively flat. Structural factors suggest that potential growth may be lower, as we highlight in Chapter 4, "The great destruction".

[2] Alquist, Killian, Vigfusson (2011). "Forecasting the Price of Oil." Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Number 1022.

FIGURE 4
The global business cycle is a key driver of oil prices



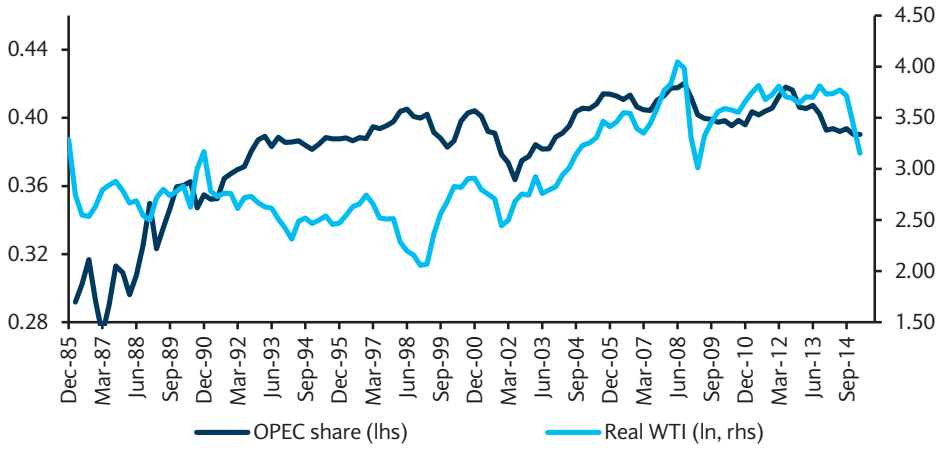
Source: Netherlands Bureau for Economic Policy and Analysis, Haver, Barclays Research

OPEC share of supply is a key variable; US tight oil was a game changer

We view OPEC's current desire to maintain and regain share as reflective of the competitive balance provided by US tight oil supply

The role of OPEC is discussed at length in the literature. We use OPEC's share of supply to capture its power. The higher OPEC's market share, the higher the price of crude (Figure 5). OPEC market share grew from about 36% in 2002 to about 42% in 2008 and was again near that level at the end of 2012, before US production began to surge. This rise in OPEC pricing power magnified the boom in oil prices. With the boom in US tight oil, OPEC's share has now fallen to about 39.5%, its lowest level since 2004, which, all else equal, points to a lower price for crude. That said, a concerted rise in Saudi and OPEC production, as occurred after 1986, significantly pushed out the supply curve, with the new supply added at the lowest cost point on the curve. We view OPEC's current desire to maintain and regain share as reflective of the competitive balance provided by US tight oil supply. This is different from 1986, when Saudi production needed to return toward normal levels after years of cutting supply unsuccessfully.

FIGURE 5
Oil prices have moved with OPEC market share



Source: IEA, Haver, Barclays Research

Power prices capture peak power demand for crude, and oil substitutes

Oil is often burned during peak power demand (cold winters, hot summers, etc). As a result, it is important to capture marginal and often unanticipated demand for oil, although the two tend to move contemporaneously. We use real power prices from US CPI data (ie, energy services divided by CPI). Additionally, the longer-term path for power is seemingly converging

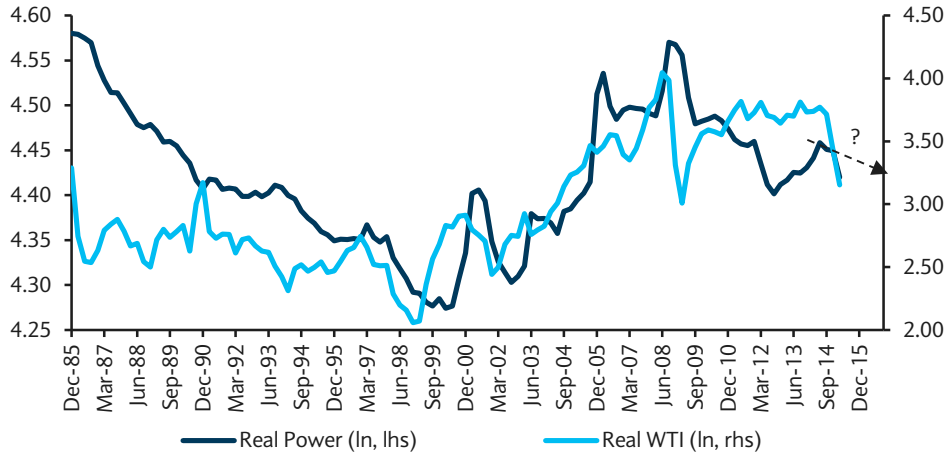
around a grid that draws from multiple energy sources. Crude as a source for power is likely to continue to decline (even in Saudi Arabia), as other sources become cheaper. The ultimate threat to crude and gasoline is the electrification of cars (or fuel cells), which is far off but still worth including in a macro framework for oil prices, in our view.

The ultimate threat to oil is the electrification of cars, which is far off but still worth including in a macro framework for oil prices

The oil price rise that began in 1999 coincided with the rise in real power prices as demand for energy in aggregate soared (Figure 6). Big spikes in oil (eg, 2000 and 2005-07) coincided with surges in power prices driven by large demand-supply imbalances. Overall, since natural gas production began to take off in 2007, real power prices have continued to decline as natural gas prices have fallen.

FIGURE 6

Power prices capture peak oil demand as well as potential threats to oil



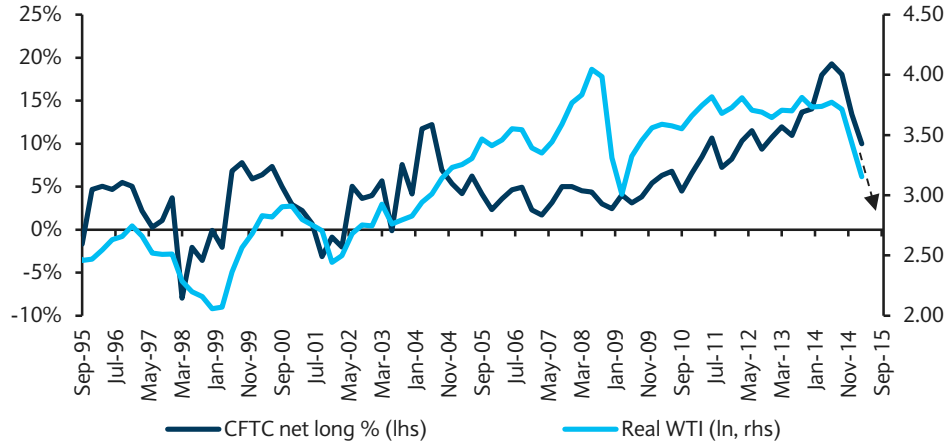
Source: BLS, Haver, Barclays Research

The dollar and speculative positioning are likely exacerbating oil price moves

A number of researchers find that speculative CFTC positioning in oil is a significant factor in explaining oil price movements[3] as it often captures the price premia associated with geopolitical risk and price shocks from supply disruptions. We find similar results using net non-commercial CFTC futures for WTI, scaled by open interest; oil prices and speculative positioning often move together (Figure 7). Speculative positions in WTI futures reached a record 21% of open interest at the June 2014 peak. The covering of oil longs exacerbated the selloff.

FIGURE 7

CFTC speculative oil positioning exacerbates price moves



Source: CFTC, Haver, Barclays Research

[3] Antonio Merino and Alvaro Ortiz, "Explaining the so-called 'price premium' in oil markets", 2005, OPEC Review.

The literature on the relationship between the trade-weighted US dollar and oil prices essentially shows that the dollar has less long-term power in terms of predicting and explaining oil price moves[4][5]. However, over short-term horizons, there is a more robust relationship between the dollar and oil[6]. As the goal of our model is to have a medium-term framework for oil prices, the coefficients on the level of the US dollar become less significant when the fundamental drivers are included. However, including q-o-q log changes in the trade-weighted dollar into our fundamental model captures the essence of the short-term impact of dollar moves on the price of oil.

A macro model of oil prices: The recent collapse in the context of the drivers

The r-square of the model is 89% since 1991; the fit improves to 94% after including the dollar and spec positions

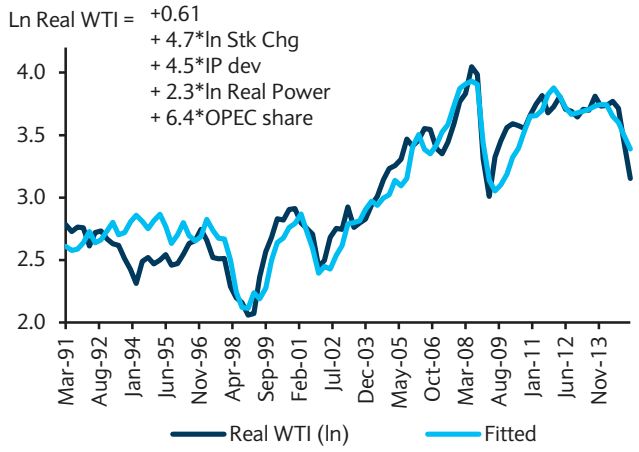
Based on our findings we construct a model to explain real WTI oil prices (in log terms) over longer horizons based on the global demand-supply balance for crude, global IP (de-trended), real US power prices and OPEC market share (Figure 8). The r-square of the model is 89% using quarterly data available since 1991. Including CFTC speculative positioning with data available since 1995, as well as the dollar, improves the fit slightly. The model does a good job explaining all of the major turns in real oil prices in the last 20 years.

FIGURE 8
Table of select variables

	Univariate		Joint (since 1991)		Joint (since 1996)	
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Stock change	-6.0	-13.7	-4.7	-14.0	-4.3	-15.0
Global IP	2.8	1.5	4.5	6.3	3.2	5.1
Real power	5.4	10.3	2.3	6.8	2.3	7.1
OPEC share	22.1	7.1	6.4	4.0	7.5	3.6
USD qoq					-1.0	-1.7
CFTC spec yoy					0.9	2.3
R-square			0.89		0.94	

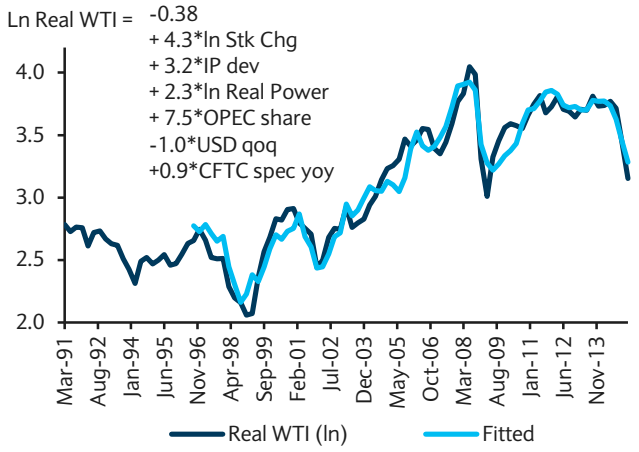
Source: Barclays Research

FIGURE 9
Fundamental variables do a good job of explaining oil price moves



Source: Haver, Barclays Research

FIGURE 10
The recent plunge looks to have been exacerbated by the dollar and spec positioning



Source: Haver, Barclays Research

[4] Galbraith, Dufour, Zhang (2014). "Exchange rates and commodity prices: measuring causality at multiple horizons." CIRANO working paper 2013-s39. Submitted to Journal of Empirical Finance.
[5] Christian Grisse (2010). "What Drives the Oil-Dollar Correlation?" Federal Reserve Bank of New York Working Paper.
[6] Ferraro, Rogoff, Rossi (2011). "Can Oil Prices Forecast Exchange Rates?" Federal Reserve Bank of Philadelphia. Working Paper No. 11-34.

Oil prices fell a little further than our model would have predicted, but have recovered some losses recently

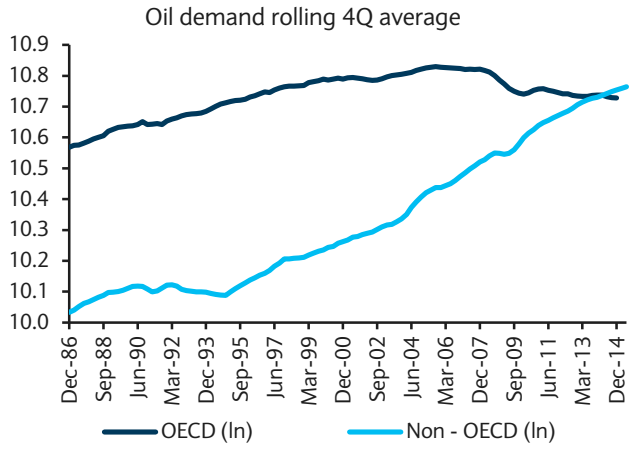
Fundamentals explain roughly 35pp of the selloff; the dollar and speculative positioning another 10pp (Figures 9-10). Based on Barclays' commodities analysts' estimates in the *Blue Drum*, the stock build since Q2 2014 has been nearly 5% of demand, which would imply a 23% decline in oil prices since June. Global IP has been volatile but at fairly flat levels through October. An extrapolation of the 1pt decline in the global manufacturing PMI would point to a 1pp slowing in global IP in Q4, which in turn would point to a 4% decline in oil prices. Real US power prices ticked higher in December after a cold November, but the collapse in natural gas since late December suggests power and heating demand had fallen as US winter temperatures have been warmer. The decline in natural gas explains part of the last leg down in oil based on our model, though gas production may have played a bigger part. The fall in OPEC share due to rising US supply in 2014 contributed just 2% to the oil price fall, though the signalling impact was much greater. Including the surge in the dollar and the covering of net speculative positions would account for a further 10pp of the decline. **Our oil strategists see fundamental drivers leading oil even lower before a recovery to $60 in 2016** (see *Blue Drum*, 28 January 2015). They assume that OPEC will maintain its position, that non-OPEC supply growth will stay firmly positive, and that oil consumption will be slow to respond to lower prices. Brent prices are forecast to average $44/b in 2015. During 2015, lower prices should have only a muted effect on the demand response and not be sufficient to balance the market on their own given various obstacles preventing the full feed-through in end-user pricing. Even non-OPEC supplies ex-US will likely grow, riding the momentum from several years of sustained $100/b oil before the crash. After averaging very low levels during 2015, we expect prices to rebound to $60 in 2016. Low prices will likely curb non-OPEC supply growth to just 0.3 mb/d as demand grows 1.3 mb/d in 2016.

A return to cheap oil? Drivers of oil are now headwinds

From a medium-term perspective, the model drivers suggest flat to lower real oil prices. Slowing demand growth driven by structural factors and slow-to-adjust supply suggest a market that will be in balance, with the risks tilted toward net stock builds. The trend in global IP growth is likely lower and the risk of a synchronized recovery is low given economic divergence, so global growth points to flat to slightly lower real oil prices. OPEC share remaining at current levels suggests flat real oil prices; however, OPEC's desire to regain share is logical given the structural headwinds to oil, and, if successful, would help support prices based on our model. Power prices globally are expected to rise as emission costs rise, but technological advances provide a check that points to flat to lower real prices. Finally, covering of speculative long positioning at 10% of open interest would be a 9% drag on oil in the near term while typical dollar returns in an up-cycle would constitute a 6-7% annual headwind.

FIGURE 11

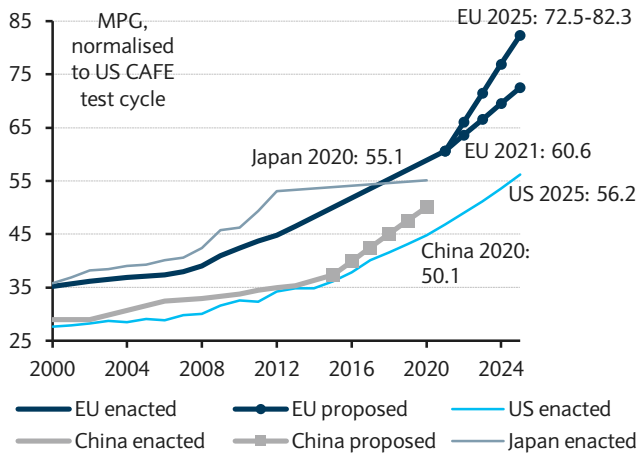
DM oil demand has been flat to down; signs of EM demand slowing



Source: IEA, Barclays Research

FIGURE 12

Headwind from vehicle fuel efficiency will be considerable



Source: ICCT

Oil demand growth forecast to slow notably

In the November 2014 World Energy Outlook, the IEA forecast crude oil demand to grow from 90mb/d in 2013 to 104mb/d in 2040, a CAGR of 0.5%. That compares to average annual demand growth of 1.0% since 2007 and 1.7% prior to 2007. Growth globally is projected to be underpinned by transport and petrochemical demand. EM demand growth outside of China is expected to continue its recent robust trend as Chinese growth plateaus and developed market growth flattens or falls amid rising fuel efficiency. A number of other longer-term structural trends are affecting demand, including: lower energy intensity of GDP, urbanization, lower population growth, aging, availability of public transportation, competition from alternative energy sources, removal of subsidies and lower elasticity of demand. We discuss how challenging demographic trends will continue to affect markets in Chapter 1, "Population dynamics and the (soon-to-be-disappearing) global 'savings glut'"; the slowing of population growth and aging will also weigh on the demand for oil, in our view.

Slower potential growth in developed economies and a decelerating Chinese economy have reduced global potential growth by 1.5pp

Global growth potential is lower. Slower potential growth in developed economies and a decelerating Chinese economy have reduced global potential growth by 1.5pp – a significant deceleration (see Chapter 4, "The great destruction"). Therefore, a return to above-trend growth is unlikely and a lower trend rate is probable. From a cyclical perspective, global IP is near trend levels (using the trend in place since the early 1990s). This reflects developed market production, which is still below potential, and emerging market output, which is slowing. As a result, the likelihood of a strong cyclical rebound like 2009 and the early 2000s is low. Given that potential growth rates have fallen and growth is so asynchronous, we see weaker global IP growth pointing to flat to slightly lower real oil prices in the medium term.

Fuel efficiency standards in the US, Europe and China are forecast to rise at a 4+% CAGR until 2025

Rising fuel efficiency will be a 4% headwind for DM and China. Our auto analysts believe that globally tightening fuel economy and emissions standards have forced automakers to focus on Powertrain engineering to design more fuel efficient vehicles and that stringent European standards mean that electrification is here to stay (see *Future Powertrain: Premium pain?*, 3 July 2014). In the US, CAFE[7] standards for passenger cars were basically the same from 1985 to 2010, at 27.5 mpg. Now, standards in the US as well as in Europe and China are forecast to rise at a 4+% CAGR until 2025 (Figure 12). The average age of the US vehicle fleet is 11 years. CAFE standards are set to go from 35 to 56.2 to 2025; this is a 4.4% annual headwind to oil gasoline demand on the simple assumption that the entire fleet turns over in 11 years. The adoption of more efficient standards by EM countries as they become more affordable could also weigh on the trajectory of demand growth, though, as older cars find their way into EM markets anyway, the efficiency standards should have a lagged impact.

Fossil fuel subsidies of $550bn[8] globally are being reduced. As oil prices have fallen, governments in China, India and Indonesia have used the opportunity to reduce fuel subsidies. As a result, lower oil prices are not fully flowing through to the consumer, which should in turn lower the demand response. In the Middle East, nearly 2 mb/d of oil are used to generate electricity when renewable energy would be competitive absent subsidies, according to the IEA. In Saudi Arabia, fuel subsidies discourage shifts to more fuel efficient cars and usage patterns. We also find that Middle East demand is well above the trend that was in place prior to 2004, likely reflecting positive spillovers from the oil boom.

US shale transformed oil into a well supplied market

Elevated oil prices led to significant capital investment, innovation and an eventual US supply response. The application of horizontal drilling and other technologies unleashed a new source of supply relatively quickly. In about two years, US crude production moved from about 5.5mb/d, where it had floundered for 15 years, to more than 9mb/d, a level last reached in 1986, when OPEC last capitulated (Figure 14). In turn, US tight oil production growth forced a response from OPEC.

[7] Corporate Average Fuel Economy.
[8] International Energy Agency

The likelihood of another period of persistent undersupply is much lower…

US tight oil is quicker to adjust, reducing the likelihood of persistent undersupply. The marginal source of supply is essentially US tight oil, which has much lower lead times. Therefore, the likelihood of persistent periods of undersupply (eg, 1999-2011) should be greatly reduced. In the near term, supply growth has once again been slow to adjust to shifting demand growth, but the market has moved from broadly undersupplied with little excess capacity to one with greater excess capacity.

…while US supply should be resilient to low oil prices

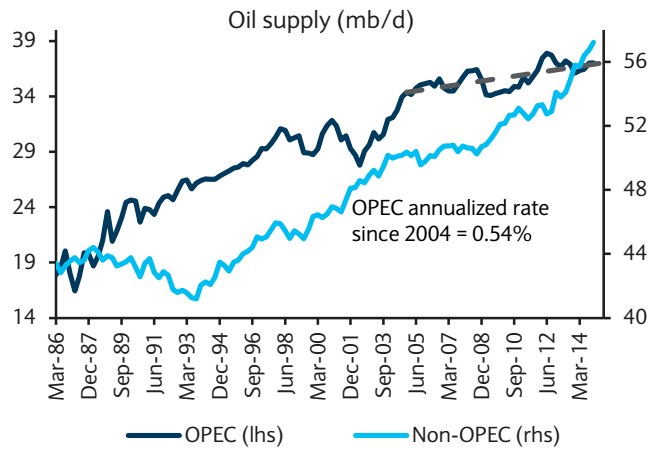
US tight oil supply costs have plummeted – resilient supply ahead (see *Re-examining the cost of oil production*, 9 January 2015). Our E&P analysts believe that US supply costs have fallen sharply and that lower supply costs will enable US producers to continue growing volumes despite a sharp pullback in CAPEX. Reduced capex will slow the growth rate, but not materially, as producers can earn 6-9% at $60/bbl and perhaps lower. After the 1986 collapse in oil, non-OPEC supply stayed relatively flat at around 44mb/d up until 1991 and was fairly resilient, while Saudi Arabia was raising production by 5mb/d. On the other hand, planned Middle East investment growth, despite falling prices means that oil supply is unlikely to collapse in response to lower oil prices in the medium term, as some worry. The IEA expects supply growth to come from the US, Canada and Brazil prior to 2020, with Middle East production growing about 10mb/d from 2020 to 2040.

Geopolitical risks remain a concern. Only last summer, investors feared that ISIS could disrupt Iraqi oil, driving oil futures higher. Disruptions are still a big risk, but the build-up of inventories should provide a buffer. Additionally, sanctions against Iran have removed a significant amount of crude from the overall market that could eventually return.

OPEC share is being held in check: A move to competitive market dynamics

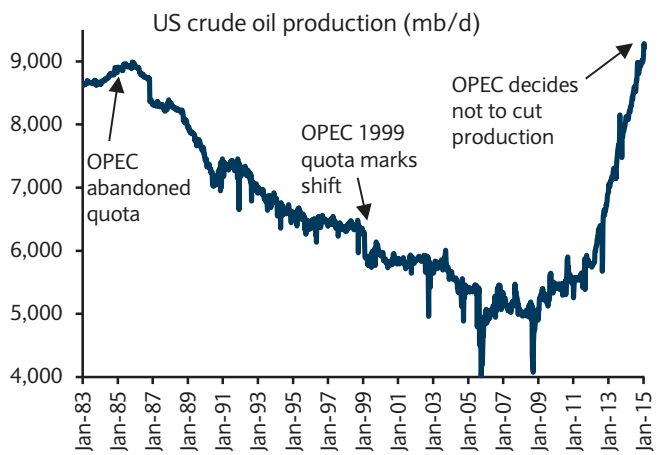
After enduring five years of pain in the early 1980s, it took just five months for Saudi Arabia to arrive at the decision not to cut production in November 2014. In 1980-85, Saudi production fell by about 75%, yet oil prices still fell by around 35%, leading to a massive revenue decline, to the benefit of others. The 1986 episode marked the shift toward a more perfectly competitive market and away from a market supported by a cartel; oil prices did not settle above the 1985 peak of roughly $30/b until 2000. Demand and supply remained fairly well balanced until the late 1990s. The OPEC quota of 1999 marked the beginning of a period in which supply continually lagged demand. The current environment, given OPEC's very loud and clear response, is one in which OPEC supply will not be constrained, market share will be maintained or even grow, and the market will drive price dynamics. Our oil strategists believe Saudi Arabia is poised to emerge as one of the most flexible suppliers of petroleum products, giving it a chance to regain share in an increasingly competitive market (see *Saudi Arabia: From swing producer to flexible petroleum supplier*, 19 February 2015).

FIGURE 13
Non-OPEC supply has surged while OPEC supply has lagged



Source: IEA, Barclays Research

FIGURE 14
US crude production rose 3mb/d in 2 years



Source: EIA, Haver, Barclays Research

Power costs continue to decline for natural gas and alternatives

Falling alternative energy prices should in theory put a medium-term cap on oil prices

Real power prices in the US rose by nearly 30% between 2000 and 2008, driven by the cyclical boom in energy demand and lagging supply. Additionally, emission abatement costs have been and will continue to be a headwind, with cheaper coal plants being retired, but significant utility investment and the growing supply of natural gas should more than compensate. Importantly, the cost of alternatives continue to decline, with solar photovoltaic costs (PV) falling at a 10% annual rate and wind costs fairly inexpensive (Figure 15). From a longer-term perspective, our strategists believe that a confluence of declining PV cost trends and residential-scale power storage is likely to disrupt the status quo (see *The Solar Vortex*, 23 May 2014). Falling alternative energy prices should in theory put a medium-term cap on oil prices; if oil gets too expensive and the payback period for an electric car is short enough, consumers will convert. Overall, the IEA sees consumer energy costs rising only modestly in Europe and Japan to 2040, slightly more in the US, and the most in China and India.

Economic justifications for real oil prices continuing to decline

Typical productivity improvements did not naturally flow through to oil prices

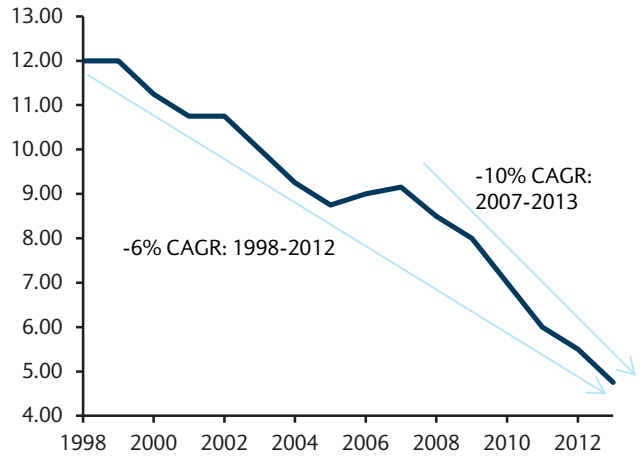
The real price of oil more than doubled from 2000 to 2014, while prices overall remained much more benign, particularly for core goods. From a high level, there is little apparent economic justification for the relative rise outside of scarcity value (real or perceived). The marginal cost of supply was incrementally more expensive, but the capex boom and its relative inefficiencies followed nearly two decades of lackluster investment. On the demand side, fuel efficiency standards were flat for nearly 25 years. Typical productivity improvements did not naturally flow through to oil prices. The fall in oil prices likely reflects in part the efficiency gains of continued investment.

The average real price of oil from 1986 to 1999 would point to a current price of $25/b to $45/b (Figure 16). Similarly, the price of oil relative to the price of natural gas remained in a 5-15x band until 2009, when it broke out as oil prices rebounded and natural gas prices remained weak. Although the dynamics are different, the gap to natural gas also points to the potential for costs to come down.

US tight oil costs are likely to continue to fall

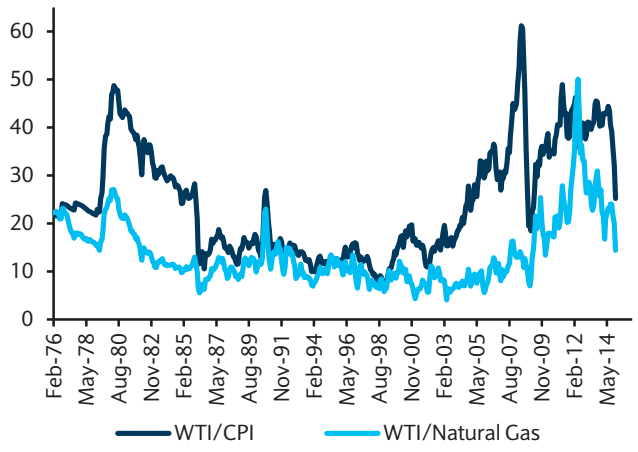
Marginal cost curve should continue to show efficiency gains. From an economic perspective, the removal of cartel pricing power in an oversupplied/balanced market means prices should settle around the marginal cost. Our US E&P and oil analysts note that US tight oil costs are likely to continue to fall, driven by technology, lower service costs (~20% declines) and improved efficiency from high-grading (drilling the "best" wells). In the current environment, there is an incentive for producers to lower costs and maintain/grow production. The magnitude of the boom likely exacerbated input cost increases for capital

FIGURE 15
Solar PV costs continue to decline and become competitive



Source: NREL, Barclays Research

FIGURE 16
On a relative basis, oil is falling toward pre-boom levels



Source: BLS, Haver, Barclays Research

(rig rates, etc) and labor (energy wages costs in the US have risen much faster than the national average). We see scope for oil supply costs to decline as the industry restructures to persistently lower prices.

Oil prices should be less volatile after settling near a new equilibrium

Inventories are back at very high levels, providing a cushion. Global inventories of crude and product have risen notably in recent months. Saudi inventories are near their peaks and US petrol inventory is back near peak levels of 95-100 days of average demand. We find that oil price volatility is inversely related to the level of total crude and product inventory. High crude and product inventories should mean lower oil price volatility, all else equal, because unanticipated demand can more easily be met by inventory (Figure 17).

After bouncing off the trough, oil prices have stayed fairly flat in past episodes. Performance of oil is highly varied in the 13 episodes in which oil has sold off by more than 30%. But in 10 of the episodes, oil prices two years after the trough were basically the same as prices one year after the trough (Figure 18). The flat trajectory likely reflects a more balanced demand-supply backdrop after the corrections.

Inflation effect of lower oil: Lower bond yields tend to persist

The oil price drop was quickly priced into lower inflation expectations and bond yields

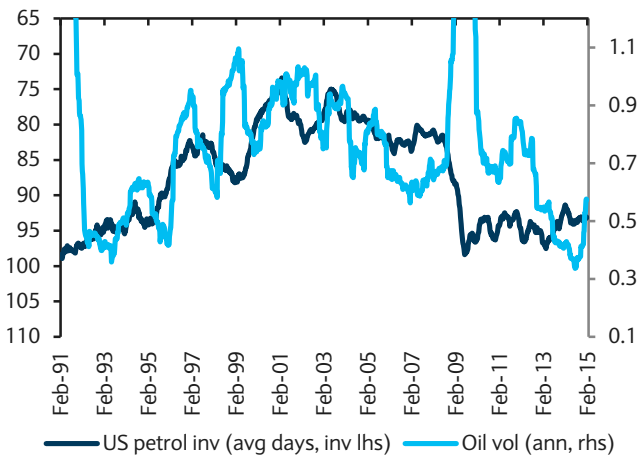
The fall in oil prices has an immediate impact on inflation. It is logical then that the collapse in oil prices has been quickly priced into inflation expectations and thus bond yields. We estimate the inflation effects from lower oil and find that emerging markets should feel a greater impact than developed markets. Sustained lower oil prices mean that energy weights in CPI will be lower and thus headline inflation vol should be lower, all else equal. Importantly, the fall in bond yields that is typical in oil selloffs tends to be fairly sticky, with yields settling 15% below higher levels prior to the oil selloff.

Inflation effects of the decline in oil are greater in emerging markets

EM should feel a greater inflation impact from lower oil than DM

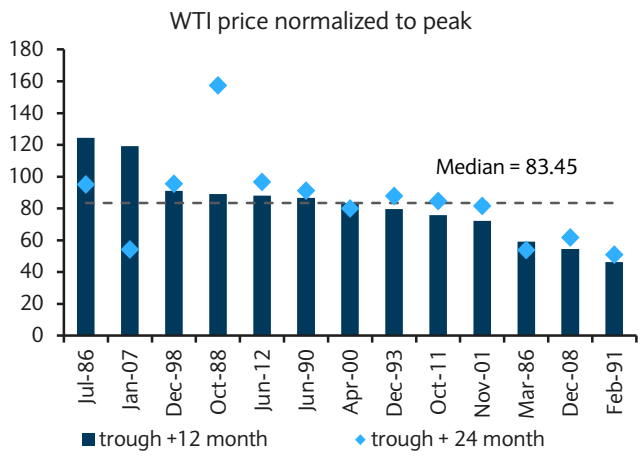
The effect of a sharp decline in oil prices on domestic inflation varies greatly across countries and derives predominantly from the direct effect of oil prices on headline CPI (weight of energy in CPI), and the indirect effect, which is estimated by the long-term pass-through of a change in oil price to the CPI via other prices. The direct weight of energy in CPI averaged 10.4% in EM versus 8.9% in advanced economies. Since overall inflation in EM is considerably higher than in advanced economies, the contribution of energy to EM inflation is proportionately higher. In terms of the indirect effect, we found that the aggregate EM long-term pass-through from oil onto inflation is 0.051 versus 0.045 in

FIGURE 17
Oil prices should be less volatile if inventories stay high



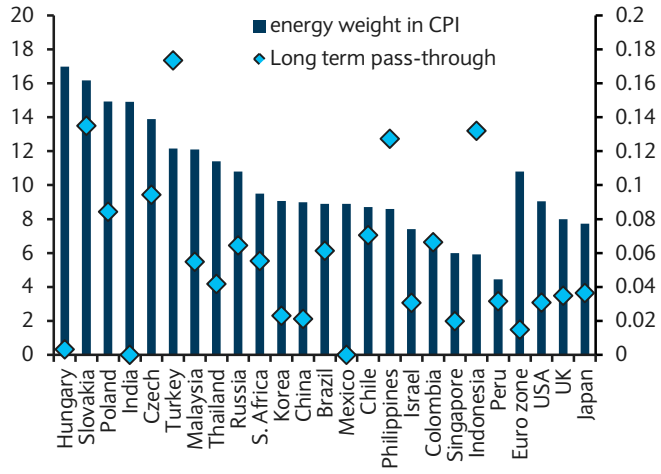
Source: EIA, Haver, Barclays Research

FIGURE 18
After bouncing off a trough, oil prices have had a flat trajectory



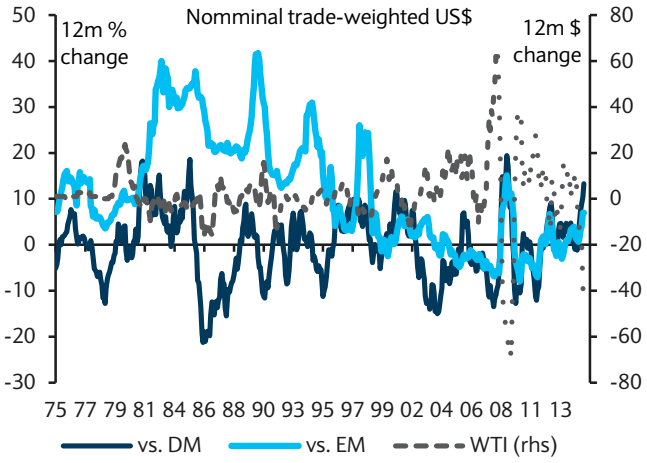
Source: Haver, Barclays Research

FIGURE 19
Energy pass-through effects vary notably



Source: Haver, CEIC, Barclays Research

FIGURE 20
EM currency depreciation has been much lower this time



Source: Haver, Barclays Research

advanced economies (see: '*The crude reality*', 8 April 2011). Unsurprisingly, in places where energy prices are heavily regulated, eg, India and the euro area, the long-term pass-through coefficients are lower (Figure 19).

It should be noted that the pass-through coefficients presented here might be slightly overstated because the importance of oil for the global economy has in fact been declining[9]. In addition, the loosening of real wage rigidities implies a more muted response from inflation and output, which means that the long-term pass-throughs are lower today relative to earlier in the sample. Nevertheless, the overstatement would be mostly consistent. We therefore expect a higher impact from lower energy prices on EM inflation relative to DM inflation, on an aggregate basis.

There is less of an offset from EM currency depreciation in this oil selloff

There is less of an offset from EM currency depreciation in this oil selloff. In the 1980s and 1990s, oil price falls coincided with large EM currency declines vs the dollar (Figure 20). EM currency depreciation through the recent fall in oil was notable, but considerably less than in past episodes and also relative to advanced currencies. Thus, the overall inflation response in EM countries should be greater relative to history as well as versus many other developed markets.

The fall in rates that is typical in oil selloffs tends to be fairly sticky

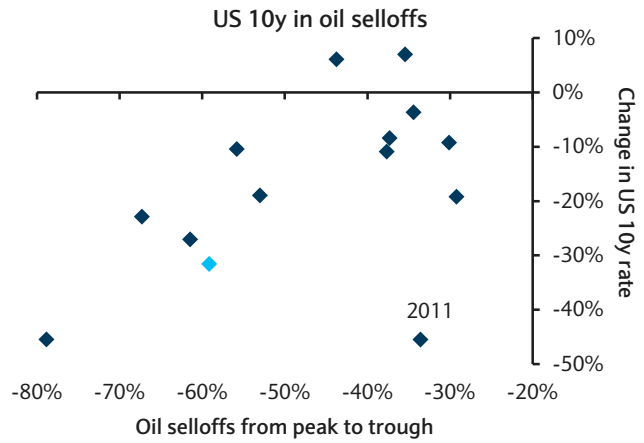
The US 10y Treasury yield declined in 11 of the 13 episodes in which oil has sold off by more than 30%. We find that the recent decrease in bond yields aligns with this pattern (Figure 21). The larger-than-implied decline in 10y yields in 2011 was likely affected by the Fed's calendar date guidance. On the other hand, the slight rise in yields in 1988 and 1990 was likely due to core inflation running above 4%.

The decrease in nominal bond yields was essentially in line with the fall in inflation expectations until early 2015

Falling inflation expectations have fueled most of the decline in nominal yields. As our inflation strategist has stated (see *Oil slick*, December 11, 2014), the link between oil and front-end inflation breakevens is clear, given the pass-through of gasoline to CPI; however, the flattening of the inflation curve and the fall in longer duration breakevens have been marked. Indeed, the correlation between daily oil price changes to daily changes in US 10y inflation breakevens has risen to exceed 60% in the past three months (30% for German breakevens). Since the June peak in oil, 10y inflation breakevens for the US and Germany fell by about 75bp from peak to trough (Figure 22). Until early this year, the decrease in nominal bond yields was essentially in line with the fall in inflation expectations as real yields in the 10y sector stayed

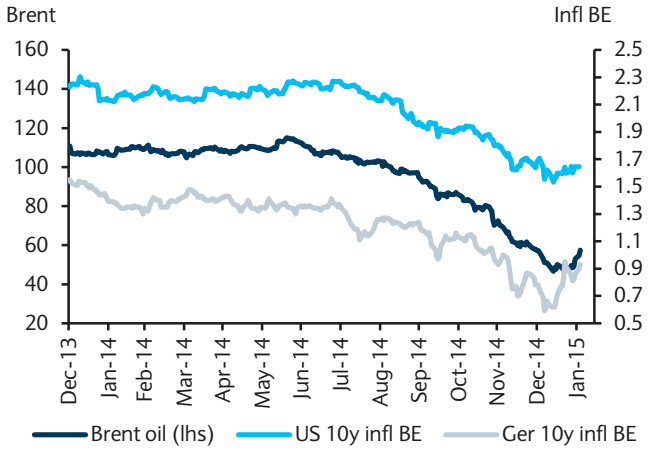
[9] See: Olivier J. Blanchard and Jordi Gali, "The macroeconomic effects of oil shocks: Why are the 2000s so different from the 1970s?", 2007, NBER working paper No. 13368.

FIGURE 21
The fall in bond yields is in line with past oil selloffs



Source: Bloomberg, Barclays Research

FIGURE 22
Breakevens have fallen globally since June as oil has fallen



Click *here* to view an interactive Barclays Live Chart
Source: Bloomberg, Barclays Research

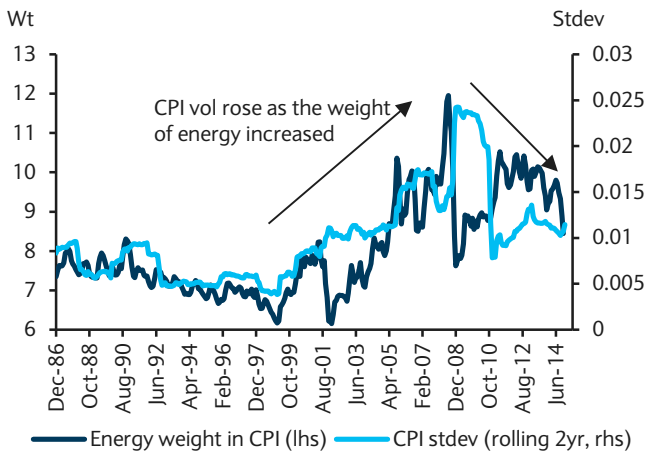
relatively flat; ECB QE likely helped drive the recent decline in real yields as oil and inflation expectations stopped falling. Clearly, central bank policy is also a key driver.

The correlation between the energy weight in CPI and the two-year volatility of headline inflation is 57%

A lower energy weight in CPI should mean less inflation volatility, all else equal. The fall in energy prices has led to a fall in the weight of energy in the CPI from over 10% in 2011-13 to probably less than 8% now; the weight of energy commodities has also fallen, by about 2pp. Since 1986, the volatility in monthly energy prices has been more than 9x that of the headline CPI index. Therefore, a lower weight of energy should logically lead to lower headline inflation volatility (Figure 23). Indeed, the correlation between the energy weight in CPI and the two-year volatility of the headline index is 57%. Additionally, as noted above, higher oil and oil product inventories could eventually lead to lower volatility in oil prices, all else equal. So the combination of a lower energy weight and potentially lower oil volatility points to lower energy inflation vol and thus lower overall inflation vol in the medium term.

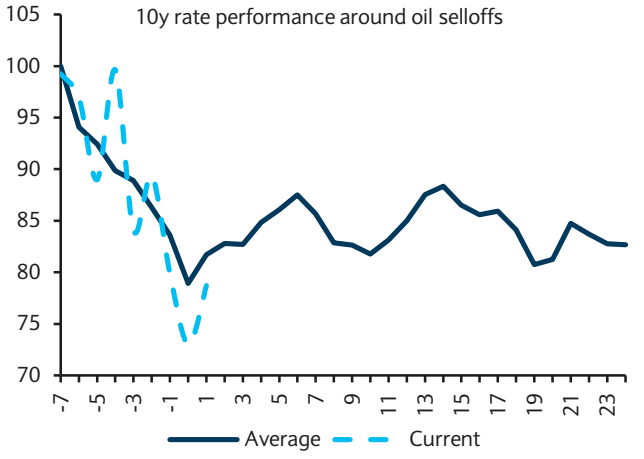
US 10y has had a flattish trajectory after past oil troughs, but is Fed-dependent. Although oil has tended to bounce after hitting a trough, the US 10y yield one and two years after an oil trough has actually been flat, using the median move of the episodes. On average, the US 10y yield settles about 15% below the higher levels prior to the oil selloff and remains in a lower range for two years (Figure 24); this implies a range around 2.2% for the US 10y.

FIGURE 23
Headline inflation volatility has historically tracked the energy weight in CPI



Source: Bloomberg, Barclays Research

FIGURE 24
The fall in the US 10y yield that is typical in oil selloffs tends to be fairly sticky



Source: Bloomberg, Barclays Research

The rise in the 10y after 1986, 1993, and 1998 coincided with subsequent Fed hikes as growth and inflation recovered, while the increase after 2012 stemmed from the taper communication. The bounce in bond yields after 2008 was from extreme levels. During the other eight episodes, US 10y yields were flat to lower a year after oil troughed.

Positive growth effects of lower oil come with a lag

The recent price decline is net positive for the global economy

A sustained decline in oil prices would be equivalent to a $1.5-2.0trn annualized redistribution from oil producers to consumers, or more than 2.0% of global GDP. A decline in oil prices means that consumers experience an increase in real disposable income while producers benefit from lower input costs. The oil price decline is therefore positive for the overwhelming majority of the global economy since most countries are net importers of oil (~90% of world GDP). Additionally, a number of buffers, including FX reserves, corporate margins and retained earnings, reduce the negative impact to the real economy from the energy fallout. Overall, as we will demonstrate, the net effect on the global economy is positive.

The benefits to growth and consumption come with a lag, in line with market pricing

The positive impact from lower oil on consumption and growth tends to manifest with a 2-3 quarter lag. Similarly, the market tends to price the benefits into growth assets with a lag; the S&P 500 rallies 12% on average the year after oil troughs. The sector beneficiaries of lower oil, such as consumer stocks, should continue to outperform amid sustained lower oil, particularly since relative valuations do not reflect the upside. Across regions, Asia disproportionately benefits since it is the largest net importer of oil; thus, an equity valuation that is in line with the rest of EM suggests the upside is not fully priced.

Assessing the effect of lower oil on consumption and global growth

According to our model, every 10% decline in oil prices boosts global GDP by 0.1pp

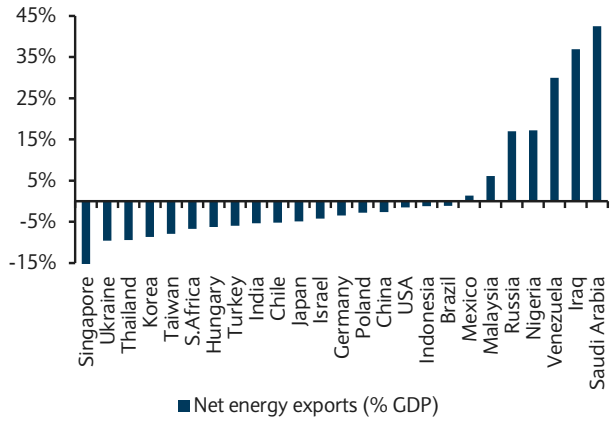
To assess the impact of oil price moves on global growth under different price scenarios, we use the framework developed in *Easy money is not easy for all EM*, (23 November 2010) and *The Crude Reality* (8 April 2011). The main channel via which oil can affect global growth is consumption, which generally accounts for 60% of GDP. In particular, we model annual real consumption growth as a function of annual real GDP growth, the level of the policy rate, and the annual change in oil prices – all variables in the coincident period and with one lag (using quarterly data). This allows us to isolate the effect of oil prices on consumption, controlling for overall activity. We ran this exercise for both oil exporters and oil importers. The resulting long-term coefficient has the expected negative sign for oil importers (ie, an increase in oil price has a negative effect on consumption, and vice versa). It is also negative for oil exporters, but much less so. This makes sense given the contrasting wealth effects arising from such price shocks in each group. At the global level, every 10% decline in oil prices is a 0.1pp boost to GDP (within one year of the price shock).

If oil prices remain in the $40-60 range, we estimate the positive effect on global GDP to be 0.4-0.5pp in 2015

We use the coefficients from this exercise[10] to simulate the global growth effect under different price scenarios. In a scenario where prices reach a floor of $40/b and remain there for the next two years, as Figure 26 shows, we estimate an incremental positive effect on global GDP of up to 0.5pp in 2015 that gradually weakens to 0.2pp by end of 2016. If prices stabilize at a level of ~$60/b by Q3 2015, the effect on global growth would reach 0.4pp in 2015 and -0.03pp in 2016 (since by then the bounce back up in price would translate to a negative real income effect on consumers). In the event that prices rise back up to $80/b, the effect on global GDP is expected to reach 0.3pp in 2015 and -0.2pp by end 2016. Our findings, based on broad sensitivities, are consistent with IMF and World Bank estimates as well as Barclays economists' forecasts of a modest boost to global growth from lower oil.

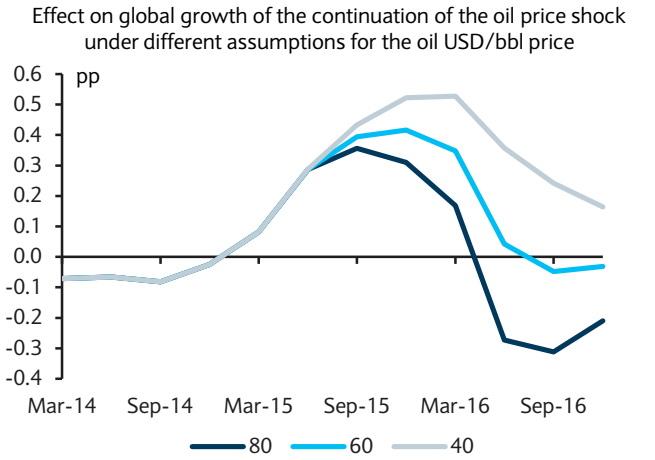
[10] That would still be valid today, given that it included 26 years of data.

FIGURE 25
Energy exports are highly concentrated



Source: UN Comtrade, Haver, Barclays Research

FIGURE 26
Global GDP growth impact (YoY) based on oil price scenarios



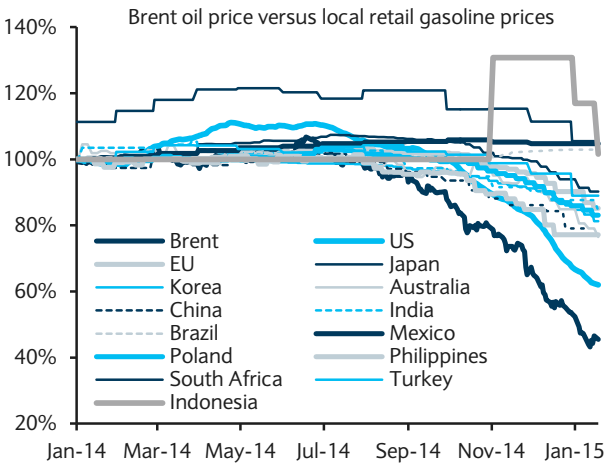
Source: Barclays Research calculations

Impact of lower oil prices on consumption could be lighter than expected

Low consumer confidence and normalizing oil subsidies could limit the positive effect on consumption

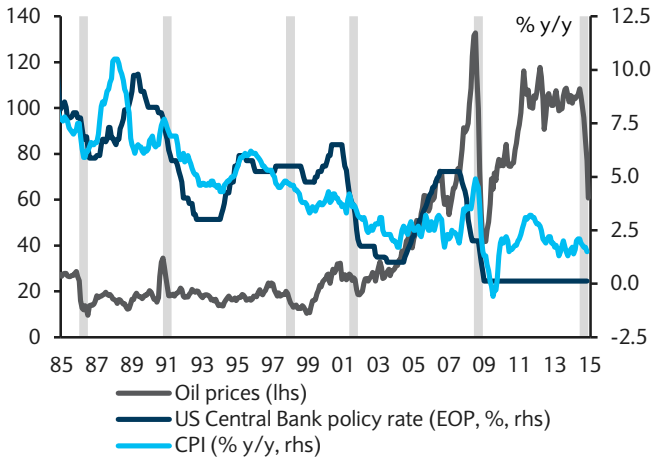
The major role of supply in the current oil decline would point to a potentially larger boost to growth, but a few factors point to a smaller impact. Low consumer confidence, as in the euro area, lessens the positive impact. The freeing up of disposable income may be saved instead of spent, and the impact on inflation may exacerbate deflation risks more than it boosts real income (see *Euro Themes: Assessing the impact of lower oil prices and the euro on growth, inflation and ECB policy*, 17 October 2014). Additionally, fuel subsidies are being normalized. Governments have used the opportunity of the recent price decline to gradually normalize prices, which means consumers are not feeling the full benefits directly (Figure 27). However, as an offset, consumers will probably still enjoy the benefits of improved fiscal balances. Finally, the zero bound limits the policy response, which is typical after oil selloffs. Interest rates that are near or below zero narrow the ability of monetary policy to respond to a disinflationary shock[11]. However, BoJ and ECB QE have showed signs of affecting inflation expectations.

FIGURE 27
Fuel subsidies and taxes limit the pass-through effect



Source: National agencies, Barclays Research

FIGURE 28
The zero bound limits the central bank policy response



Source: Haver, OECD, Barclays Research

[11] See: Olivier Blanchard and Rabah Arezki, "Seven questions about the recent oil price slump", December 2014, IMF Direct blog.

Asia is the biggest beneficiary of lower oil, followed by the US

With more than a third of global oil consumption, Asian countries benefit the most

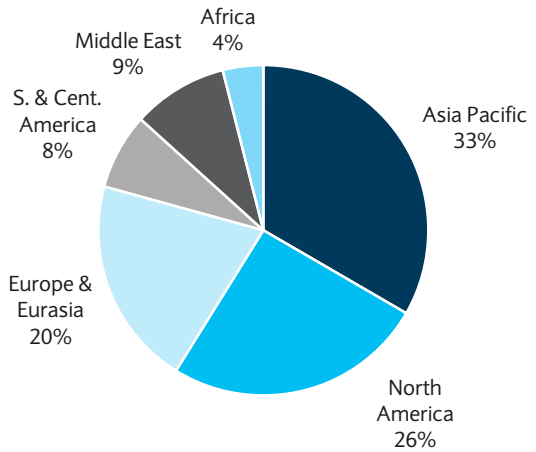
Asia-Pacific countries consume more than a third of global oil output, led by China, Japan and India (Figure 29). Asia's largest exporting economies are big importers of energy inputs and, as such, their external balances are very sensitive to oil prices. Among the heaviest importers of oil are India, Thailand, Taiwan and Korea (see: *Asia Themes: It's 'oil' good for Asia*, 2 December 2014).

- We expect China's current account surplus to rise to $356bn this year as result of lower oil. However, low energy prices and additional factors are driving inflation substantially lower, creating the conditions for PBOC intervention, which we expected in H1 (see *Lower oil ignites fresh structural reforms*, 5 December, 2014).
- In Japan, sensitivity to oil prices has risen since the 2011 earthquake as the economy has become more dependent on oil. As a result, we now estimate that a 10% decline in oil prices would lead to an initial 0.1pp positive GDP shock in Japan, with greater impact in the second and third years after the decline (see: *Sizing up recent shocks to the global economy*, 24 October 2014).
- In India, the most direct beneficiary of lower oil is the current account, which is now expected to post a small surplus of 0.1% GDP in FY 15-16 (from a previous forecast of a 1.5% deficit). Growth is also expected to improve on increased fiscal revenues from reduced subsidies and indirect taxes; however, the pass-through will likely take longer (see: *Lower oil- a boon for India*, 29 January 2015).

In the US, we estimate 0.2pp additional GDP growth for every 10% fall in oil prices, more than offsetting the expected drag from a stronger dollar. This is because of the high propensity to consume, which means a rapid transmission mechanism from lower energy prices to stronger real consumer spending (see *Consumer windfall ahead*, 17 October 2014). As the world's biggest oil consumer, the US should benefit notably from the fall in oil prices.

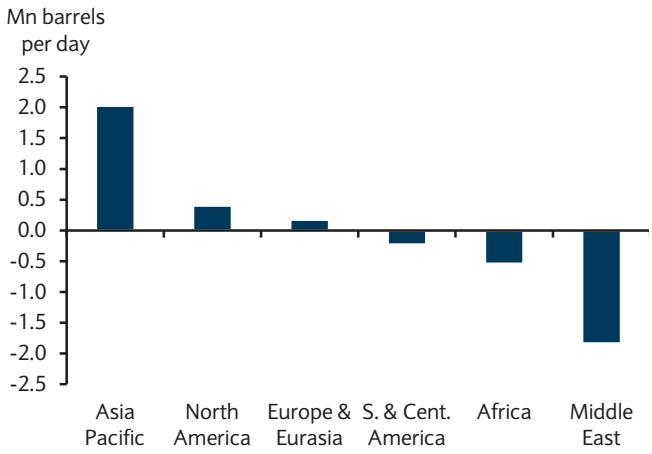
In the euro area, the impact of lower oil should be negligible, though still positive. The transmission mechanism works much less effectively, largely because of high energy taxes, which account for up to 80% of the retail price of oil in a number of member states (see *Euro Themes: Assessing the impact of lower oil prices and the euro on growth, inflation and ECB policy*, 17 October 2014).

FIGURE 29
Asia-Pacific consumes more than one-third of global oil output



Source: BP Statistical Review of World Energy 2014, Barclays Research

FIGURE 30
Asia-Pacific is by far the largest net importer of oil



Source: BP Statistical Review of World Energy 2014, Barclays Research

Global trade could rise notably on the back of lower fuel costs

Fuel is still a dominant factor in trade costs; thus lower prices should boost volumes

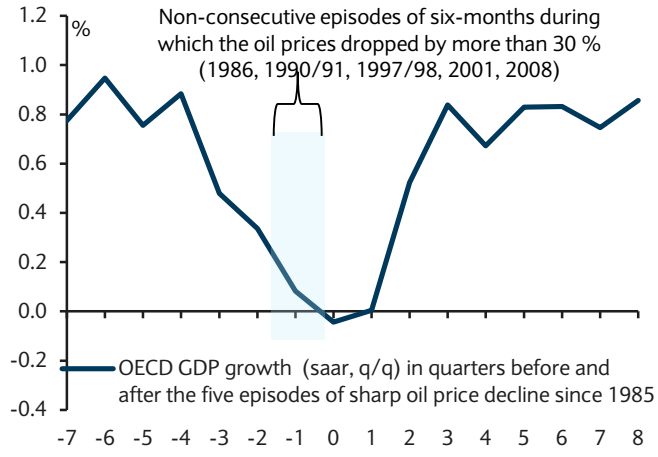
Previous research[12] found that the elasticity of trade with respect to the freight cost factor was -3[13], suggesting that the pass-through of lower oil could substantially boost global trade. UNCTAD calculated the elasticity of transport costs with respect to fuel prices and came up with a rule of thumb of 0.4. Assuming that the effect of a change in oil prices on trade is only via the freight channel, the elasticity of trade with respect to fuel costs rises to 0.4*(-3)= -1.2. Although overall trade costs have fallen in recent years, the drop has not been significant enough to dismiss them. One main reason is the dominance of the fuel component in the overall costs. As such, a large enough drop in oil prices, if sustained, could mean a significant reduction in transportation costs, which in turn should boost trade volumes.

Equities have rallied after oil troughs, reflecting lagged impacts on growth

From the June peak in oil to the recent trough, the S&P 500 rose 2%. The flattish performance is in line with the mixed performance of equities during past oil selloffs. Of the 14 episodes in which oil fell by more than 30% (including the current one), the S&P 500 was down by more than 20% four times, was flat four times, and up by more than 10% six times. The disparate performance likely reflects different demand and supply shocks in each case.

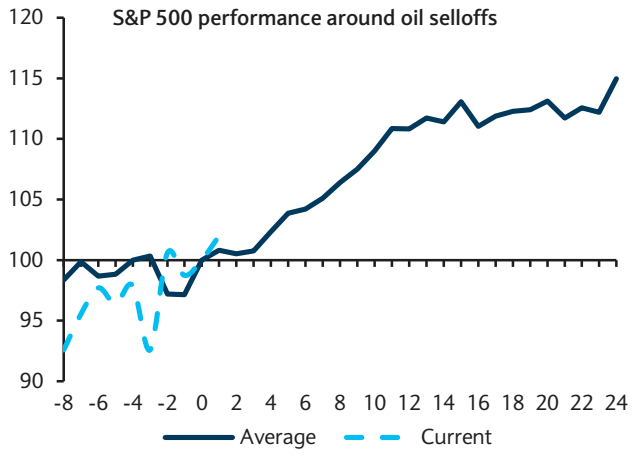
The S&P 500 has rallied by an average of 12% in the year after an oil trough (median 21%). The effect of lower oil on economic growth has been lagged by 2-3 quarters following the initial price shock (see *Oil and growth – mind the lag and keep the faith*, January 22, 2015). The positive effect on growth also tends to get priced into equities with a lag. After oil troughs, the S&P 500 has rallied by an average 12% over the next year (Figure 32). The only time equities were lower was when the tech bubble burst (2000, 2001). Adjusting for negative and positive outliers, the median S&P return in the year after a trough is a strong 21%. Performance in the second year is still positive, on average (7%), but more mixed, suggesting that the positive effects are priced in relatively quickly before other factors take over.

FIGURE 31
Past oil price declines came with slower global growth and a lagged growth rebound



Source: Haver Analytics, OECD, Barclays Research

FIGURE 32
Equities have rallied notably after oil troughs



Source: Haver, Barclays Research

[12] See: *http://economics.ouls.ox.ac.uk/14816/1/paper488.pdf*
[13] The rationale behind such a large number is the very wide definition of 'costs', which includes infrastructure of transit, trade facilitations, policies and logistics, technology, distance and geography (eg, landlocked countries were found to trade 30-60% less than coastal countries with otherwise similar characteristics).

Sector beneficiaries of lower oil have further to run

Earnings forecasts and relative valuations do not reflect the upside potential for sector beneficiaries

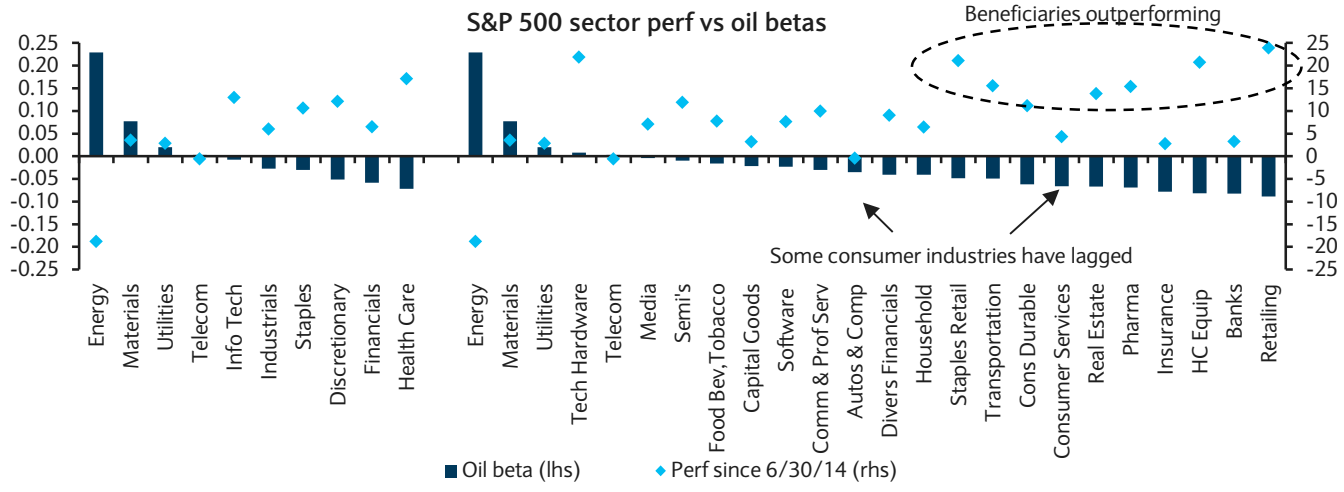
Equity sector and industry relative performance has been 73% correlated to oil betas for the US and Europe since the June peak in oil (see *Investor Intel: Cross-asset effects of lower oil*, 4 February 2015). Beneficiaries of lower oil are significantly outperforming and we find that the outperformance tends to persist. Our equity strategist points out that the world's 50 largest consumer discretionary and transportation stocks have seen no improvement in earnings or share prices since July, yet they benefit significantly from lower oil (see *Crude Calculations*, January 29, 2015). Importantly, valuations do not reflect the potential upside of higher consumption, either, particularly the consumer discretionary sector.

Healthcare, consumer and industrials have outperformed after oil troughs. Using Fama-French data, we analyze how sectors have performed during and after selloffs. Consumer non-durables, retail and healthcare have outperformed by more than 5% during oil selloffs; consumer non-durables' flattish performance has lagged the typical pattern (Figure 34). Consumer durables and manufacturing have underperformed the market since June, when relative performance was historically in line. After oil bottoms, healthcare, chemicals, manufacturing and consumer non-durables and durables have historically outperformed the market (Figure 35). Retail, banks and tech have typically performed in line with the market after oil troughs, while utilities and telecoms have underperformed.

Valuations of sector beneficiaries are not pricing the upside, particularly consumer discretionary. Historically, the relative valuation of the consumer discretionary sector has inversely tracked oil prices, with yoy declines in oil typically coinciding with a rise in the relative forward P/E multiple. However, current consumer discretionary relative multiples are near historical lows, while the fall in oil points to a relative valuation that is about 20% higher (Figure 36). Similarly, we find that staples, healthcare and materials multiples inversely track oil prices; their relative valuations are in line with or below historical averages, suggesting the upside potential from lower oil is also not fully priced.

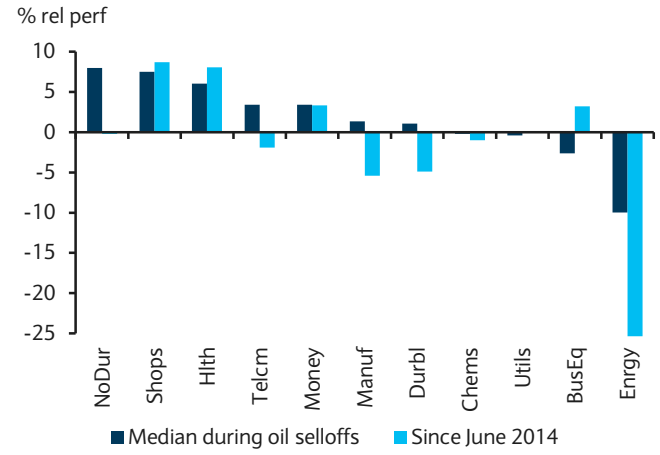
FIGURE 33

S&P 500 sector and industry performance have been closely correlated to respective oil betas



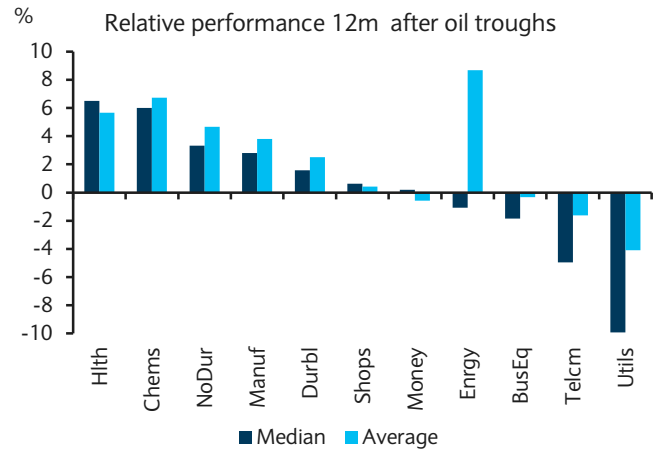
Source: Factset, Barclays Research

FIGURE 34
The decline in energy stocks has been greater than average



Source: Fama-French, Barclays Research

FIGURE 35
Healthcare, consumer and industrials have outperformed after oil troughs



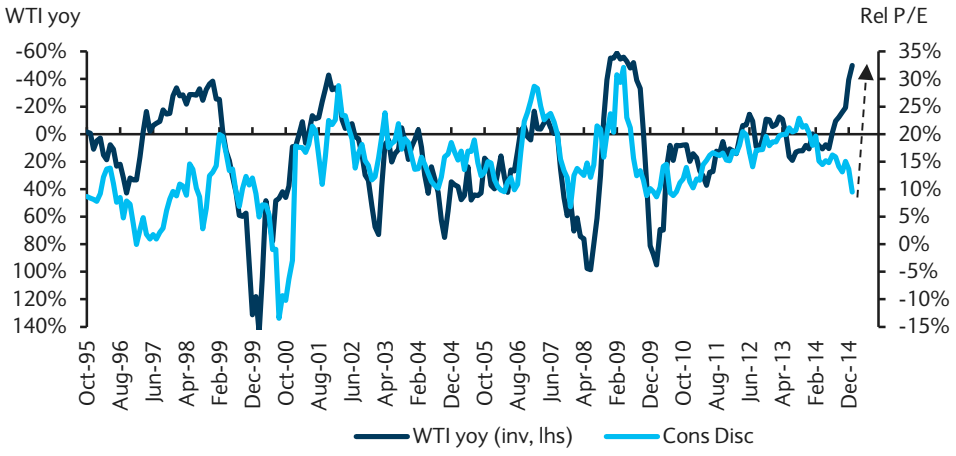
Source: Fama-French, Barclays Research

Region and country performance has also tracked oil sensitivities

Region and country relative performance since the June peak in oil has been 67% correlated to oil betas (Figure 37). Energy exporters with the exception of Canada have been punished. In addition, a number of beneficiaries to lower oil have lagged notably, eg Korea.

EM and oil exporters tend to outperform after oil troughs. Of the 11 oil selloffs since 1987, EM equities have outperformed DM equities in the year after an oil trough in seven of the episodes and performed in line in two. EM underperformed only in 2000-01 and 2012-13. Oil exporters including Russia, Mexico, Norway and Malaysia have typically outperformed as oil has rebounded (Figure 38). However, EM beneficiaries of lower oil (Korea, South Africa, Hong Kong, India) also continue to outperform developed markets. Against the current backdrop of DM interest rates at the zero bound and elevated real yield premiums, central bank easing in EM on the back of lower oil has had a notable impact, with India, China and Indonesia outperforming through volatility in 2014. After four years of EM underperformance, continued supportive policy coupled with the consumption boost from lower oil could help turn the relative performance picture. That said, the risks are high given the magnitude of the dollar move. Finally, as our equity strategist notes, the relationship between EM equities and oil that existed from the late 1990s to 2011 has not been present this time, potentially indicative of different causality (see *Crude Reality*, 8 April 2011.)

FIGURE 36
The decline in oil prices points to a rise in consumer discretionary valuations



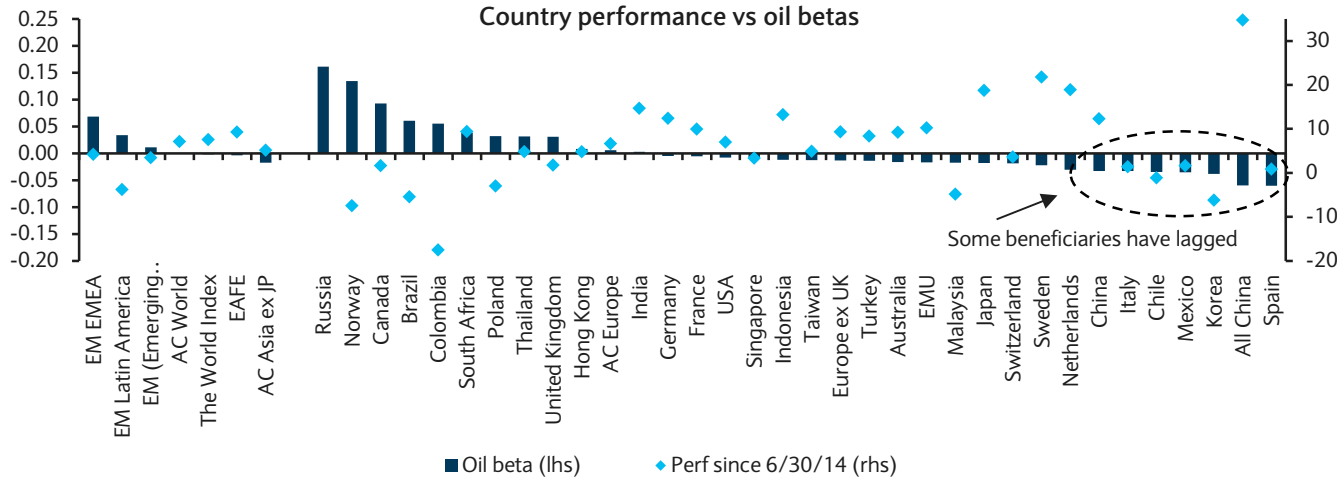
Source: Factset, Haver, Barclays Research

The collapse in oil points to further outperformance for Asia ex Japan

Asian equities have further to run amid lower oil. Of the main global regions, Asia ex Japan has the largest (negative) sensitivity to oil prices, such that lower oil should lead to outperformance. Asian equities have held up relatively well in the selloff, but in-line performance since June versus outperformance by many other beneficiaries of lower oil suggests Asian equities have further to run. Indeed, the relative performance of Asia ex Japan versus EM has inversely tracked oil prices and the recent collapse in oil points to further outperformance (Figure 39). From an economic perspective, as noted above, Asia should disproportionately benefit from sustained lower oil prices. Additionally, lower fuel prices could lead to a pickup in demand for Asian goods if world trade rises. P/E valuations for Asia that are essentially in line with EM overall suggest that the relative benefits are not fully priced, particularly given that Asia has traded at a premium to the rest of DM historically. Finally, as discussed later, many Asian currencies have not priced in the positive terms of trade shock from lower oil, so currency could also be a tailwind.

FIGURE 37

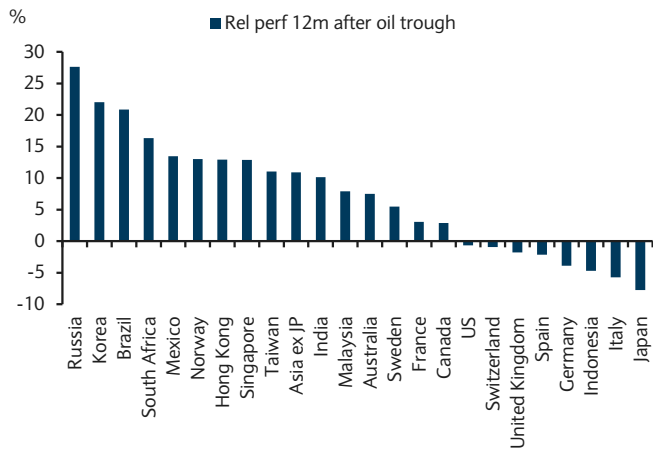
Country performance has tracked sensitivities to oil



Source: Bloomberg, Barclays Research

FIGURE 38

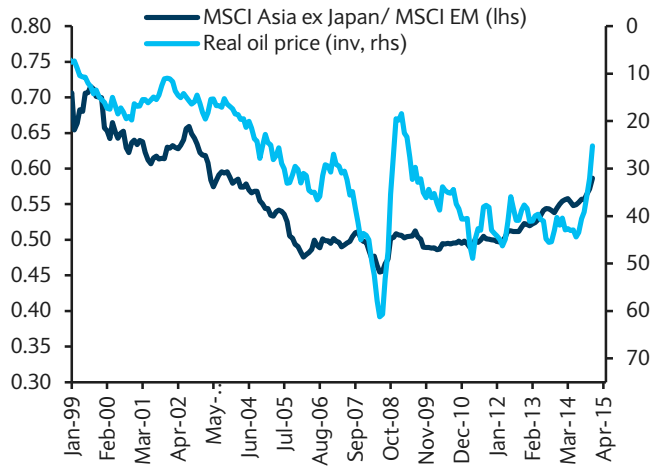
On average, EM and oil exporting countries have outperformed after oil troughs



Source: MSCI, Factset, Barclays Research

FIGURE 39

Asian equities should outperform EM amid lower oil



Source: MSCI, Haver, Barclays Research

Terms of trade shock is a tailwind for FX beneficiaries

Sustained lower oil price may have a strong effect on current accounts and currencies

The magnitude of the oil and commodity boom from the early 2000s to the peak in 2011 was extraordinary and led to a massive build-up in trade imbalances. Oil was essentially the last commodity standing, and the collapse since June shocked markets. Sustained lower oil prices are likely to have a profound effect on current accounts and currencies for some time. Thus, we assess the sensitivity of countries' external balances to a fall in oil prices. The decline in oil is largely attributable to US tight oil supply; the resultant narrowing of the US petroleum deficit should reduce the impact of oil price moves on the dollar. Finally, while currencies of oil exporters have largely adjusted, the currencies that benefit from the oil terms of trade shock have further to run, in our view.

Assessing the effect of lower oil prices on current accounts

Oil exporters are much more dependent on oil than net importers;

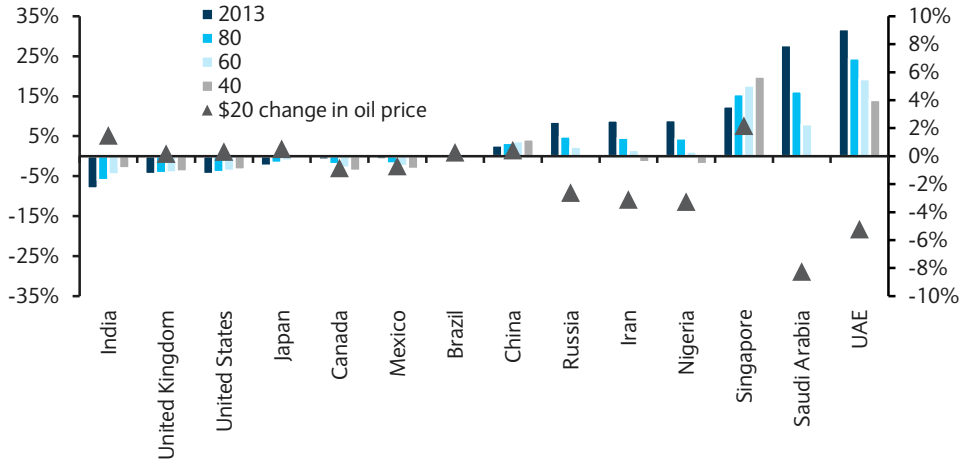
Oil exporters depend much more on energy exports than importers are affected by them, so the shock to exporters' trade balances will be felt more acutely. Oil accounts for 64% of Gulf region exports, 70% of Russian exports, and 94% of Venezuelan exports. In contrast, petroleum products account for only 10% of total US imports and 16% in China. To quantify the effect of oil price declines of different magnitudes on countries' external balances, we estimate the change in the value of the 2013 trade balance that would arise from a decline in the average price of oil as it stood in 2013 ($108/b) to $40/b, $60/b and $80/b. This simple analysis assumes perfect inelasticity of trade, which slightly overstates the response, and should therefore be used to gauge mainly short-term effects.

A $20 oil price drop improves India's trade balance by 1.5%, and worsens Saudi's by 8%

The results are shown in Figure 40. As the largest energy importer in the region (in % GDP terms), Singapore stands out with a net 2% increase in its trade balance as a result of a $20 oil price decline. However, given its already large surplus, the increment is relatively marginal. Another notable beneficiary is India, which enjoys a nearly 20% improvement in its trade deficit (1.5% increase from a deficit of 8.1% in 2013) from each $20 price drop. On the other side of the chart, the most significant negative impact would be incurred by Saudi Arabia, which should take a hit of roughly 8%, a 30% reduction in its trade surplus. Russia would experience a shock similar in magnitude (a 2.6% decline from a 9% surplus), but is left with a much smaller cushion from external balances. Oil exporters Canada and Mexico would experience a relatively muted reduction in trade balance of only 0.7% and 0.8%, respectively, but those come off a deficit of 0.9% in 2013 for both, so not marginal.

FIGURE 40

Current account impacts of changes in oil prices



Source: BP, Haver, Barclays Research

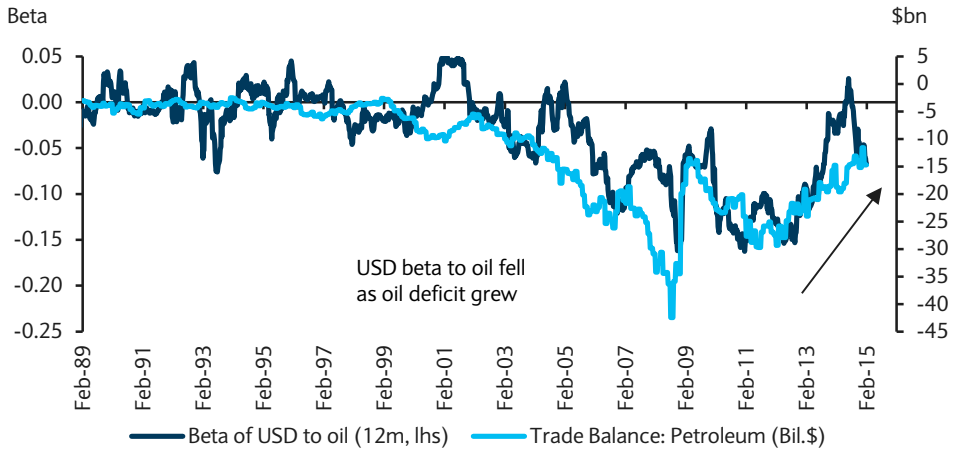
The dollar's sensitivity to oil prices should be lower

The narrowing of the US petroleum deficit has coincided with a less negative relationship between the dollar and oil

The beta of the trade-weighted US dollar to oil prices has historically tracked the US petroleum trade balance (Figure 41). In the early 2000s, as the US began importing more petroleum products on net and oil prices began to rise, the petroleum deficit burgeoned. The beta of the US dollar to oil prices became much more negative, with higher oil coinciding with a lower dollar. Since US crude production began to surge in 2012, the petroleum deficit has continued to narrow. The collapse in crude oil prices will further narrow the deficit. Accordingly, the beta of the dollar to oil price moves has become much less negative, even turning briefly positive in 2014. As noted earlier, however, causality between the dollar and oil runs both ways.

FIGURE 41

The beta of the dollar to oil has tracked US net petroleum imports



Click *here* to view an interactive Chart of the beta of Oil vs USD REER
Source: Bloomberg, Haver, Barclays Research

FX and oil: Losers largely priced, winners have further to run

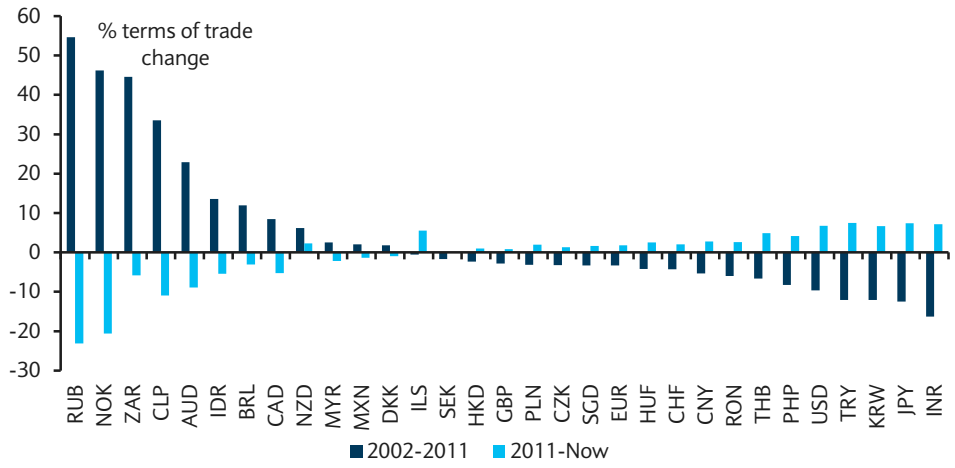
Oil prices matter for FX because they drive the terms of trade. A rise in oil prices would improve an exporting country's terms of trade and worsen those of an oil importer. In our view, the beneficial shifts from lower oil and commodity prices have yet to be priced into many importing currencies (eg, Asia FX). Markets seem concerned about disinflationary stories and may be underestimating the medium-term positives of lower oil and commodity prices.

Only about a third of the terms of trade shifts of 2002-11 have been unwound, implying that exchange rates are unlikely to revert to 2002 levels given that fair values have changed

Oil has been a primary driver of terms of trade shifts and thus currency movements. Figure 42 shows the moves in our measure of terms of trade, which is calculated as the ratio of each country's commodities export and import price indices. A number of oil producing countries enjoyed extremely large increases in their terms of trade (RUB and NOK) as did those producing base metals (AUD, IDR and CLP) and precious metals (ZAR). Terms of trade movements explain about 20% of the cross-sectional variation in real exchange rates since 2002-11, when oil/commodity prices increased. This makes sense given that terms of trade is a key driver of a currency's medium-term value. Indeed, our behavioral equilibrium of exchange rates (BEER) model includes terms of trade as one of four drivers of a currency's value alongside relative productivity, a country's net foreign asset position and the relative level of government spending (for details, see *Currency valuation from a macro perspective*, 14 June 2011). Only about a third of the terms of trade shifts of 2002-11 have been unwound, implying that real exchange rates are unlikely to revert to 2002 levels given that fair values have changed. This raises the question: how have currencies evolved relative to fair value?

FIGURE 42

Only about 1/3 of the 2002-11 commodity boom terms-of-trade impact has been unwound



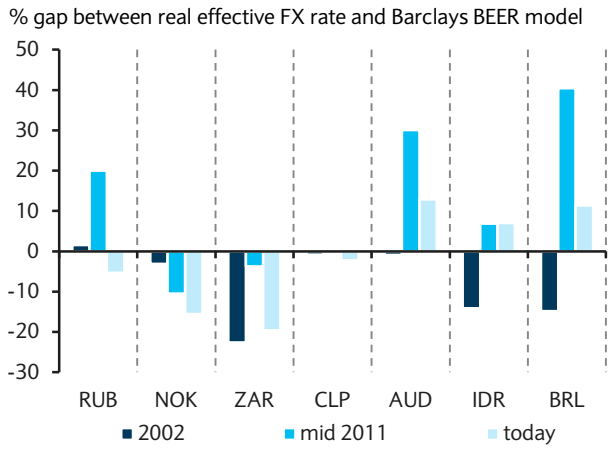
Source: Barclays Research

Countries where terms of trade improved as a result of the commodity price run-up largely went from being cheap in 2002 to expensive in 2011 and cheapened recently (and vice versa). Figures 43 and 44 show how the gap between the currency level and its BEER fair value has changed for the countries that were the big winners and losers from the terms of trade shifts (we look at the top and bottom seven countries). By and large, the terms of trade winners went from cheap to expensive in 2011 and have erased some of this richness more recently. The NOK is a notable exception that can be ascribed to the offshore petroleum fund that prevents oil revenues from coming onshore unless the government is running a non-oil fiscal deficit. For the terms of trade losers, the opposite pattern holds. Effective exchange rates for a basket of terms of trade winners and losers do not suggest significant misvaluations at present, despite large currency movements. The REER and BEER of a GDP-weighted basket of commodity exporting countries have cheapened recently, but it is not particularly cheap. Nor are commodity importers at particularly rich levels.

Oil exporting currencies have adjusted notably, oil importing currencies have not. We believe currencies are sensitive to oil prices via three major channels: 1) the effect on external balances; 2) the effect on economic growth; and 3) the effect on monetary policy. Figure 45 summarizes the exposures of different currencies through these channels (see *Global FX Quarterly: Oil matters*, November 20 2014 for details). Baskets of the top and bottom seven currencies based on this oil sensitivity score are shown in Figures 46 and 47.

FIGURE 43

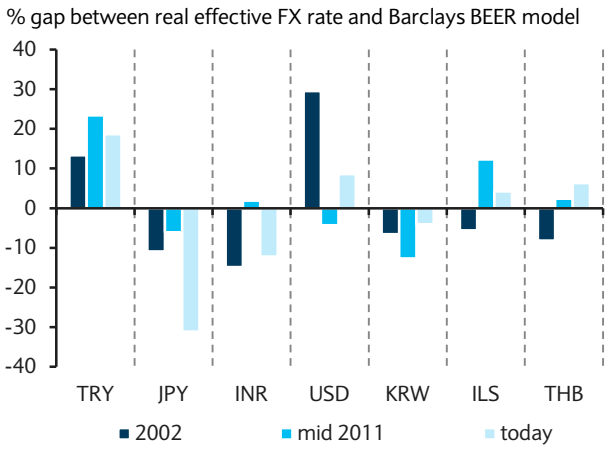
Terms of trade winners - % misvaluation vs BEER fair value



Source: Barclays Research

FIGURE 44

Terms of trade losers - % misvaluation vs BEER fair value



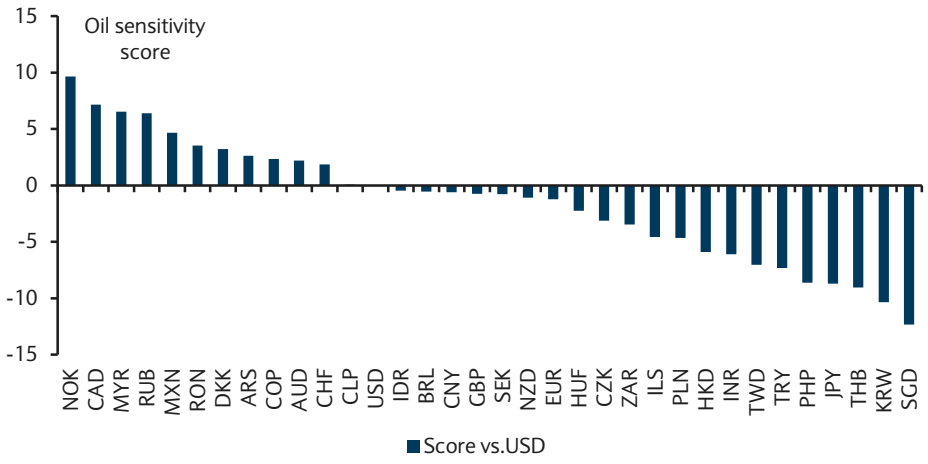
Source: Barclays Research

The results are striking: whereas currencies of oil exporting countries have adjusted lower and their overvaluations have declined, currencies of oil importing currencies have not yet done so.

Among oil-exporting countries, currency movements since the end of Q3 2014 have been largely consistent with the deterioration in their terms of trade fundamentals stemming from oil/commodity price declines (Figure 48). The depreciation has been especially sharp for the RUB but also for CAD, MXN, MYR and DKK on a relative basis. We find it interesting that the terms of trade boost among oil-importing countries has so far been largely ignored (most notably Asia FX, including INR, KRW, etc). The market seems to have settled the debate over whether lower oil/commodities intensify disinflationary forces or support growth through consumption in favor of the former. In our view, the terms of trade boosts are likely to yield faster growth, rising inflation, tighter monetary policy and stronger currencies on a relative basis in the medium-term.

FIGURE 45

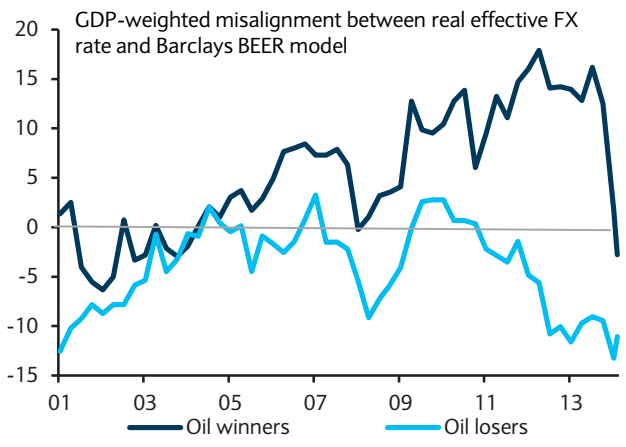
Currency rankings based on an oil sensitivity score



Source: Barclays Research

FIGURE 46

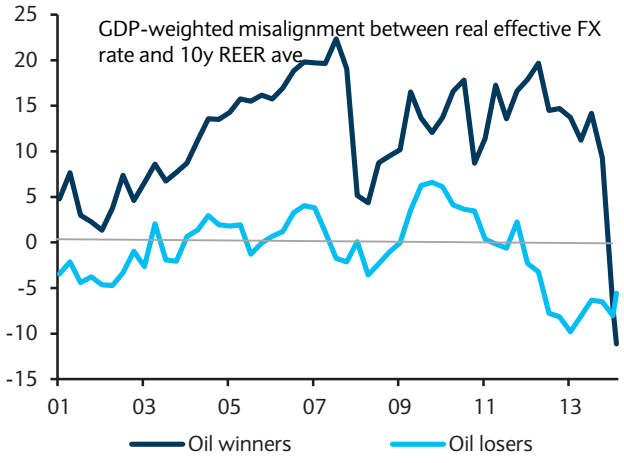
GDP-weighted misalignment between REER and Barclays BEER model



Source: Barclays Research

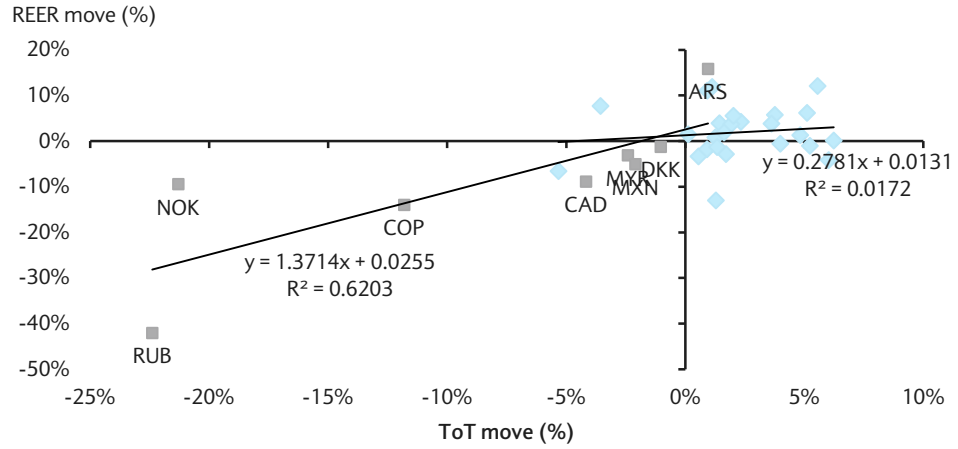
FIGURE 47

GDP-weighted misalignment between REER and its 10y average



Source: Barclays Research

FIGURE 48
REER move versus the terms of trade shift since Q3 2014



Source: Barclays Research

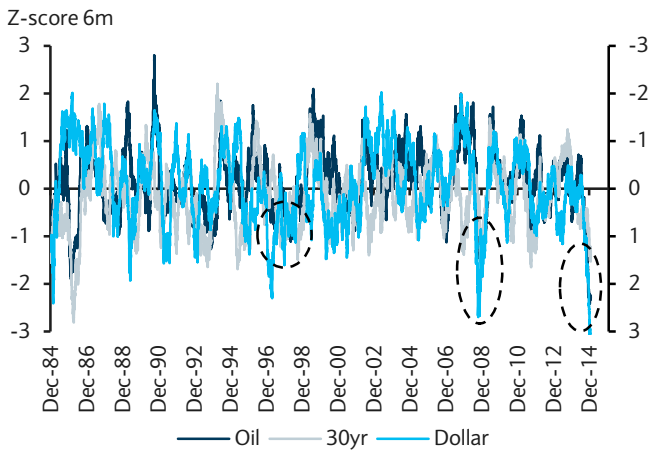
Energy fallout and financial stability concerns

The magnitude of the oil decline and the likely persistence of lower oil prices mean that energy-exporting countries and energy companies will have to bear the brunt of a $1.5-2.0trn annual reduction in revenue. A wave of energy-related defaults on the back of sustained lower oil prices could reverberate through the system and lead to heightened risk aversion. However, there are important differences in country fundamentals and market dynamics that suggest the risks to financial stability are lower this time around. That said, risk premiums for energy-related assets are likely to remain elevated in an environment of sustained lower oil.

Sustained oil weakness is often followed by financial stress. The recent oil price collapse, a 2.5stdev move, coincided with a surge in the dollar (3std), and a plunge in bond yields (Figure 49). The only other time all three have moved so far, so fast was during the depths of the financial crisis in 2008. Oil plummeted and the dollar rose during the Asian and Russian crises in 1997-1998, and the 1992-93 oil collapse likely contributed to the Mexico devaluation in 1994.

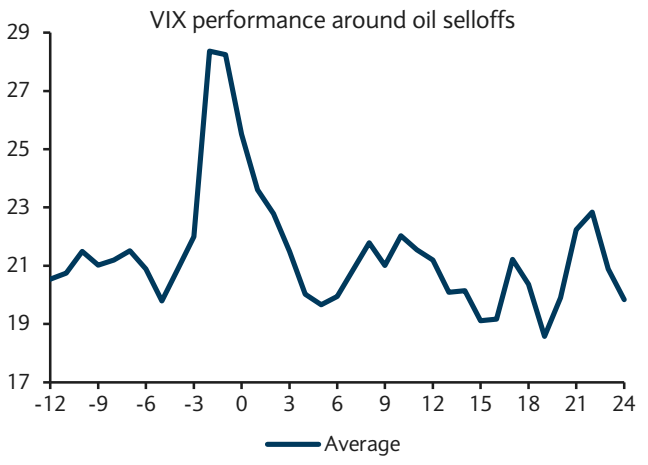
Energy is a big weight in EM and US HY. Most crises are the result of debt and equity issuance to fund (over) investment. The rise in debt among energy and EM corporates has followed a similar pattern. The weight of energy countries and companies in the EM sovereign and corporate bond indices is about 30% and about 15% in EM local bonds and

FIGURE 49
The shocks to oil, bond yields and USD are similar to 2008



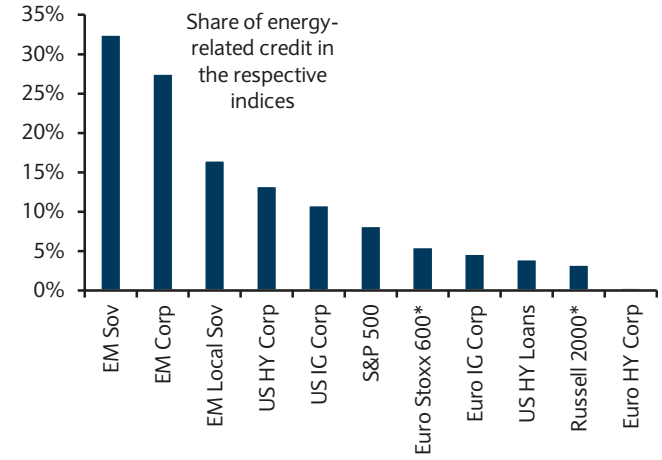
Source: Bloomberg, Barclays Research

FIGURE 50
Volatility tends to subside once oil bottoms



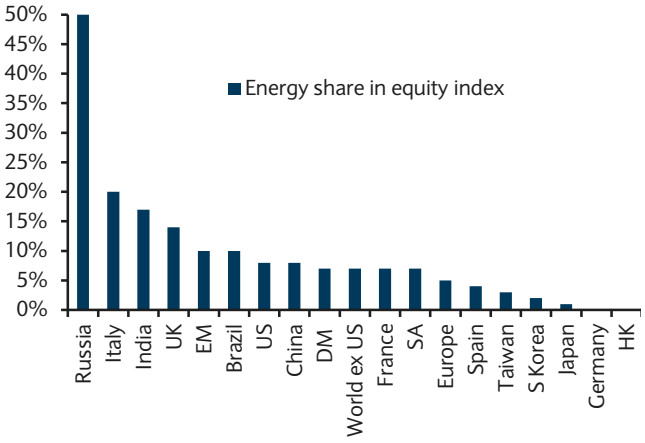
Click *here* to view an interactive Chart of the VIX. Source: Haver, Barclays Research

FIGURE 51
The weight of energy is highest in EM hard currency debt



Source: iShares, Bloomberg, Barclays Research

FIGURE 52
The weight of energy in equity indices



Source: MSCI, Barclays Research

US HY, posing notable default risk, and thus spillover risk, to investors (Figure 51). The energy weight in global equities is much smaller, 7%, with Russia having the largest exposure by far (Figure 52).

Volatility tends to subside after oil finds a bottom, however. Using the average of the VIX around past oil selloffs, we find that volatility tends to peak in the weeks right around the trough in oil, but returns to normal levels once oil bottoms (Figure 50).

Oil-exporting countries are the clear losers from a decline in oil prices

Russia stands out as having taken the largest hit from the oil shock so far

Apart from the real activity implications, a large shock to these energy-dependent countries can pose financial stability risks. However, a closer look suggests the risks are lower than in the past.

- **Russia is the biggest sufferer, with the ruble taking the largest hit.** The RUB selloff is causing large inflationary pressures, though Russia has the ability to at least partially offset the negative growth effect via imports, which tend to contract more than consumption. Nevertheless, there is a high risk of financial instability and over-depreciation because of the spiral effect on business confidence, productivity growth and investment growth (see *Russia quarterly: Problems accumulate*, 5 December 2014). Russia's "Big Four" companies, Gazprom, Rosneft, Lukoil and Novatek essentially have cash/short term debt ratios in excess of 100%; this, coupled with their low-cost position and the flexible Russian oil taxation system, suggests that a default on their hard currency debt in coming months is unlikely (see *Russia Big 4 Credit & Equity Cashflows: Surviving the "Time of Troubles"*, 15 December 2014).
- **Venezuela, with 94% of exports from oil, is highly exposed, but default risk is priced.** The hard currency regime means that the oil price decline is hardly offset by devaluation, and ongoing wild fiscal spending is expected to continue, maintaining a deep deficit of roughly 16% of GDP. (*The Emerging Markets Quarterly: Content with carry, concerned with commodities*, 5 December 2014).
- **Middle Eastern oil producers have accumulated significant FX reserves.** The IMF estimates a $98 oil price is needed to balance Saudi Arabia's budget, and above $65 to maintain a CA surplus. However, with FX reserves covering more than 900% of Saudi's external debt, a net asset position of over 100% of GDP and among the world's lowest levels of public debt (less than 3% of GDP), the kingdom has ample fiscal space and plenty of policy tools to accommodate the lower oil price (see *The end of OPEC's golden age?* 24 November 2014).

- **Mexico has also been hurt by the oil price drop, but concerns look to be overstated.** The opening of the economy to international trade has intensified the links to the US, and in turn reduced reliance on oil and gas, which now account for only 7.3% of GDP. In the past 10-15 years, oil and gas production has shrunk by nearly 25% in real terms and the exposure of government revenues to oil prices has declined by 60% (see *Oil price collapse; for Mexico's economy, concern looks overstated*, 21 January 2015).
- **The primary loser in Asia is oil-exporting Malaysia,** which is expected to take a 0.5% CA hit for every USD10 drop in oil prices. However, lower fuel subsidy spending should clear some fiscal policy space.

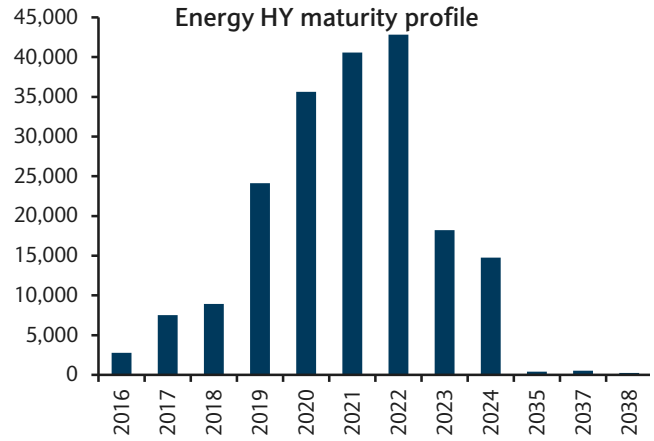
EM country fundamentals are in better shape, reducing spillover risks

As noted in Chapter 3, "Why EM is still an attractive asset class", the economic performance of EM improved markedly in the early 2000s. This is attributable to a combination of macro stability post EM crises and a benign external environment. Inflation fell to single digits as central bank independence and inflation-targeting started playing a bigger role. Governments took action to ensure debt sustainability and enhance their external buffers. As a result, government debt and fiscal deficits fell and external vulnerability indicators improved notably. For a detailed discussion of the changes in the macroeconomic and financial landscape and the resulting resilience to negative shocks see *Navigating the new EM landscape: Where to find the best returns*, Equity Gilt Study 2011. That said, the external backdrop for EM economies has grown tougher since 2011 and will likely remain so over the next few years, while progress on structural reforms has been disappointing.

Market dynamics are also different, providing buffers to the oil shock

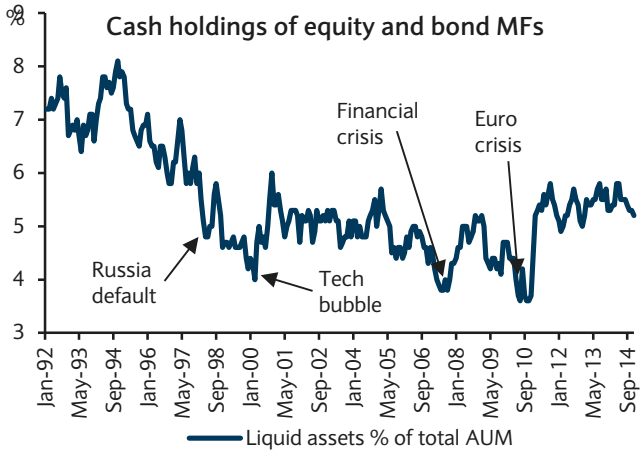
- **Financial markets are more flexible, with fewer currency pegs.** Many past crises stemmed in part from currency pegs that did not allow adjustment to occur through exchange rates. The 50% decline in the Russian ruble since June has meant that the resultant increase in import prices will lead the adjustment, while FX reserves were not exhausted to defend an overvalued currency. Importantly, Russian equities held up reasonably well in local currency terms. The currencies of other oil exporters, including Colombia, Mexico, Canada and Norway, have also depreciated considerably.
- **FX reserves provide a sizeable cushion for the terms of trade shock from lower oil.** The reserves of major oil exporters mushroomed when oil was rising, to almost $1.5trn (Saudi Arabia, $718bn; Russia, $316bn; UAE, $315bn; and Qatar, $106bn).
- **Maturity profile in HY and much of EM provides some breathing room, for now.** A number of US E&P companies will find it difficult to keep operating even at the current level of oil prices, raising the potential for defaults. However, most HY energy companies have some breathing room until 2018-19, when debt maturities will start to be significant (Figure 53). Within EM, LatAM and EMEA debt maturities should provide some time to ride out lower oil prospects and the start of Fed hikes, but less so for Asia.
- **The Fed is not hiking (yet) and other central banks are easing.** The recent oil selloff has led to considerable central bank easing, while the Fed has stayed the course. This contrasts with the Mexican peso devaluation in 1994 and the crises in Brazil and Argentina in 1999-2001, when the Fed was hiking. Additionally, the Asian and Russian crises were set against a backdrop of high US real yields, which is certainly not the case currently. However, the prospect of sustained lower oil and Fed hikes starting this year could put further external pressure on at-risk countries and companies.
- **Investor liquidity remains a buffer, but market liquidity remains a concern.** Liquidity ratios dropped below 4% prior to the euro crisis in 2010, the financial crisis in 2007 and the bursting of the tech bubble in 2000. Current post-QE cash ratios have remained above 5%, despite cash yielding essentially zero (Figure 54). Cash levels for bonds and asset allocation funds are elevated, while equity fund cash holdings are average. Importantly, US HY bond funds have raised their cash holdings to 5.6% from a low level

FIGURE 53
Debt maturities are not significant for another few years



Source: Barclays US HY Index

FIGURE 54
Investor liquidity is higher than other pre-crisis periods



Source: ICI, Haver, Barclays Research

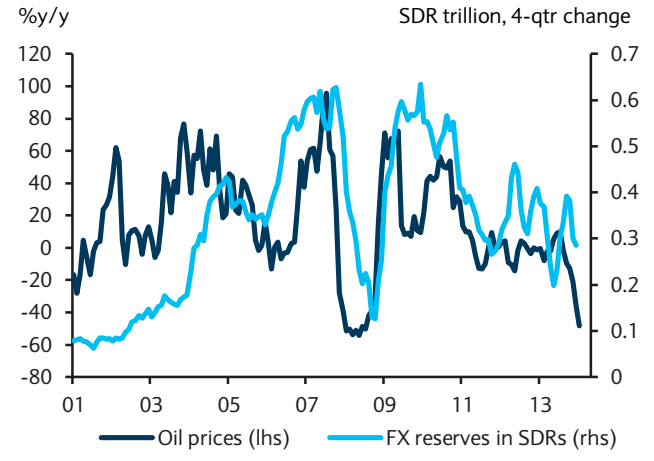
in June (4.5%), a scenario that has historically pre-dated volatility in HY (eg, 2007, 2000 and 1998). That said, redemption cycles, such as the one during the taper tantrum, show that markets are much less liquid after a financial crisis in a world of smaller dealer balance sheets.

Slower FX reserve accumulation removes a key source of bond demand

(This is excerpted from GMD Focus *, 6 February 2015)*

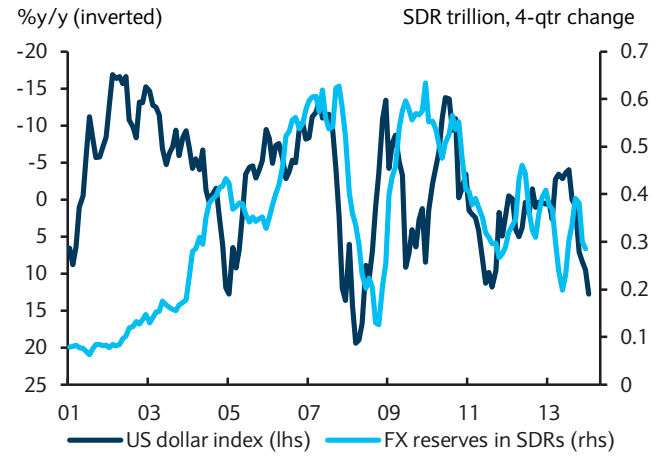
With the decline in oil and the rise in the dollar, one important source of global fixed income demand – central bank reserve managers – is set to fade from the fixed income markets in the months ahead (Figures 55-56). Already, growth in central bank FX reserves has slowed markedly. From an average net increase of around $750bn per year since 2002, FX reserve growth has slowed to just half that pace in the past four quarters. Indeed, total FX reserves actually fell in Q3 2014 – only the third fall since 2002 (the other two quarterly declines were during the financial crisis of 2008-9.) Admittedly, part of the recent decline in FX reserves simply reflects the translation of non-USD holdings reported in the now-stronger US dollar. But there are reasons to think the weakness in FX reserves is also fundamental, and will prove more lasting. As such, it should come as no surprise that Russia has seen its largest decline in FX reserves in recent months. To be sure, Russia's problems extend beyond a weak oil price, but even Saudi Arabia posted a rare decline in FX reserves toward the end of 2014.

FIGURE 55
FX reserve growth and oil price changes



Source: Bloomberg, Barclays Research

FIGURE 56
FX reserve growth and US dollar index changes



Source: Bloomberg, Barclays Research

US energy sector will be hard hit, but it is smaller than TMT and financials

The oil price decline will be felt globally, but US energy companies stand to be hurt most. However, to put this into perspective, US energy stocks had a $1.9trn market cap in June 2014 (11% of S&P) and energy high yield companies were about 15% of the index. In comparison, in 2000, TMT comprised more than $5trn of US market value (44% of market cap) and about 44% of high yield. In 2006-08, US financials were $3trn in market cap (22%) with $15trn of mortgages outstanding before the housing bust. In terms of the US economy, the financial sector employed 8.4mn people in 2007 and lost 800k jobs, while TMT employed 3.7mn and 600k jobs were lost. Energy and related sectors in the US employ fewer than 1mn people. Finally, oil-related assets and debt typically do not have the type of collateral function that can cause larger systemic effects, as was the case with mortgage debt.

Energy-related assets will require higher risk premiums

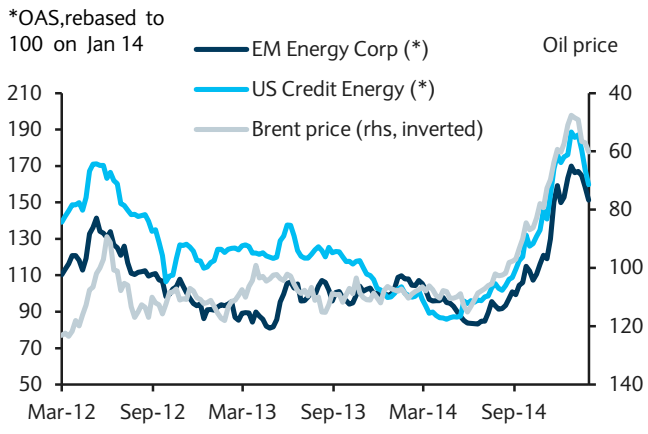
Assets most exposed to the oil price decline have been particularly affected as the oil price collapse has led to a re-pricing of risk premiums. EM and US energy credit spreads have widened and energy equities' relative price to book ratios have fallen toward historical lows. The currencies of oil exporters have sharply depreciated. Given that energy-related asset prices and valuations move with the price of oil, sustained lower oil prices means that risk premiums for energy-related assets will remain high to account for the still significant headwinds.

US high yield spreads reflect lower oil prices, but maybe not low enough

(This is excerpted from US HY Energy 2015 Outlook, 14 January 2015, and Energy Effects, 9 January 2015)

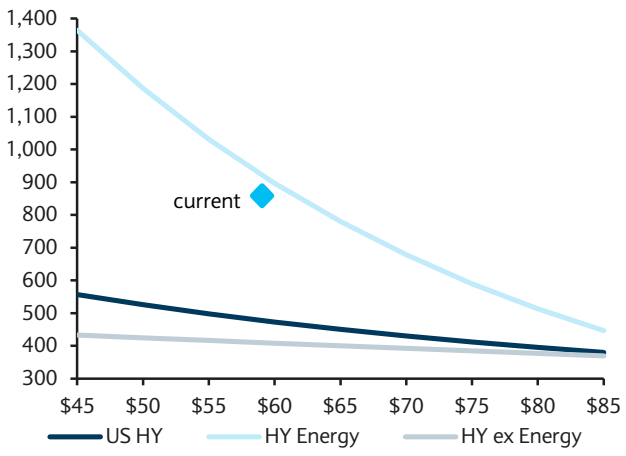
If this oil cycle is "lower/longer," as we expect, HY energy spreads could widen further, based on our sensitivity analysis of high yield OAS to oil prices (Figure 58). Assuming $50/bbl WTI, E&P debt/EBITDA could jump to 4.3x from 2.8x and about 1/3 of the credits we model will have leverage above 5x. In 2016, even under higher assumed WTI prices of $60/bbl, ~40% of the names under coverage will likely have debt/EBITDA over 5x as weaker hedges more than offset a rise in assumed oil prices. Spreads could approach 1200bp in such a scenario. We model a 4.5% default rate in such a scenario, taking into account hedges that should help insulate certain credits in 2015, but stopping short of the full bottom-up analysis that will be necessary for a more comprehensive view on potential default losses if oil prices are at these levels a year from now.

FIGURE 57
EM and US energy spreads have widened with the fall in oil



Source: Bloomberg, Barclays Research

FIGURE 58
High yield OAS sensitivity to oil prices



Source: Bloomberg, Barclays Research

Energy equity discount reflects sizeable headwinds

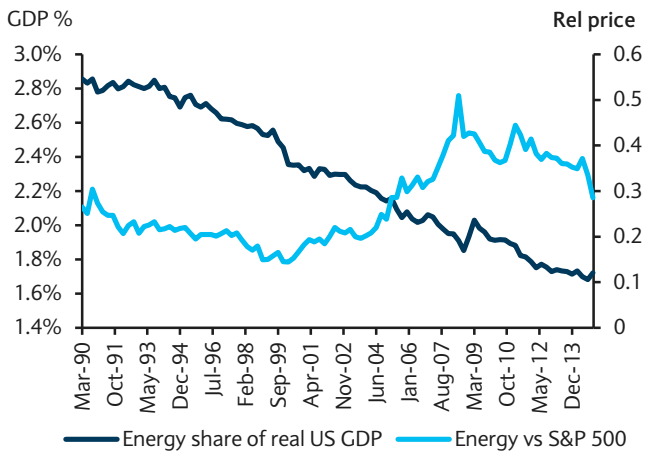
Since June 2014, the S&P 500 energy sector has underperformed by 23% while global energy underperformed by 27%. Using Fama-French industry data going back to the 1980s, to capture more episodes, we find that energy stocks have underperformed the market by 13% on average during oil selloffs. The 1986 episode is probably most similar to the current one and energy stocks underperformed by 29% as oil fell by 67%. The significant underperformance of the energy sector likely reflects the re-pricing of medium-term prospects, particularly the decision by Saudi Arabia not to cut production. The removal of cartel support for higher prices and the implicit competitive stance by OPEC amid an environment of weakening demand helped drive the larger underperformance.

Beta of energy sector earnings to oil prices is greater than 1x. Our US equity strategists have estimated that energy sector revenue and operating cash flows have a beta to oil prices of roughly 1x (see *Lower oil prices – a net positive*, 6 November 2014). The impact on earnings should be larger because of non-variable expenses such as depreciation offset by some expense relief by negotiating lower costs with the oil service companies, but the latter represent 15% of energy sector earnings. We estimate the energy sector's net income beta to oil is near 1.5x.

Slower oil demand growth is also a headwind. Oil demand growth is expected to slow further in the medium term, suggesting that the downward trend in the share of energy in real GDP should continue. In addition to flat to lower real oil prices, the lower real growth profile should weigh on the relative performance of energy stocks (Figure 59). Using a joint regression, the beta of relative energy sector performance to real oil prices is 1.1x, in line with our US strategist's findings, while the beta to relative energy GDP is 0.33. The average difference between energy and GDP growth has been 2% since 1990. A similar differential and a beta of 0.33 imply a 0.67% headwind to relative energy sector performance in the medium term, which is not insignificant in a lower-return environment.

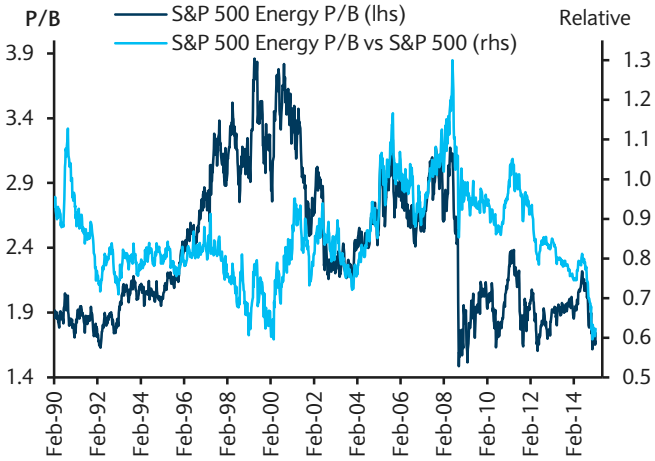
Energy valuations near the lows reflect medium-term headwinds. Energy sector EPS will likely be volatile for some time, so price to book ratios are a good valuation metric. The S&P 500 energy sector is trading near 25-year lows at 1.7x price to book (Figure 60). As important, on a relative basis, energy is trading at a 40% discount to the S&P 500. The fall in oil means that asset writedowns remain a real risk. Using 1986 as a comparison, the energy sectors traded at around 1.0x book through the worst of the selloff until oil prices started to recover in late 1986; the valuation discount at the oil trough was 46%. To put the relative P/B in perspective, S&P financials have traded at a persistent 50% discount since the crisis.

FIGURE 59
Lower energy demand growth should also be a headwind



Source: Haver, Barclays Research

FIGURE 60
Energy P/B valuations near the lows



Source: Bloomberg, Barclays Research

EM risk premiums are also likely to remain elevated, particularly for corporate debt

As we discuss in Chapter 3, "EM is still an attractive asset class", EM risk premia are again moving toward levels more consistent with the early boom stages, especially in local currency debt. Our analysis suggests that investors have so far been compensated for the risks they have taken. Given the significance of energy in many EM countries and indices, sustained lower oil poses some still-significant risks, particularly for EM corporate debt given large issuance and the 30% weight in the index. Although EM debt dynamics are highly influenced by idiosyncratic issues, such as the Russia sanctions and Petrobras scandal, the link between many EM sovereigns and related EM corporate complicates investing in EM (see *The Emerging Markets Quarterly: Content with carry, concerned with commodities*, 5 December 2014). EM oil producers are lower cost than US HY companies and are more comparable to DM IG producers (in ratings, until recently, and certainly in terms of leverage). However, the effect of oil on macro dynamics, including fiscal strength and therefore sovereign spreads, is a reason to expect a larger spread discount in EM than DM given equal fundamental exposure to weaker oil.

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Appendix: Heat map of sensitivities to oil price changes

EM data from *The Emerging Markets Quarterly: Content with carry, concerned with commodities*

	Heat map of EM vulnerability to energy price changes											
	Economic activity		External accounts					Inflation		Fiscal accounts		
	Net exports of oil (% GDP)	Net exports of energy (% GDP)	C/A change in % of GDP from $/b 10 oil price change	C/A change in USD bn from $/b 10 oil price change	C/A Break-Even oil price ($/b)	C/A forecast (% GDP) 2014	C/A forecast (% GDP) 2015	% of energy in CPI basket	Long term oil pass through coefficients	revenues (% of government revenues)	Energy subsidies (% of GDP)	Fiscal Break-Even oil price ($/b)
EM net oil exporters (darker colour = greater vulnerability from lower oil price)												
Kuwait	53	57	-4.7	-9	33	38.9	21.1	-	-	92	4.9	54
Saudi Arabia	46	43	-3.9	-32	64	14.8	5.3	-	-	90	8.3	98
Oman	41	43	-3.5	-3	82	8.1	-1.3	-	-	86	-	99
Iraq	40	37	-3.3	-8	94	1.6	-8.2	-	-	98	6.0	111
Qatar	36	62	-3.0	-7	56	26.4	17.2	-	-	56	3.1	55
Venezuela	30	30	-2.7	-6	77	6.6	1.5	5.0	-	-	10.2	600
UAE	25	51	-2.1	-9	64	12.3	6.8	-	-	64	5.6	79
Bahrain	20	15	-1.8	-1	67	9.1	2.3	-	-	88	7.8	125
Nigeria	13	15	-1.2	-6	77	3.5	-1.6	8.5	-	66	1.0	113
Russia	14	17	-1.5	-26	72	3.6	6.7	9.0	6.4	51	2.2	95
Colombia	8	7	-0.6	-3	-	-4.3	-5.0	6.8	6.6	-	0.0	-
Malaysia	7	7	-0.5	-2	48	5.0	3.0	12.1	5.5	25	1.5	-
Ghana	1	1	-0.1	0	204	-9.6	-7.8	-	-	8	0.3	-
Mexico	1	1	-0.1	-1	-	-1.7	-1.9	8.9	-	32	0.8	-
Argentina	0	-1	0.0	0	-	0.9	0.9	9.9	-	1	4.1	-
Peru	0	-1	0.0	0	-	-5.0	-4.6	5.7	3.2	-	-	-
Kenya	0	0	0.6	0	-	-7.3	-7.5	3.7	-	-	-	-
Egypt	0	0	0.0	0	-	-1.2	-2.3	-	-	-	6.6	-
EM net oil importers (darker colour = greater benefit from lower oil price)												
Brazil	-1	-1	0.1	2	-	-3.9	-3.2	8.9	6.1	1	-	-
Indonesia	-2	1	0.1	1	-	-2.8	-1.9	6.0	13.2	21	2.4	-
China	-2	-3	0.2	23	-	3.3	3.6	-	2.1	-	0.2	-
Hungary	-3	-6	0.4	0	-	3.7	3.8	17.6	0.3	3	-	-
Israel	-3	-4	0.3	1	-	2.9	2.9	7.2	3.1	0	-	-
Turkey	-3	-6	0.5	4	-	-5.4	-4.3	13.6	17.3	-	-	-
Poland	-4	-3	0.3	2	-	-1.2	-0.7	17.8	8.4	3	-	-
Philippines	-4	-5	0.3	1	-	4.4	5.4	8.9	12.7	-	-	-
Chile	-5	-5	0.5	1	-	-1.6	-2.1	10.5	7.1	-	-	-
S. Africa	-5	-4	0.6	2	-	-5.4	-4.1	4.2	5.5	-	-	-
India	-5	-6	0.4	9	-	-1.3	-1.2	9.5	-	-	1.0	-
Ukraine	-5	-10	0.7	1	-	-3.0	-2.4	9.4	-	-	5.8	-
Morocco	-8	-10	0.6	1	-	-4.8	-4.5	-	-	-	3.8	-
Singapore	-8	-8	1.4	4	-	19.4	19.2	2.4	2.0	-	-	-
Korea	-9	-10	0.8	10	-	5.7	6.2	10.0	2.3	-	-	-
Taiwan	-9	-11	0.7	4	-	12.0	12.6	6.7	-	-	-	-
Thailand	-10	-10	0.9	3	-	3.0	4.4	11.4	4.2	-	0.7	-
Zambia	-	-	0.4	0	-	-0.8	2.6	-	-	-	-	-
DM net oil importers (darker colour = greater benefit from lower oil price)												
US	-2	-2	0.2	28	-	-2.3	-2.3	9.0	3.1	-	-	-
Euro Area	-3	-	0.3	33	-	2.2	2.0	10.8	1.4	-	-	-
UK	-1	-1	0.1	3	-	-5.0	-5.1	8.0	3.4	-	-	-
Japan	-3	-5	0.3	14	-	0.2	0.9	7.7	3.6	-	-	-
Switzerland	-2	-2	0.2	1	-	10.1	9.8	6.4	8.0	-	-	-
DM net oil exporters (darker colour = greater vulnerability from lower oil price)												
Norway	13	19	-1.1	-6	-	-	-	7.8	2.0	-	-	-
Canada	5	4	-0.4	-8	-	-2.4	-2.3	8.6	7.4	-	-	-

Source: EIA, Haver, IEA, National statistics office, Barclays Research

CHAPTER 3

EM is still an attractive asset class

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- **The external backdrop for EM economies has grown tougher since 2011 and will likely remain so over the next few years. On the domestic front, progress on structural reforms has been disappointing. But EM economies have evolved since the start of the boom years in the early 2000s, with many of their macroeconomic and financial vulnerabilities now reduced.**
- **EM risk premia are again moving toward levels more consistent with the early boom stages, especially in local currency debt. Our analysis suggests that investors have so far been compensated for the risks they have taken. However, because of the negative backdrop, annualized returns in the down period have been far smaller than annualized gains in the boom.**
- **When we look at EM in the context of a global portfolio, the gap between EM and DM risk premia is significant. Thus, we think allocations to EM assets make sense even if asset returns are likely to be much lower than in the boom years.**

A changing landscape

The EM investment landscape has changed dramatically over the past two decades

EM economies have gone through a remarkable economic transformation over the past two decades as the crisis-plagued 1990s led to a boom in 2002-11. Three key factors drove that transformation, in our view. First, China emerged as a global manufacturing power and a major source of demand for commodities. Second, EM countries reduced their dependence on external debt finance and the associated currency mismatches. This was reinforced by a secular downtrend in term interest rates in the developed world, notably the US. Third, most EM economies achieved macro stability through fiscal responsibility, lower inflation, more flexible exchange rates and the build-up of external buffers.

After the 2002-10 boom, the environment for EM assets has become more challenging

These factors reinforced each other, producing a virtuous cycle that led to strong macroeconomic outcomes and high asset returns. However, the boom years were followed by a 'landing' phase that began in 2011 with the reversal of the favourable external backdrop: a slowdown in China, lower commodity prices and a stronger US dollar. As these positive factors recede, the likelihood of much needed structural reforms to boost potential growth will likely fall. In that context, the environment for EM asset returns over the next few years is likely to be a lot more challenging, even if some of the macroeconomic improvements (notably lower inflation, the shift toward exchange rate flexibility, and more stable sovereign external debt) are proving to be long-lasting.

The EM investment landscape must be considered in the context of a new reality: a more challenging external backdrop and the need for structural reform to boost growth. First, we discuss the bust, boom and landing cycles of the past two decades. Second, we assess the key challenges of the changing external environment. Third, we highlight the main domestic challenges and remaining vulnerabilities. Finally, we review how EM risk premia have evolved and where investment opportunities look most attractive given these new challenges.

EM asset returns have fallen but there are still attractive opportunities, especially in fixed income and currencies

Our assessment is that EM is much more resilient than it was 15-20 years ago, though still vulnerable to various external macro headwinds. Activity and earnings growth are likely to remain challenging and so are equity returns. Local bonds have better prospects as real yields remain high and growth and inflation prospects subdued. However, there remains plenty of scope for differentiation. In equities, we favour countries that benefit from macro/structural reforms, lower oil prices and a stronger US economy, notably EM Asia. High carry and undervalued currencies also make some bond and FX markets attractive.

Bust, boom and landing: EM cycles since the 1990s

Emerging markets have experienced bust, boom and landing phases since the early 90s

Emerging market economies have gone through three major phases over the past two decades: the economic and financial fragility of the crisis-plagued 1990s; the economic and financial boom of 2002-10; and the 'landing' period that started in 2011.

The crises of the 1990s and the early 2000s are well documented in the academic literature.[1] The macroeconomic outturns at the turn of the 1990s were dismal: growth was slow by EM standards, inflation high and indicators of external vulnerability poor (Figure 1).

FIGURE 1

EM macro fundamentals in bust, boom and landing cycles

Domestic factors:	1998-2001	2002-2010	2011-2014
Real GDP growth (% YoY)	3.9	6.6	5.1
Inflation (% YoY)	10.6	6.6	6.2
Government gross debt (% GDP)	52.3	43.8	39.1
Fiscal balance (% GDP)	-2.1	-1.1	-1.3
Current account balance (% GDP)	0.1	2.7	1.1
External debt (% exports)	147.1	92.0	79.6
External debt service (% exports)	38.1	29.4	27.1

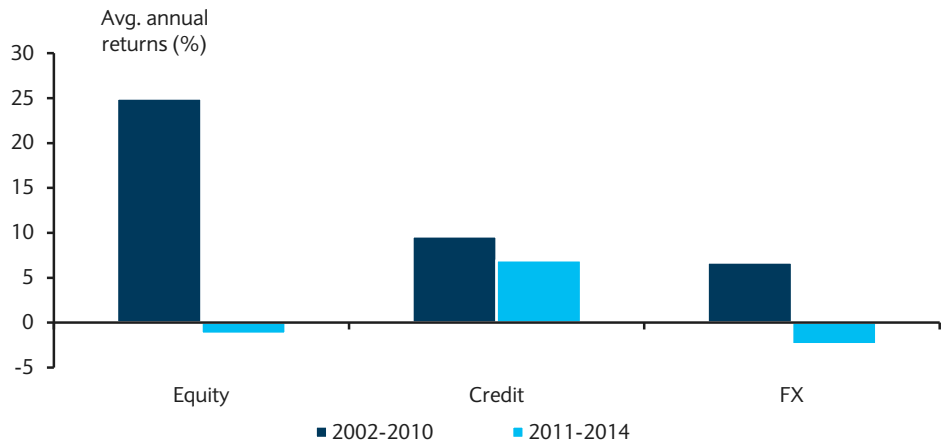
Source: Barclays Research, IMF

Economic performance improved materially in the boom cycle (2002-10)

The economic performance of EM changed markedly for the better in the early 2000s on a combination of macro stability post-EM crises and a benign external environment. For a detailed discussion of the changes in the macroeconomic and financial landscape and the resulting resilience to negative shocks, see 'Navigating the new EM landscape: Where to find the best returns,' *Equity Gilt Study 2011*.

FIGURE 2

Asset returns* were very high during the boom years, but have been lackluster since 2011



Source: Barclays Research, Bloomberg. *Total returns

Benign external conditions and better fundamentals led to high asset returns in the boom years

The boom years were supported by a virtuous cycle of benign external conditions and improvements in domestic fundamentals. On the external front, the emergence of China as a global economic power, the associated boom in commodity prices and lower external financing costs (notably via falling US interest rates) fuelled the EM growth recoveries. Meanwhile, macro stability and the build-up of external and fiscal buffers led to significant improvements in macro fundamentals. These synergies led to strong economic performance and a reduction in risk premia, which had soared following the EM crises. As a result, EM experienced very high asset returns (Figure 2).

[1] See for example, Calvo (2005), *Emerging Capital Markets in Turmoil: Bad Luck or Bad Policy?*; or Roubini, Nouriel and Brad Setser (2004), *Bailouts or Bail-Ins: Responding to Financial Crises in Emerging Markets*.

The benign external environment began to reverse in 2011 and asset returns fell as a result

However, in 2011, the benign external environment began to reverse. At the same time, little was achieved in terms of institutional progress and structural reforms beyond the post crises adjustments, and EM asset returns have been uninspiring apart from EM sovereign credit. As a result, economic growth and asset returns deteriorated markedly.

External headwinds led to EM emergency landing

Five external factors have become less supportive since 2011: slower growth in China and the euro area, weaker commodity prices, US yields edging higher and a stronger US dollar

EM economies are heavily influenced by the external macroeconomic environment. According to the IMF, about half the variance in EM economic growth rates in 2000-12 can be explained by external factors, including China and developed market growth, low core interest rates and the commodities boom. Furthermore, global factors remain important drivers of macroeconomic outcomes even in the aftermath of the EM crises.[2] Although external factors were very supportive of EM economies and their asset returns in the first decade of the millennium, they started to reverse in 2011. We identify the key external factors that have driven these changes, construct an indicator of external supportiveness and discuss how it may evolve and affect EM asset returns in the next few years.

Changes in the external environment

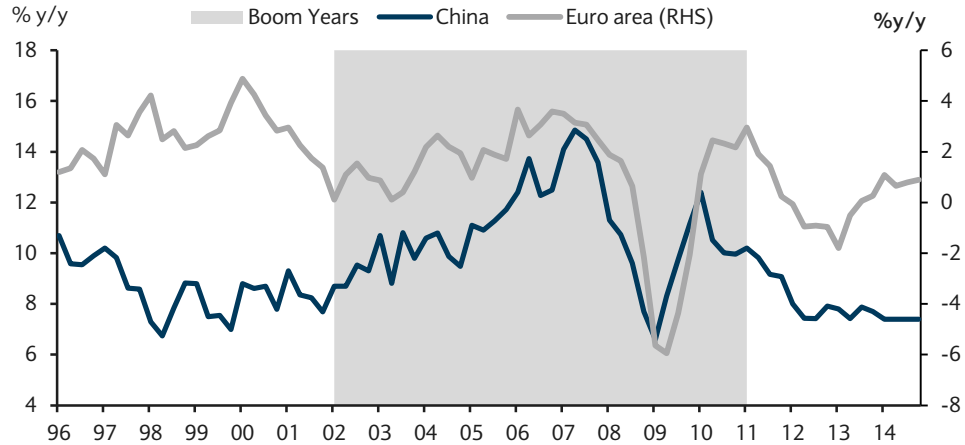
In our view, the following factors are the key external headwinds faced by EM since 2011:

- slower growth in China
- slower growth in the euro area
- sharply lower commodity prices, particularly oil
- prospect of higher US yields
- stronger US dollar

Slower GDP growth in China and euro area

China's GDP growth slowed to *c.*8% in 2011-14 after recording average annual growth of *c.*11% during the boom years of 2002-10. One of the main reasons for this was the rebalancing of public investment and exports into private consumption. In addition, euro area growth has been low, relative to historical norms, since early 2011. Average GDP growth since Q1 2011 has been *c.*0.3% y/y, well below an average of close to 1.7% in 1999-2010, a period that included the global financial crisis (Figure 3).

FIGURE 3
Slower China and euro area GDP growth since 2011



Source: Haver Analytics, Barclays Research

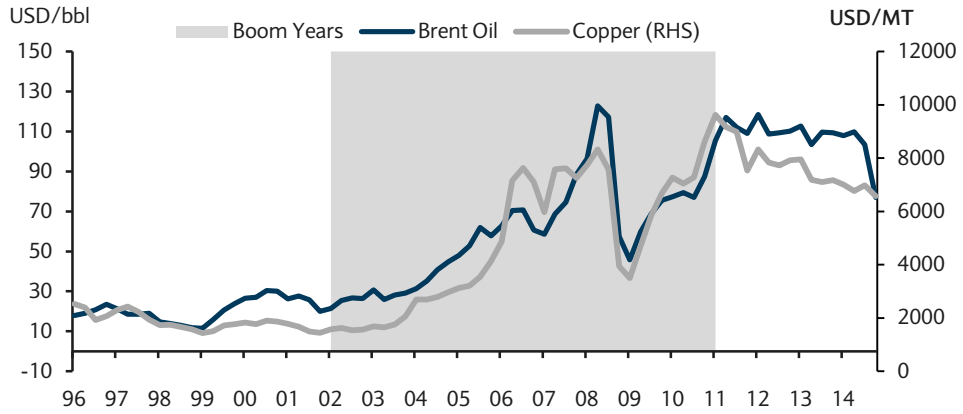
[2] Indeed, Felices and Wieladek (2012) find that the link between external factors and fundamentals remains tight even though macro fundamentals have improved materially.

Sharply lower commodity prices

Strong economic activity in China, primarily fixed asset investment, boosted Chinese demand for commodities and triggered a multi-year rally in commodity prices. Slowing global growth, primarily lower demand from China, has since pushed base metals prices lower. Crude prices were slower to respond to easing global growth. However, demand-supply mismatches have caused a steep fall in crude oil since mid-2014 (Figure 4). See Chapter 2, "Adjusting to a world of lower oil", for a discussion of the implications of the oil price correction for global growth and asset prices.

FIGURE 4

Sharp decline in commodity prices since 2011



Source: Bloomberg, Barclays Research

US Treasury yields edging up

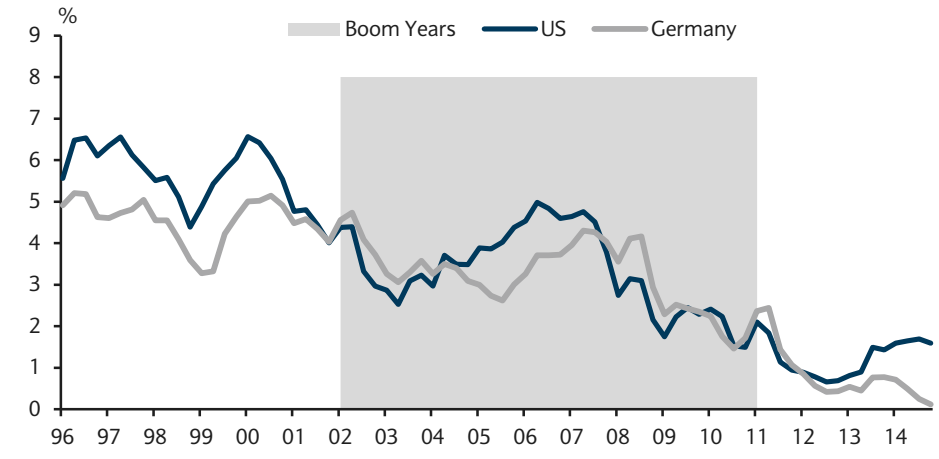
Term US Treasury yields have been on a broad downward trend for several years, but some temporary upswings have been notable. For example, 5y yields rose from mid-2003 to 2006 (Figure 5), driven by higher Fed policy rates in 2004-06. However, this back up in yields did not derail the EM rally. This was largely because the structural drivers of EM (ie, Chinese growth, commodity prices and domestic fundamental improvement) were in full swing.

Stronger US dollar

A weak US dollar was also very favourable for emerging markets during the boom (2002-10). During those years, a large fraction of total returns in equity and local bond holdings for US dollar-based investors was the appreciation of EM currencies relative to the US dollar. Average annual returns for EM currencies, for example, were *c.*7% against the US dollar during the boom years, but only -2.4% in 2011-14.

FIGURE 5

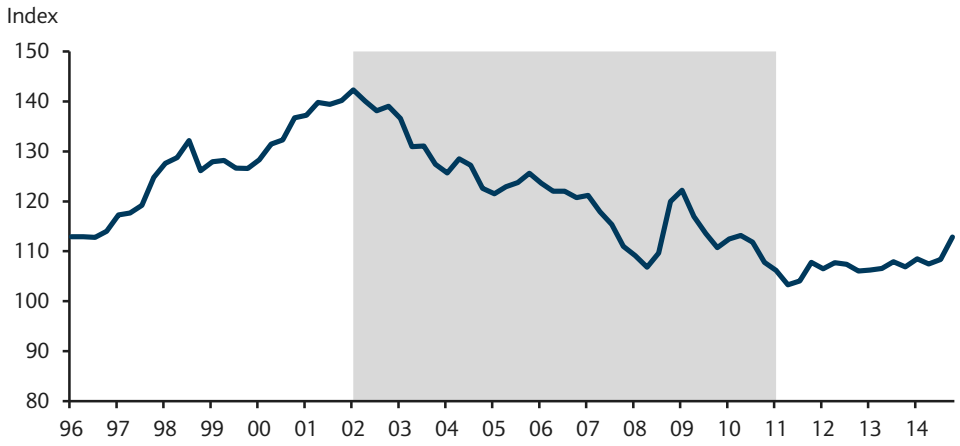
UST 5y yields set to edge up



Click *here* to view an interactive Barclays Live Chart. Source: Bloomberg, Barclays Research

FIGURE 6

The US dollar is on the rise (USD vs broad basket of currencies including EM)



Click *here* to view an interactive Barclays Live Chart. Source: Bloomberg, Barclays Research

A measure of external supportiveness

We combine the five external headwinds to form a measure of external supportiveness for EM

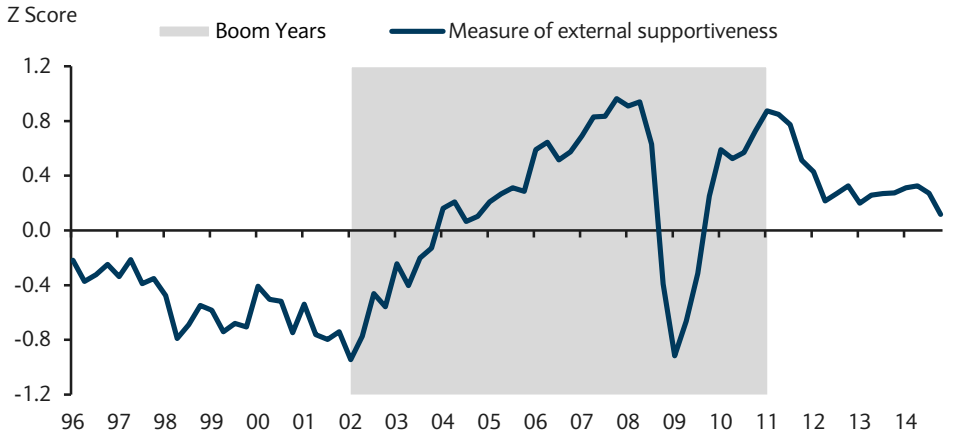
We combine the five key external headwinds (slower China growth, euro area growth, weaker commodity prices, higher US yields and a stronger USD) to form a measure of external supportiveness. The measure is an average of the Z-scores (standard deviation away from the mean) of each of the external factors. UST yields and the USD are included in the indicator with a negative sign to reflect their negative effect on EM economies. In the Appendix, we present the exposure of various EM economies to the five external measures discussed above as well as an aggregate ranking of EM countries to those factors.

Our external supportiveness measure captures the transition from bust, boom and landing since the mid-90s

Figure 7 shows our measure of external supportiveness. Three observations stand out. First, the measure shows very clearly the transitions from bust, boom and landing since the mid-1990s. Second, the global financial crisis was a major negative for the asset class but the external backdrop improved rapidly, largely because of China's huge counter-cyclical effort, easier US monetary policy and a weaker USD. Third, these phases clearly mirror the pattern of the asset class in the boom and landing phases (Figure 2).

FIGURE 7

A measure of external supportiveness (Higher = more supportive of EM)



Source: Haver Analytics, Bloomberg, Barclays Research. Note: We combine the five key external headwinds (slower China growth, slower euro area growth, weaker commodity prices, higher US yields and a stronger USD) to form a measure of external supportiveness. The measure is an average of the Z-scores (standard deviation away from the mean) of each of the external factors.

External environment looks likely to worsen

We expect the external environment to become more challenging and to weigh on asset returns in the next few years

We expect the external environment (and our indicator of vulnerability) to become even more challenging and to continue weighing on asset returns. China is undergoing structural changes and the economy is expected to experience slower GDP growth in the coming years. We forecast growth to slow to 7% in 2015 and to 6.6% in 2016, from an average of about 10% in 1995-2007. In the euro area, we expect a very gradual recovery to 1.1% in 2015 and 1.5% in 2016, still below the average in 1996-2010. We see these slowdowns as structural shifts that will have long-lasting effects, especially on the EM countries that export goods and services to them. Indeed, potential growth has slowed in the euro area and other developed economies and it is likely to remain challenged over the next few years (see Chapter 4, "The great destruction").

Crude oil prices in 2015 have recovered from recent lows, but our commodities analysts expect the price to remain low and think that for consistent gains in commodity prices, global growth must exceed 4% (see *Cross commodity themes and strategy: Plumbing the depths*, 10 February 2015). Lower commodity prices affect EM countries in various ways, with the EM commodity exporters[3] that benefited materially from the commodities boom most at risk.

The first three headwinds are structural in nature and, as such, likely to persist for several years. The remaining two headwinds are more cyclical, but also likely to be long-lasting. First, we expect US interest rates to rise as the Fed continues to normalize its monetary policy. This process follows a prolonged period of monetary policy expansion that included quantitative easing (QE), which led to a compression of market volatility and a search for yield that benefitted EM assets. EM countries are at risk of renewed capital outflows as this process reverses. The 'taper tantrum' of May 2013, for instance, showed how destabilizing the change in US monetary policy can be for EM. Second, the rise of the USD versus EM currencies, although cyclical, is also likely to persist. USD cycles tend to be long, and this one should be no exception, as it will likely be underpinned by higher Fed policy rates.

Macro fundamentals improved in the boom years, but the bar to further improvement is higher now

Sound macro policies led to stronger EM domestic fundamentals in the boom years

Domestic EM fundamentals improved markedly during the boom years. Figure 1 summarises some of the positive changes in these economies in 2002-10. Inflation fell to single digits as central bank independence and inflation-targeting began to play a bigger role. Governments took action to ensure debt sustainability and enhance their external buffers. As a result, government debt and fiscal deficits fell and external vulnerability indicators improved markedly. Another crucial development was the reduction in foreign-currency-denominated debt and the transition to debt issuance in local currency. This was important because local-currency depreciation had increased debt burdens and hurt GDP growth. According to the IMF's Global Financial Stability Report (2006), the share of local-currency-denominated bonds in EM's marketable sovereign debt rose by 9pp between 1996 and 2004, reflecting mainly increased local currency issuance. Naturally, the improved fundamentals vary by country, but broad improvement was visible across EM (country-specific macro fundamentals in the bust, boom and landing cycles can be found in the Appendix).

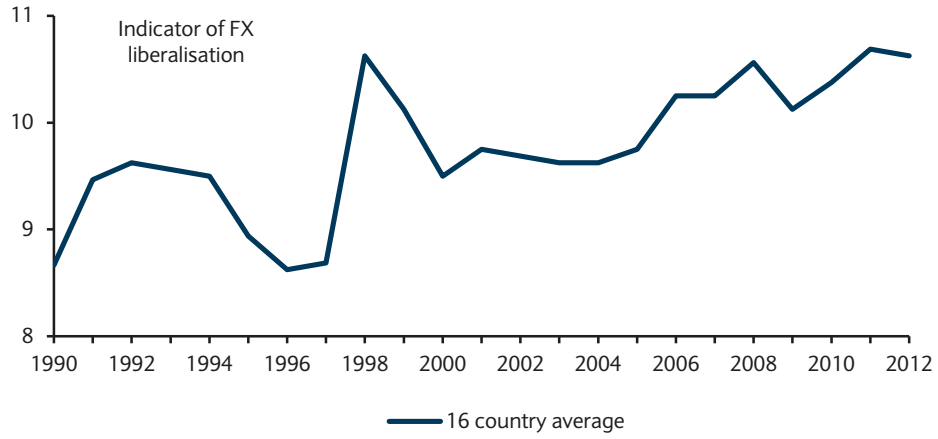
Macro policies included sound debt management and the buildup of external buffers, including more flexible exchange rates

Another important area of improvement was the transition from fixed or heavily managed exchange rate regimes to more flexible ones. Flexible exchange rates have been very effective shock absorbers (eg, during the global financial crisis and more recently for countries under stress, such as Russia). Using a classification of exchange rate arrangements conducted by Reinhart and Rogoff (2004), we construct an indicator of FX liberalisation for a group of 16 EM economies (Figure 8). This indicator takes a value of 1 if

[3] These include, for example, Russia, Venezuela, Brazil, South Africa, Mexico, Chile, Peru, Colombia and Malaysia.

the country has a hard peg and 15 if the FX market is fully flexible. The values in between take into account other 'shades' of FX regimes. The chart also shows that FX liberalisation has improved markedly since the early 2000s.

FIGURE 8
FX liberalization has improved materially since the early 2000s (higher = more flexible)

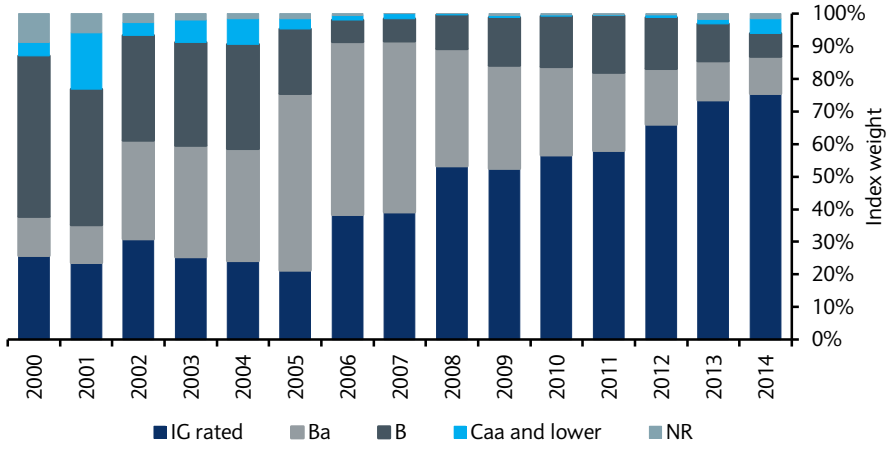


Source: Barclays Research, Reinhart and Rogoff (2004)

EM sovereign debt credit ratings are now mostly investment grade

The adjustment toward more stable and resilient macro frameworks led to improved confidence in the asset class among market participants and credit ratings agencies. The latter can be seen in the evolution of credit ratings on sovereign and corporate external debt. Figure 9 shows that in the early 2000s, only around 30% of the asset class was rated investment grade; this had risen to more than 70% by end-2014. Note also, however, that this trend is starting to turn. For example, Russia's sovereign external debt has been downgraded by several ratings agencies and it lost its investment grade (IG) status in February 2015.

FIGURE 9
EM external debt is now mostly investment grade (weighted using Barclays' EM sovereign index weights)

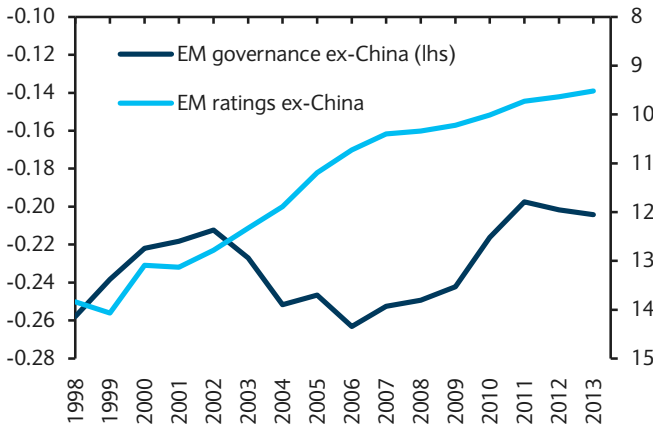


Source: Barclays Research, S&P and Moody's.

Three areas of vulnerability remain: deeper structural reforms, weakening growth and the build of corporate external debt

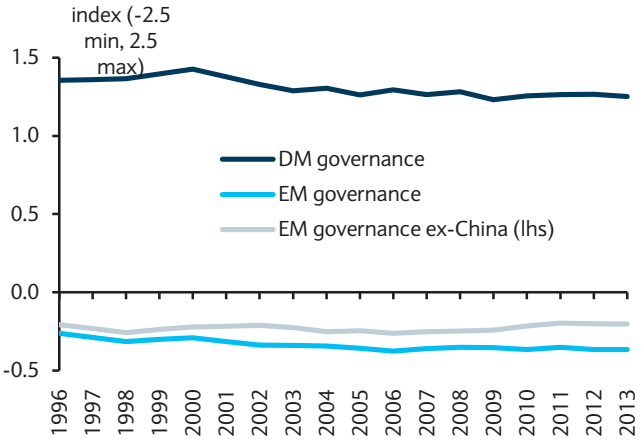
Despite these major improvements, at least three areas of domestic vulnerability remain of concern. First, structural reforms needed to boost potential output have been disappointing. Second, activity growth has slowed markedly and has disappointed analysts' expectations. Finally, although sovereign external debt as a share of GDP has been reduced and remains contained, corporate external debt has risen rapidly in recent years.

FIGURE 10
Ratings have improved more than governance (rating and governance indicators weighted by GDP)



Source: Barclays Research, S&P, Moody's and World Bank
*Numerical score: lower = higher credit rating. Countries include: Brazil, Chile, Colombia, Indonesia, Malaysia, Mexico, Peru, Poland, Russia, South Africa, Turkey, Philippines, Argentina, Venezuela.

FIGURE 11
EM governance remains poorer than in DM (governance indicators weighted by GDP)



Source: Barclays Research, S&P, Moody's and World Bank. DM countries include: Australia, Canada, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Swede, Switzerland, United Kingdom, and United States. EM countries include: Brazil, Chile, Colombia, Indonesia, Malaysia, Mexico, Peru, Poland, Russia, South Africa, Turkey, Philippines, Argentina, Venezuela

Progress on structural reforms and institutions/governance has been slow

Progress on structural reforms and governance has been slow

EM macro stability has largely been achieved, but progress on governance/institutional development and structural reform has been slow. This is partly because the effectiveness of structural reforms is perhaps greatest when there is plenty of room to reduce macroeconomic distortions. For example, structural reforms in several emerging markets after the financial crises of the 1990s had a big impact on macro outcomes, partly because the distortions were large in the first place: inflation was high, some prices were managed, and exchange rates and capital accounts were controlled. But underlying political constraints on reforms also matter. Acemoglu et al (2004) argue that structural reforms have a better chance of being effective in economies where there is enough political room for reforms to be adopted. Such room exists in many EM economies, but only a few (eg, India and Mexico) are making progress.

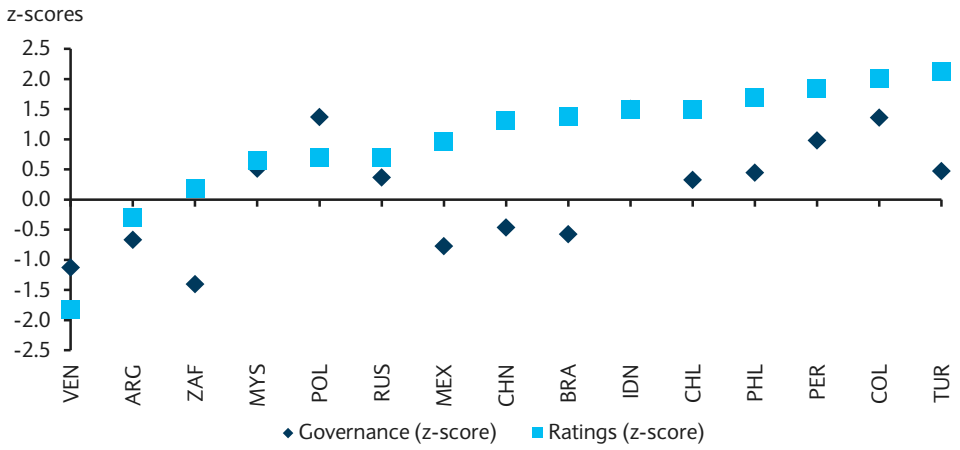
Sovereign ratings have improved more than governance metrics in most EMs

We gauge the recent institutional/governance developments in EM by studying the World Bank's Governance Indicators. This dataset includes governance metrics for six categories, including rule of law, voice and accountability, government effectiveness, regulatory quality, political stability and control of corruption. When we aggregate these metrics (weighted by GDP) we find that EM governance has hardly improved since 1998 (considering that the scale goes from -2.5 to 2.5), whereas credit ratings have clearly improved (Figure 10). Furthermore, the gap between EM and developed markets (DM) remains wide (Figure 11). The inclusion of China improves the EM picture slightly as some progress has been made there, but it does not change the main message that governance and institutional progress has been slow.

Individual countries give a similar picture. Figure 12 considers Z-scores for ratings and governance metrics for 1998-2013. With the exception of Venezuela and Poland, ratings have improved more than governance. This suggests to us that ratings are mainly capturing macroeconomic developments and not necessarily institutional or reform progress.

FIGURE 12

No clear improvement in governance metrics of EMs: Z-score of ratings and governance (as of 2013)



Source: Barclays Research, S&P, Moody's and World Bank. Z-scores calculated using a sample from 1998-2003.

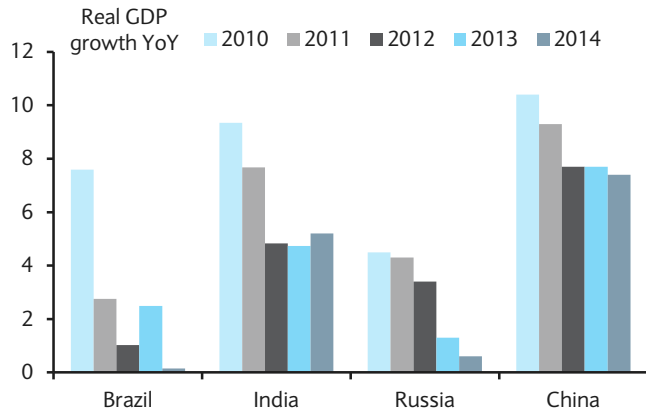
Growth has been a major disappointment in the past few years

Activity growth has been a major disappointment since 2011

The lack of progress on structural reforms means that potential output in EM economies is likely to be constrained. This makes GDP growth more vulnerable to external headwinds, especially in those countries that depend heavily on external demand and commodity exports. The so-called BRICs, once the flagship of the EM boom, have slowed significantly. In Brazil, GDP growth has slowed from close to 8% to almost 0% in just five years (Figure 13). Such outturns have consistently surprised the consensus to the downside (Figure 14). Disappointing growth has been the main driver of lower asset returns, especially in equity markets, where returns are tightly linked to expectations of earnings growth, which in turn depend on prospects for activity growth.

FIGURE 13

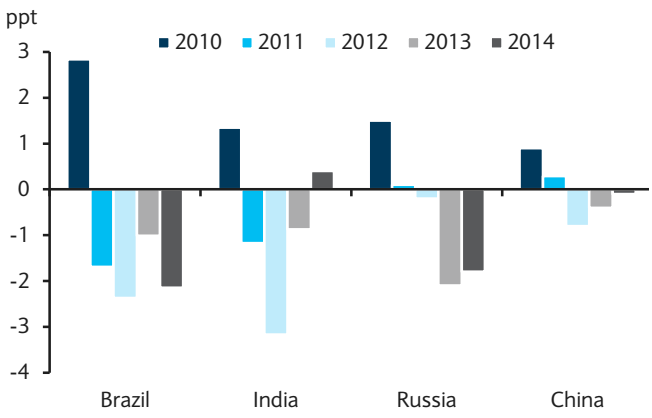
GDP growth has slowed rapidly in the BRICs*



Source: Barclays Research and Bloomberg. BRICs are Brazil, Russia, India and China.

FIGURE 14

BRICs* growth has surprised the consensus to the downside in recent years (GDP growth – year-ahead-forecast)



Source: Barclays Research and Bloomberg. BRICs are Brazil, Russia, India and China.

EM external debt: From sovereign to corporate vulnerability

As part of the fundamental improvement during the boom years, EM sovereigns managed to reduce foreign currency external debt, thereby limiting the damaging effect of currency depreciations on sovereign balance sheet and growth (Figure 15). However, corporate debt has risen from 18.5% of GDP in 2003 to 24.7% in the year to Q3 2014. In contrast to the more cautious sovereign debt management, the corporate sector continued to issue in foreign currency (mainly USD), partly because of the improved sovereign fundamentals and the associated fall in country risk premia, and partly because of the stable, and later falling, cost of finance in hard currency as a result of the sharp drop in interest rates in the developed world.

FIGURE 15

EM corporate external debt* has been rising faster than government external debt since mid-2000s

*Corporate external debt is total external debt minus government and central bank debt. It therefore includes the debt of deposit-taking corporations. Source: World Bank – Quarterly external debt data, Barclays Research

The charts below show that the governments of Hungary, Poland, Mexico, Malaysia, and South Africa have large external debt (more than 15% of GDP). Note, however, that not all that debt is in foreign currency. Indeed, a large fraction of South Africa's external debt is in local currency. The corporate sectors of Hungary, Chile, Czech Republic, Malaysia and Poland have much larger external debt outstanding (more than 40% of GDP). Hungary's corporate sector is the most indebted even though, as a percentage of GDP, its external debt has fallen to 90%, from 107% at end-2008. By contrast, corporate sector external borrowing as a percentage of GDP in the Czech Republic, Chile and Turkey has risen by more than 10pp since 2008. Note, however, that these data include not only bond issuance but also loans that international banks may have extended to EM corporates and financial institutions.

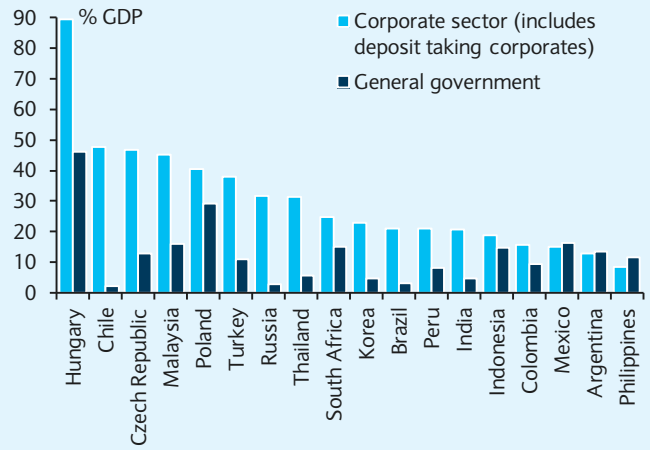
The corporate sector in EM economies is increasingly borrowing by issuing offshore debt securities. EM corporations borrow abroad via offshore affiliates and repatriate the proceeds. Some authors have mentioned that this sort of corporate borrowing is partly responsible for the massive expansion in EM corporate issuance in international bond markets in the past few years. This has probably increased foreign exchange risk exposure in EM. This expansion also means that indicators of vulnerability that are based only on international bank credit expansion do not fully capture financial system risks.[4]

The increase in EM corporates' foreign exchange risk is not necessarily a big negative, however. A stronger USD environment is likely to weigh on companies that earn revenues in local currency but incur costs in USD. By contrast, companies earning revenues in USD but incurring costs in local currency are likely to be less risky. This is the case with many exporters, which usually issue debt in the currency of their export receipts (see *Emerging Markets Weekly: Don't drop your guard*, 15 January 2015). Other risks from the external environment include rising USD interest rates and higher rate volatility.

In sum, EM corporate external debt has soared in recent years and, unlike sovereign debt, has risen materially relative to GDP since the mid-2000s. The build-up of corporate debt varies by country, with CEEMEA looking most exposed. A rise in the USD and higher US interest rates are important risks that need to be monitored, especially given that markets do not appear to have discriminated by the size of corporate debt in recent episodes of risk aversion (Figure 16). Overall, given the existing buffers at the sovereign level, we see the risk of corporate stress as a pocket of vulnerability rather as a source of systemic risk of EM.

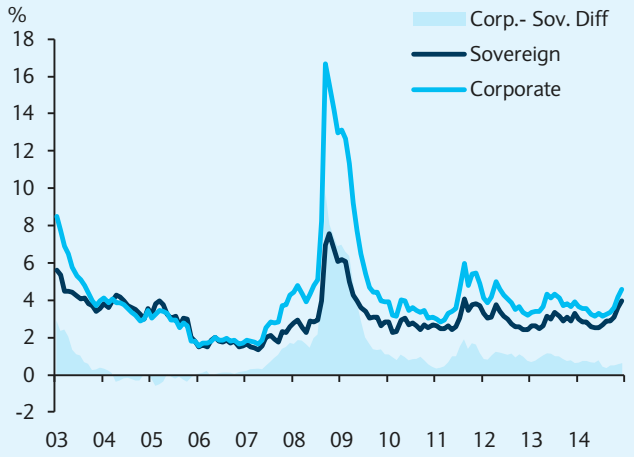
[4] See 'The global long-term interest rate, financial risks and policy choices in EMEs', Philip Turner, BIS working paper 441 and BIS Quarterly Review, December 2014 - Non-financial corporations from emerging market economies and capital flows.

FIGURE 16
EM corporate debt* is generally higher than sovereign external debt (% GDP – Q3 2014)



Source: World Bank- Quarterly external debt statistics, Haver, Barclays Research
*Corporate external debt is total external debt minus government and central bank debt. It therefore includes debt by deposit taking corporations.

FIGURE 17
EM corporate and sovereign (OAS) external debt spreads have converged since mid-2011



Click *here* to view an interactive Barclays Live Chart. Source: Barclays Research, Bloomberg

Decent risk reward in EM, especially vs developed markets

The combination of external challenges and more resilient domestic fundamentals suggests that we have entered a new regime for EM asset prices in the 'landing' phase that began in 2011. We assess the prospects for asset returns and risk premia in the main EM sub-asset classes: equities, local bonds, sovereign credit and FX. We also assess the prospects of these asset classes relative to developed markets.[5]

EM equities

Vulnerable to external factors

EM equities have been resilient to the less benign external conditions

EM market equities clearly capture the transitions from bust to boom and landing cycles in the past two decades. In fact, their path is notably similar to our measure of external supportiveness (Figure 18). The external drivers we identified supported EM GDP and earnings growth in the boom years, so the close relationship between the measure and EM equities is not entirely surprising. Similarly, when those drivers became less supportive starting in 2011, EM equities fell. Given our view that the external environment will become even more challenging, there seems to be room for some downside risk to EM equities.

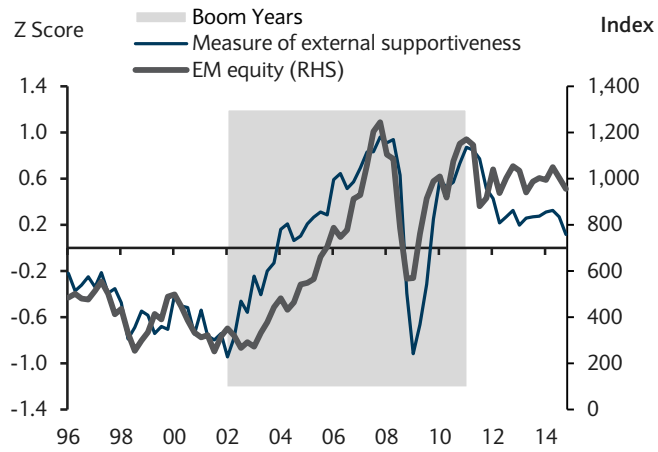
But the resilience masks regional differences: LatAm and CEEMEA equities have priced the tougher external environment

However, looking at EM equities by region, it is apparent that the resilience of the overall index has been driven by EM Asia. LatAm has already priced in the more challenging backdrop (Figure 19). That is not surprising given that the region benefited hugely from China's growth and demand for a wide range of commodities, including bulk commodities (iron ore), crude oil, base metals and agricultural products.

CEEMEA equities have also priced in the bad news (Figure 20). Despite the region being a net commodity importer, it has a large exposure to the euro area via trade and financial links. So perhaps the region has been penalised more for its dependence and links with the euro area and the negative effects of the ongoing crisis.

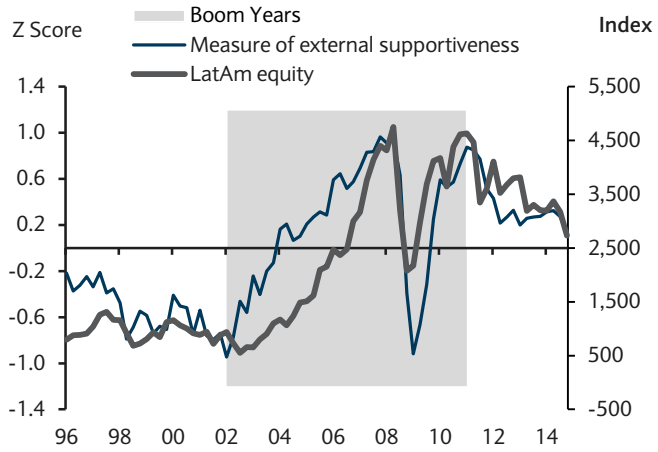
[5] Our analysis includes a group of 16 EM economies (Brazil, China, India, Mexico, Poland, Russia, South Africa, Turkey, Korea, Indonesia, Malaysia, Thailand, Hungary, Colombia, the Philippines, Chile) and a group of 11 DM (US, Canada, Japan, UK, Germany, France, Italy, Spain, Netherlands, Sweden, Norway).

FIGURE 18
EM equities: Overall resilience masks regional differences



Source: Barclays, Bloomberg and MSCI

FIGURE 19
LatAm seems to have priced in the more challenging backdrop already



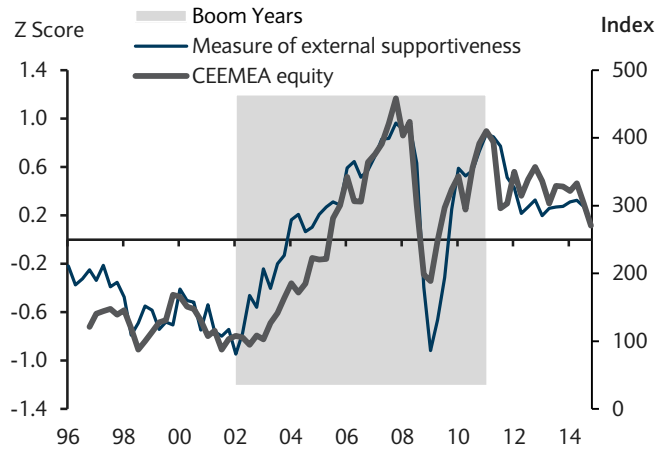
Source: Barclays, Bloomberg and MSCI

EM Asian equities have been more resilient largely because of the recent strong performance of China and India

The gap between the EM Asia equity index and our measure of external supportiveness widened further in 2014 (Figure 21) as equities markets in the two regional heavyweights – China and India – rallied strongly. Chinese equities had posted a weak H1 14 but surged in H2 14, despite monthly economic indicators indicating easing domestic demand. Poor economic data fuelled investor expectations that the PBoC would ease policy. Favourable terms of trade as a result of lower oil prices, as well as increased retail participation and the beginning of a Shanghai-Hong Kong cross-trading link, boosted Chinese equities in H2 15. Structural reform progress under the Xi-Li government, expectations of further benchmark rate and reserve requirement ratio (RRR) cuts and low valuations of large-cap stocks fuelled another c.30% rally in Chinese equities between November 20 and end-December 2014, pushing the SHCOMP index up c.50% in 2014.

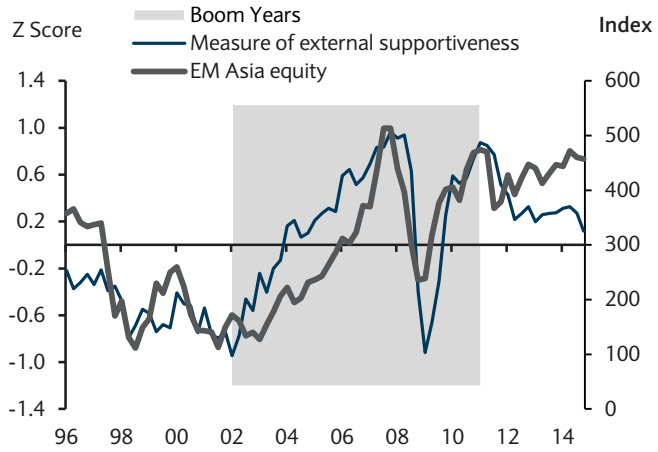
In India, expectations of a Narendra Modi-led government began to spur investor interest in Indian equities at the start of 2014. A landslide win for the BJP pushed Indian equities to touch record highs in May 2014. More important, the steep drop in oil prices turned key macroeconomic indicators favourable last year, further boosting investor interest in India. Lower oil prices resulted in easing inflation, shrank the current account deficit and prompted the government to undertake fiscal consolidation measures. Moreover, GDP growth improved

FIGURE 20
CEEMEA also seems to have priced in the bad news



Source: Barclays, Bloomberg and MSCI

FIGURE 21
EM Asia shows some structural resilience



Source: Barclays, Bloomberg and MSCI

and earnings growth accelerated. All these factors, combined with a better policy environment, resulted in a significant rise in fund flows into India, boosting Indian equities by c.30% in 2014. See Chapter 6, "India: A step change" for a thorough discussion of the positive economic changes that India has recently experienced as well as its bright prospects.

Ongoing and expected structural changes in China and India should help equity markets in these countries to continue to attract investor attention. China still has significant control over its capital account, but gradual liberalisation has been pushed forward in recent years. Further opening of China's capital account will be appealing to investors (see *Macro Daily Focus: What causes divergent performance of onshore and offshore China-related stocks?* 20 January 2015). In India, a sustained decline in inflation and inflation expectations, improved consumer spending and increased capacity utilisation are likely to work in favour of equities.

EM Asia's resilience could also reflect the benefits of lower oil prices and sizable exports to the US

EM Asia's resilience could also stem from the fact that most Asian economies export a sizable fraction of their GDP to the US. Moreover, falling commodity prices (notably oil prices) have been a positive terms of trade shock for EM Asia as it is the main oil importer and consumer within EM. Lower inflation gives central banks more scope to keep policy accommodative.

EM equity risk premia

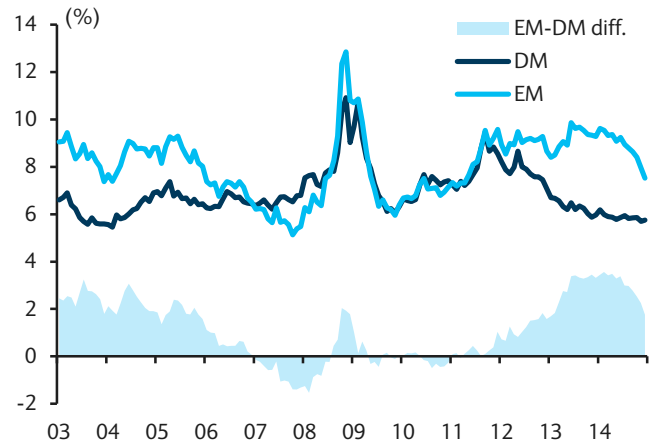
We also explore the evolution of EM earnings yields, the ratio of corporate earnings over prices (the inverse of the price/earnings ratio). A higher earnings yield means EM equities are more attractive from a valuation point of view. But it also suggests higher risks, as the earnings yield is a measure of the compensation demanded by investors for holding EM equities.[6]

EM earnings yields have fallen since the 'taper tantrum', but they remain higher than in developed markets

Figure 22 shows that EM earnings yields were higher than in DM in the early 2000s. This gap closed as EM equities outperformed DM into and after the global financial crisis of 2008-09. In 2011, both metrics started drifting apart, with EM equities underperforming DM, in line with a tougher external environment. The 'taper tantrum' of 2013 opened that gap further and there has since been a gradual fall in the EM earnings yield. Note also that the recent acceleration in the fall of the EM earnings yield has been mainly because of the rally in Chinese equities. Figure 23 shows that the fall is more gradual and the gap to DM still wide when China is excluded. Overall, this suggests that EM equities offer more attractive earnings yields, but we also know that this is for good reason, as the external environment has been a lot tougher for EM since mid-2011.

FIGURE 22

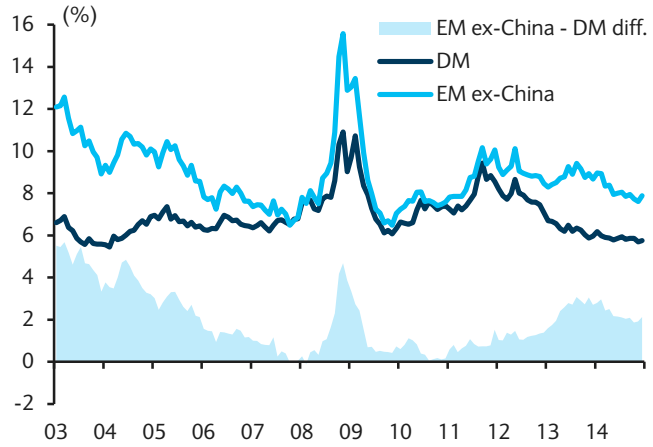
EM vs DM equity earnings yields (%) - gap closing largely because of recent rally in China



Note: GDP-weighted; Source: Barclays, Bloomberg, Haver Analytics

FIGURE 23

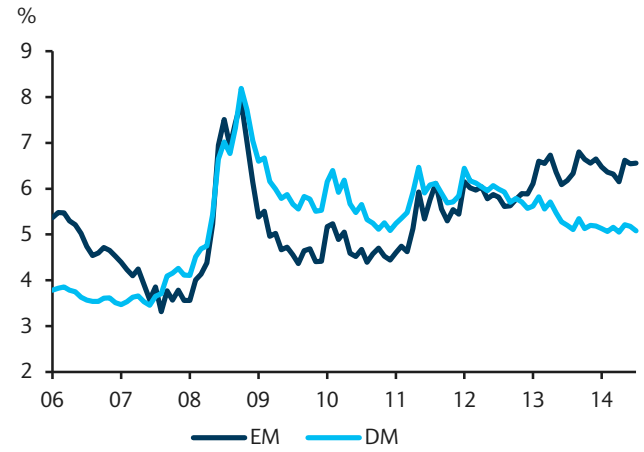
EM ex-China vs DM equity earnings yields (%) - gap remains wide when China is excluded



Note: GDP-weighted; Source: Barclays, Bloomberg, Haver Analytics

[6] Note that a common measure of the equity 'risk premium' is the earnings yield minus real 'risk free' rates. We do not use this metric in this article. Note, however, that the difference between earnings yields and real bond yields is currently roughly the same for EM and DM.

FIGURE 24
EM vs DM equity earnings yields based on SCAPE (%) is wide



Source: Barclays and Bloomberg

FIGURE 25
EM vs US equity earnings yields based on SCAPE (%) is even wider

Source: Barclays and Bloomberg

Using SCAPE-based earnings yields shows an even wider gap between EM and DM

Many analysts dislike aggregating EM and DM countries and making comparisons between them because of big sector differences. Indices like the DAX, the argument goes, include high-value-added corporates and virtually no commodity producers, whereas the opposite is true in countries like Russia. How can their earnings yields be compared? Our in-house Sector and Cycle-Adjusted P/E ratios (SCAPE) take into account such sector differences.[7] We use the inverse of these metrics (earnings over price) to compare the earnings yields in EM and DM (Figure 24). The picture does not really change much. If anything, it shows that the gap remains wide and is even wider when comparing EM and US earnings yields (Figure 25).

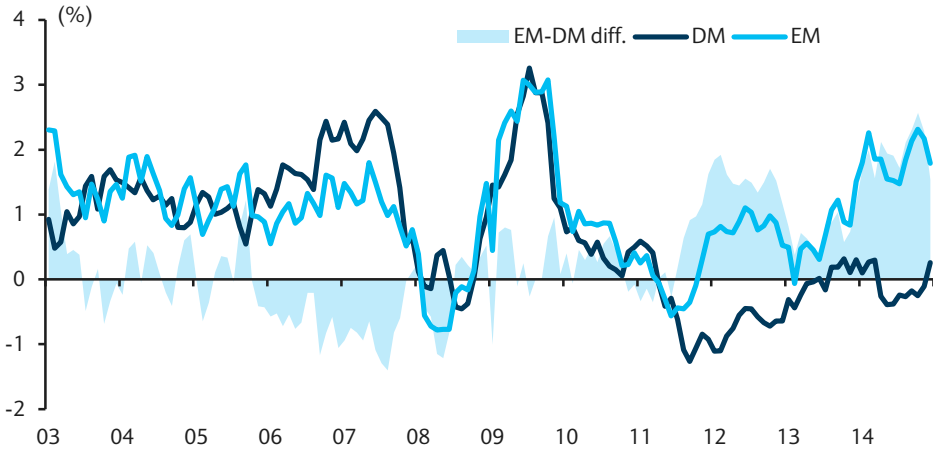
Of course, one reason why earnings yields are higher in EM versus DM is because real interest rates are higher there, too, so the compensation is not just for a risky earnings profile; it is also because of higher bond risk premia.

Risk premia in EM local debt (real bond yields)

EM real bond yields have widened sharply vs DM since 2011, suggesting value in EM vs DM debt

We define the risk premium in local debt markets as the real yield on 5y local bonds (5y yields minus CPI inflation). Figure 26 shows a GDP-weighted average of these metrics for selected EM and DM economies. During the boom years, EM had average real rates of around 1.5% excluding the global financial crisis period. These were not very different from

FIGURE 26
Real bond yields are higher in EM vs DM (5yr real yields, GDP weighted)

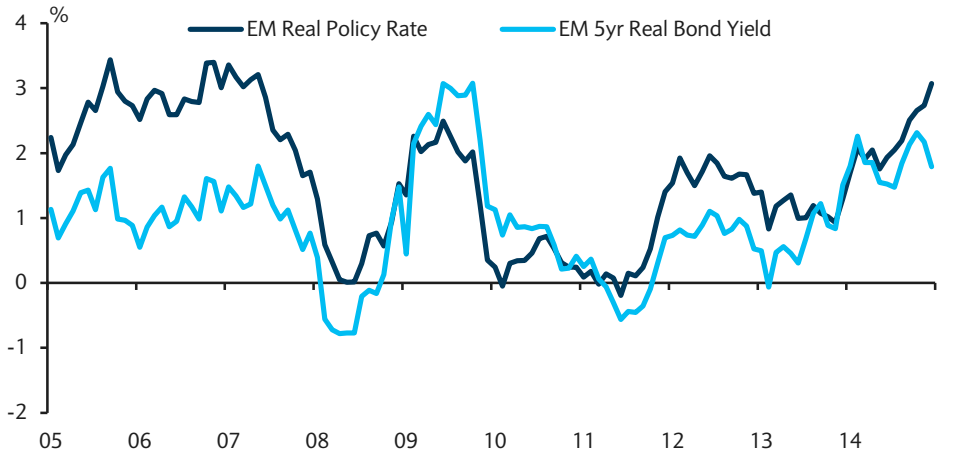


Source: DataStream, Haver Analytics, Barclays Research

[7] For details see Introducing the SCAPE: why US equities are less expensive than they seem, Equity Gilt Study 2014.

FIGURE 27

Real bond yields in EM reflect high real EM policy rates (GDP-weighted)



Source: Haver Analytics, Barclays Research

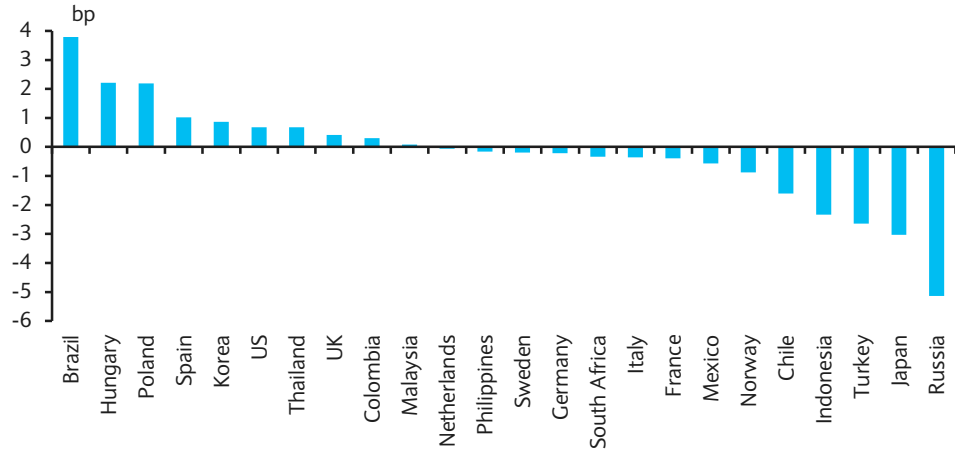
those of DM in that period. However, this pattern changed significantly in the period from 2011 to 2014. DM real yields went deeply negative, while EM real yields initially fell but then rose to about 2% in 2014.

High real yields in EM are hard to ignore when those in DM are close to zero

From an asset allocation point of view, this difference is hard to ignore. The universe of positive real yields is becoming scarcer as central banks in the developed world continue to hold policy rates close to zero, with some even venturing into negative policy rates. This contrasts with policy rates in EM, where the zero bound is further away. Indeed, real policy rates in EM are close to 3%, the highest since 2007 (Figure 27). The rise in real policy rates since 2011 has more to do with falling inflation than higher nominal policy rates: while EM policy rates remained broadly stable, inflation has gradually fallen since 2011. Looking ahead, the growth environment is likely to remain challenging and external conditions to deteriorate further, while inflation is likely to remain subdued given the fall in energy prices. In this context, local bonds in EM are an interesting proposition. Cyclical headwinds are likely to keep central banks in check even as US yields start turning higher. In addition, carry is still generally high and in some countries (eg, India and Brazil) it should compensate for weaker currencies.

FIGURE 28

Real bond yields 5y minus CDS spreads – plenty of potential left in some EMs after stripping out credit risk



Source: Haver Analytics, DataStream, Bloomberg, Barclays Research

As EM real yields embed credit risk premia on local bonds, it is helpful to gauge the risk premium left in bonds after stripping out such credit risk. Although these risk premia are difficult to measure, metrics of credit risk on external debt, including CDS, can be used as proxies. On our calculations, these premia are high in such countries as Brazil, Hungary and Poland (Figure 28).

Sovereign credit spreads

EM CDS spreads have widened recently vs DM, reflecting the tougher external environment

Sovereign external debt is perhaps the asset class within EM that received most attention during the boom years, largely because issuance had been extensive during and after the EM sovereign crises as most sovereigns had to access international financial market via foreign-currency-denominated debt. We study credit risk on sovereign external (USD-denominated) debt via sovereign CDS spreads.

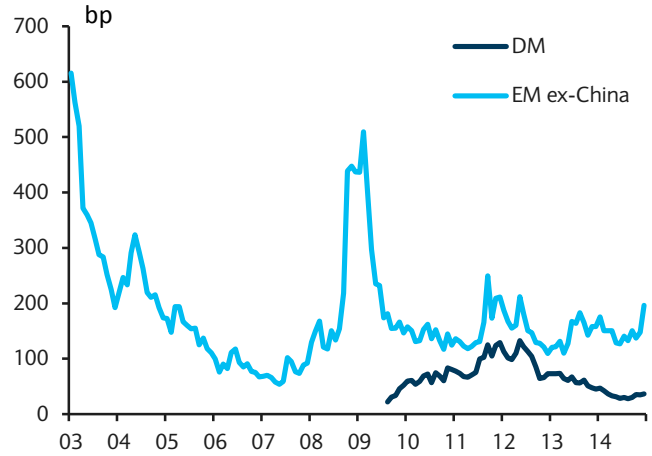
Figure 29 shows the GDP-weighted average of these spreads since 2003 for our groups of EM ex China and DM economies.[8] The first observation is that EM ex-China CDS spreads reached a low in 2007, before the global financial crisis. The second is that these spreads have moved broadly sideways but above the 2007 tights since 2011. We attribute this to the role that risk appetite and global macro volatility play in EM credit risk. Figure 30 shows that risk appetite, proxied by the VIX, has a high correlation with EM credit risk. Global risk appetite has strengthened recently but has not returned to pre-2008-09 levels. However, it has remained strong enough to contain the rise of EM credit risk in the face of a tougher external backdrop since 2011.

But domestic fundamentals also play an important role for CDS spreads

Other external factors have also influenced EM credit spreads recently. For example, in Figure 30, the large spike in mid-2011 coincides with the slowdown in Chinese activity and the widening in 2013 stemming with the taper tantrum. At the same time, at the country level, the domestic fundamentals discussed earlier also play a big role. We study the importance of external and domestic influences in the Box below.

FIGURE 29

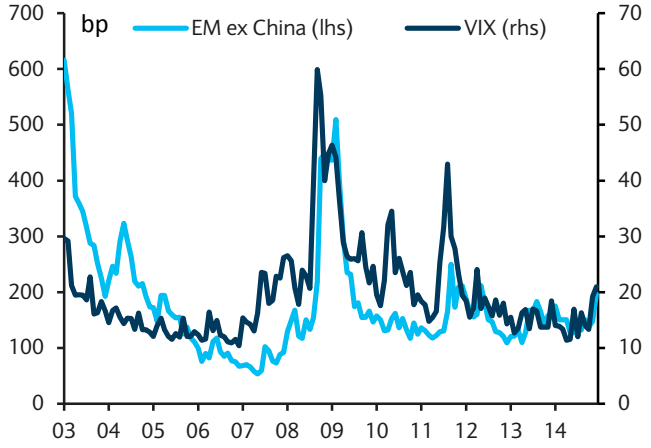
EM vs DM CDS spreads*: Higher EM spreads mainly reflect tougher external environment



Source: Barclays Research, Bloomberg, IMF. *GDP-weighted. DM data since 2009

FIGURE 30

EM CDS spreads* and VIX: External drivers matter



Source: Barclays Research, Bloomberg and IMF. *GDP-weighted.

[8] We exclude China as the sovereign has very little external debt. Indeed, China's weight in our sovereign external debt index is close to zero.

Determinants of EM sovereign credit spreads: The role of domestic and external factors

We gauge the importance of external and domestic factors for EM sovereign credit by estimating a model of EM CDS spreads. In particular, we estimate the model using a dynamic panel of 16 EM countries, with monthly data since 2000. The panel is unbalanced as data are sometimes unavailable for several EM countries before the mid-2000s. We estimate 5y CDS spreads as a function of sovereign credit ratings (the average of Moody's and S&P and a measure of domestic macro fundamentals), the World Bank's governance indicators (a proxy for institutional progress), China activity growth (the National Bureau of Statistics of China leading index), commodity prices (the y/y % change in the CRB index) and the VIX (a proxy for risk aversion/macro volatility). The model also incorporates fixed effects (country dummies) to control for country-specific characteristics that may not be captured by the other domestic variables considered.

FIGURE 31

OLS fixed-effects regressions of CDS sovereign spreads on domestic and external factors

	Coefficient	T-Stat	Coefficient	T-Stat
Constant	1772.2	7.5	1594.1	6.4
Sovereign credit ratings	77.9	30.3	71.3	24.1
VIX	6.6	15.8	6.9	15.9
China leading index of activity	-23.7	-10.2	-21.6	-8.8
Commodity prices	-0.9	-5.5	-0.8	-5.0
WB governance indicators			-327.5	-7.5
Adjusted R-squared	0.69		0.67	
Cross-sections included	16		16	
Total panel (unbalanced) observations	2417		2225	

Source: Barclays Research. *Statistically significant at less than 1%. When standard errors are corrected for autocorrelation, the coefficients remain statistically significant at the 1% level, with the exception of the governance indicator, which is significant at the 15% level.

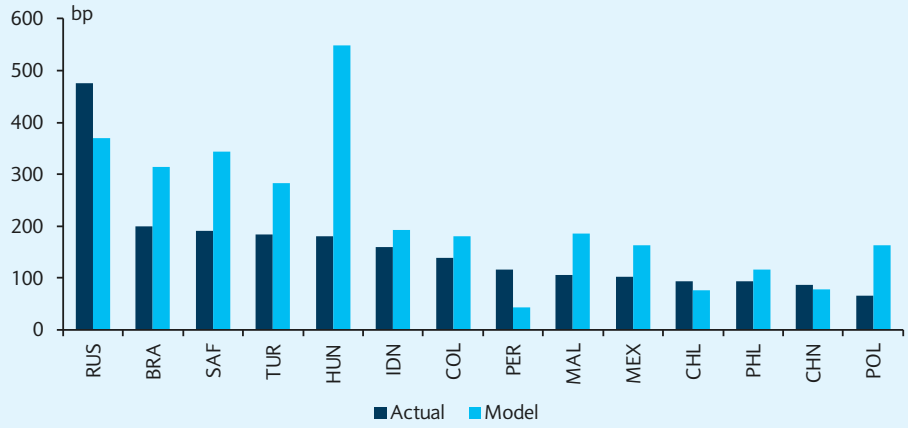
The key results of the model are as follows:

- All the estimated coefficients of the variables considered are statistically significant and their signs are the ones we expected. Countries with better sovereign credit ratings (lower numerical rating) tend to have tighter spreads. In particular, a one-notch credit upgrade (coded as a decline of 1 in the 'sovereign credit variable') is worth a 70-80bp spread compression, depending on the specification. Countries with better governance/institutions (higher World Bank governance indicators) also tend to have tighter spreads: a 'typical' (1 std dev) improvement tightens spreads by 25bp. This is important because it suggests that institutional progress matters even after considering the improvement in macro fundamentals captured by ratings and other country-specific factors captured by the country dummies. The country fixed effects explain 23% of the CDS spreads variation. See Figure 31 for details of the model estimates.

- On the external front, a 'typical' (one standard deviation) rise in the China leading indicator is worth a spread compression of 38-41bp depending on the specification. A 10% rise in commodity prices tightens spreads by 8-9bp, while a 'typical' rise in the VIX widens spreads by 56-59bp, also depending on the model specification on Figure 31.These results, combined with our view that Chinese growth will continue to slow, macro volatility will likely rise, commodity prices will not surge, EM macro fundamentals will not improve materially and institutional reform will remain challenging, mean that a sustained compression of spreads based on these factors is unlikely. Country differences may present interesting opportunities rather than directional views for the asset class as a whole. For example, countries that are directly linked to Chinese demand for commodities like Peru and Chile may remain challenged, while those with prospects of deeper reform, like Mexico or Indonesia, are in a better position.

- Our model does not incorporate many other variables that affect sovereign spreads, such as structural changes in financial institutions' demand for EM assets, or forward-looking metrics of country fundamentals (eg, prospects for institutional reforms, political outcomes or growth outlooks). With those caveats in mind, we use the model to assess 'fair value' spread estimates (Figure 32). Mexico, for example, ended 2014 with tighter spreads than the model predicts, suggesting that markets expect US growth and domestic structural reforms to anchor credit risk. Hungary is another interesting example, where the model predicts much wider spreads, reflecting worsening credit ratings and a market perception that euro area policies will indirectly support Hungary. Russian spreads are wide versus the model but our ratings metric misses the S&P and Moody's downgrades early in 2015 and likely further downgrades this year, while sanctions are probably limiting some investors' ability and willingness to engage in Russian risk.

FIGURE 32
Actual CDS vs fair value estimates (December 2014)



Source: Barclays Research, Bloomberg and IMF. Model included the following explanatory variables: credit ratings, China leading index of activity, commodity prices and VIX. Argentina and Venezuela are not shown in the chart. Their CDS were truncated at 1500bp estimation purposes as they trade at distressed levels. The values predicted by the model are 1397bp and 1092bp.

Overall, a more challenging external environment may provide a difficult backdrop for EM sovereign credit. And although macro vulnerabilities are generally lower than they were15-20 years ago, growth prospects are limited by lack of structural reforms. But rather than systemic crises in EM, we are likely to see differentiation against a more difficult external backdrop. There are also positives for some EM countries on the horizon, such as low crude prices and a stronger and more solid US economy, so sovereign credit in countries that benefit from that backdrop, mainly in EM Asia, is likely to outperform.

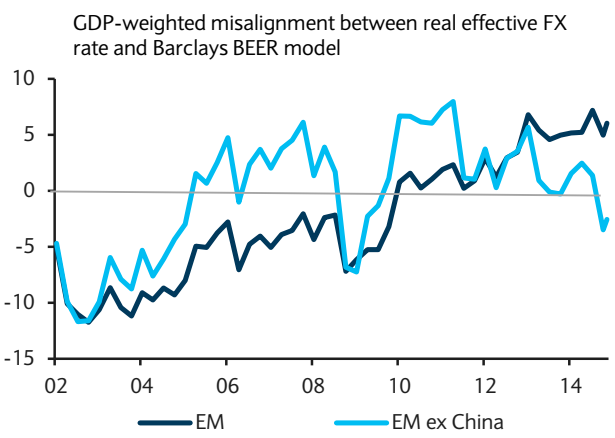
FX risk premia

We explore two key areas related to EM FX risk premia: first, whether EM currencies have adjusted enough to the negative shift in underlying fundamentals in recent years; second, whether EM FX carry remains an attractive investment.

EM currencies (ex-China) are now cheap relative to fundamentals, but not markedly so

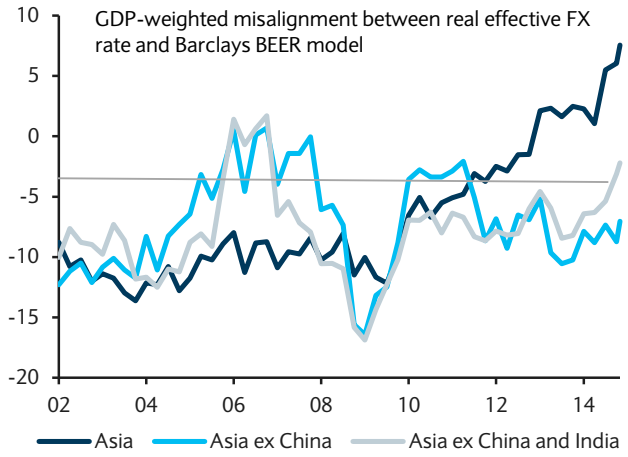
As best we can judge, the answer to the first question is yes, but only just. Figures 33- 35 look at the percentage misalignment between real effective exchange rates and our FX team's behavioural equilibrium exchange rate model (BEER) for an EM aggregate and EM regional aggregates (see *Currency valuation from a macro perspective*, 14 June 2011). Back in 2002, when the EM boom began, the aggregate FX valuation was signalling very cheap EM currencies – perhaps unsurprising following years of EM crisis episodes. Over the subsequent 10 years, EM valuations climbed, peaking around mid-2011, which marked the start of China's structural slowing and the end of the commodity super cycle. Admittedly,

FIGURE 33
Aggregate EM FX (ex China) are now cheap relative to fundamentals, but not markedly so



Source: Barclays Research, Bloomberg
*Note: in Figures 33-35, the EM FX universe is BRL, CLP, CNY, HKD, IDR, ILS, INR, KRW, MXN, MYR, PHP, PLN, RUB, SGD, THB, TRY and ZAR

FIGURE 34
Outside of China, Asian currencies remain below fundamental fair value, mainly because of India



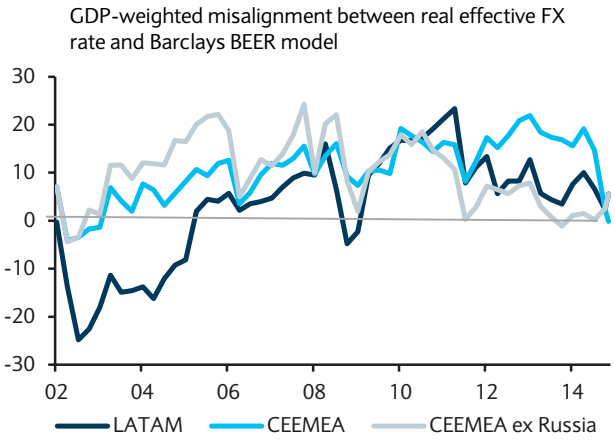
Source: Barclays Research, Bloomberg, IMF

the overall EM FX misalignment with "fair value" has continued to grow in the past few years – the GDP-weighted EM currency basket now stands a little over 5% above fair value, having been 10% cheap to fair value in 2002. But today's overvaluation of EM currencies is mainly a function of China's real effective exchange rate, which is close to 20% overvalued, according to our BEER model. Once we remove China, EM currencies have shifted to mildly cheap over the past year or so.

Outside of China, Asian currencies remain below fundamental fair value, mainly because of India

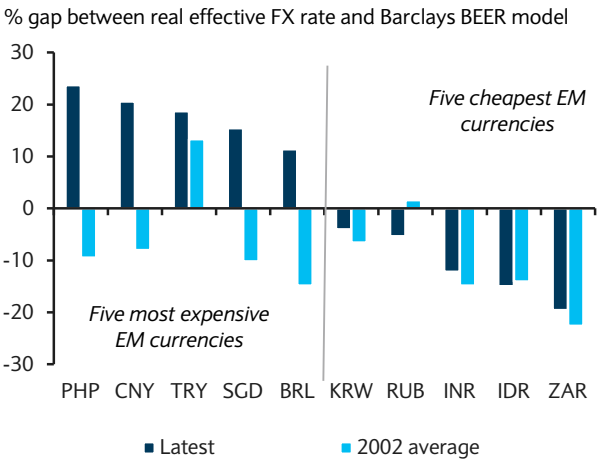
Regionally, the picture is an interesting one. Asia excluding China has been cheap to fair value for much of the past 15 years – only in 2005-06 did Asian currencies move slightly above fair value. Today, Asian currencies are still more than 5% below fair value, although this is almost exclusively a function of a still-cheap Indian rupee. Most other Asian currencies are at or above fair value – the Philippine peso is, according to our BEER model, the most expensive currency in EM (Figure 36). Latin America's FX valuations have largely followed the ups and downs of the region's terms-of-trade cycles. Having started the EM boom period close to 30% cheap to fair value, LatAm currencies had moved to 20% expensive by 2011. Today, despite persistent currency weakness, LatAm currencies remain some 5% above fair value – mainly a function of the still expensive Brazilian real (11% expensive). CEEMEA currencies have shifted from significantly expensive just a few months

FIGURE 35
Outside of Asia, EM currencies have moved from significant overvaluations to fair value in recent years



Source: Barclays Research, Bloomberg

FIGURE 36
Largest EM FX misalignments according to Barclays' BEER model



Source: Barclays Research, Bloomberg

ago, to near fair value today – almost exclusively a function of the Russian rouble closing its near-40% gap to fair value. According to the BEER model, the rouble is now below fair value for the first time in more than 10 years. Elsewhere, the Turkish lira is one of the more expensive EM currencies, while the South African rand is the cheapest.

Positive carry has been a big support for EM currency returns

Another way of thinking about EM currencies is to ask whether they have been a good investment choice, irrespective of fundamental valuations. In other words, do EM currency risk premia compensate investors for the risk they are taking? Here, we would say the evidence is compelling. One simple exercise is to track the performance of the five high-yielding EM currencies (TRY, INR, IDR, ZAR and BRL) that have received significant attention in recent years because of a mix of a deteriorating global backdrop and poor domestic fundamentals. Figures 37 and 38 look at the average BEER misalignments and the total returns of holding an equally weighted basket of these currencies, with and without carry.

On a fundamental basis, this basket of five EM currencies began the EM-boom period some 15-20% undervalued and by the middle of 2011, the start of the "landing" period, were 10% expensive. Since then, valuations have dropped and these five high-yielding EM currencies are now, on average, mildly cheap, though neither notably nor universally so. During this almost 15-year period, this basket of high-yield EM currencies has dropped by around 30% against the US dollar. Still, once the carry is added back into the basket (risk premia), the returns of holding these high-yielding EM currencies have been more than 150%, or around 7.5% per annum. Indeed, despite a sense of crisis in EM currencies in the past few years, total returns in the basket are down just 13% from the peak and virtually flat from May 2013, when then-Fed Chairman Ben Bernanke delivered his famous "tapering" speech. Net-net, it would seem that in the universe of higher-yielding EM currencies, investors have been broadly well rewarded for being long.

Carry in high-yielding EM currencies relative to volatility has picked up in recent years, making them an attractive investment

A last measure of the investment attractiveness of EM currencies is the ratio of implied FX carry to implied volatility. Figure 39 looks at this ratio of an equal-weighted basket of TRY, INR, BRL and ZAR (IDR was excluded because of data unavailability). On a carry-to-volatility basis, it is clear that the pre-Lehman-crisis period was a near-perfect environment for EM FX carry. Following a period of persistent crises, EM FX carry was high and a supportive global and EM backdrop kept implied volatility low for much of the time. Still, despite a sharp pick-up in EM FX volatility in the past few years, rising carry has more than kept up with this volatility increase. By now, the high-yield EM carry-to-volatility ratio is nearing levels more consistent with the early "boom" cycle for emerging markets.

FIGURE 37

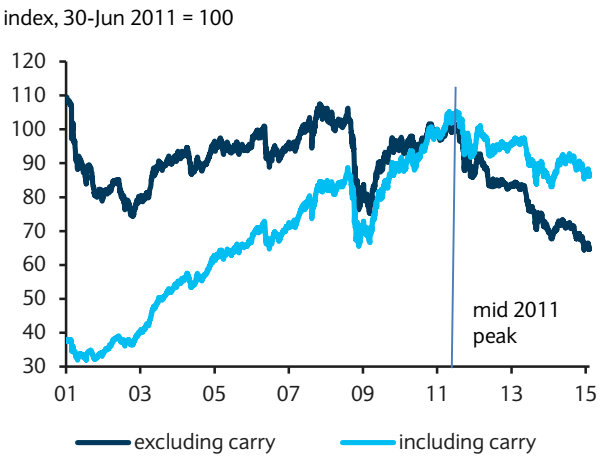
EM's vulnerable 5 * have moved from expensive to modestly cheap in the last few years

Source: Barclays Research, Bloomberg

* EM basket is equal weights of BRL, IDR, INR, TRY and ZAR

FIGURE 38

Returns in high-yield EM FX * from mid 2011 to present



Source: Barclays Research, Bloomberg

* EM basket is equal weights of BRL, IDR, INR, TRY and ZAR vs USD

FIGURE 39
Average high-yield EM FX carry-to-volatility ratio *

Source: Barclays Research, Bloomberg. * index is 12m implied FX carry / 3m implied FX volatility for TRY, BRL, INR and ZAR

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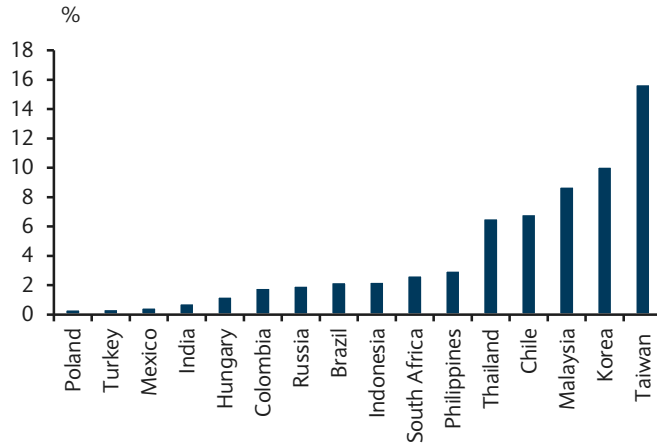
Appendix

A ranking of EM vulnerability to external headwinds

We build a ranking of EM vulnerability to external headwinds by combining the rankings of vulnerability to the five external drivers discussed in this chapter Figures 40-44. We do this by ranking each measure from 1 (most resilient) to 16 (most vulnerable). Figure 45 shows the average of the five rankings. Not surprisingly, the most vulnerable countries are commodity exporters exposed to weaker Chinese and euro area growth, such as Malaysia and Russia. The most resilient are those that are relatively insulated from China and European growth and benefit from carry and expected FX resilience, such as Mexico and India. For more details see *Macro Daily Focus: A ranking of EM vulnerability to a more challenging external environment*, 9 January 2015.

FIGURE 40

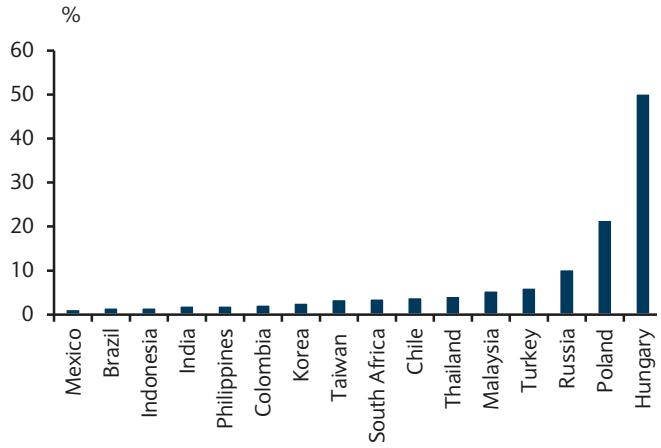
EM vulnerability to China growth slowdown (exports to China over GDP, higher = more vulnerable)



Source: Haver Analytics, Barclays Research

FIGURE 41

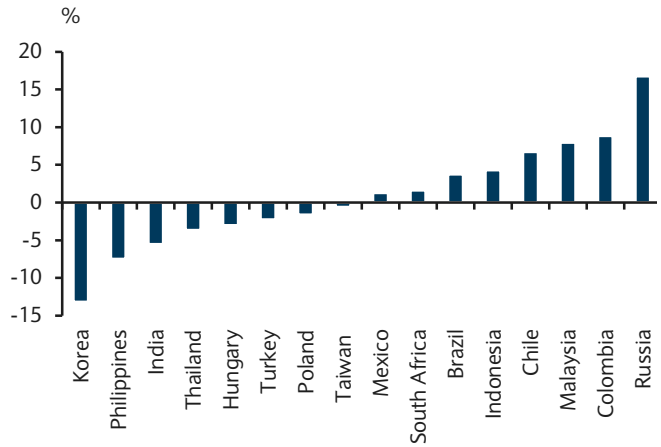
EM vulnerability to euro area growth slowdown (exports to euro area over GDP, higher = more vulnerable)



Source: Haver Analytics, Barclays Research

FIGURE 42

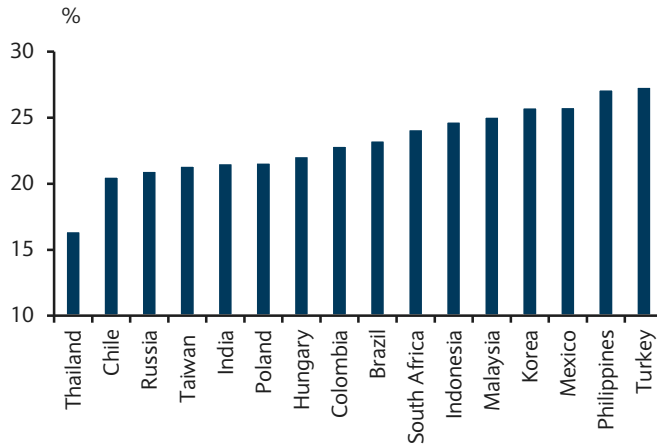
EM vulnerability to lower commodity prices (net commodity exports over GDP, higher = more vulnerable)



Source: Barclays Research, Haver Analytics,

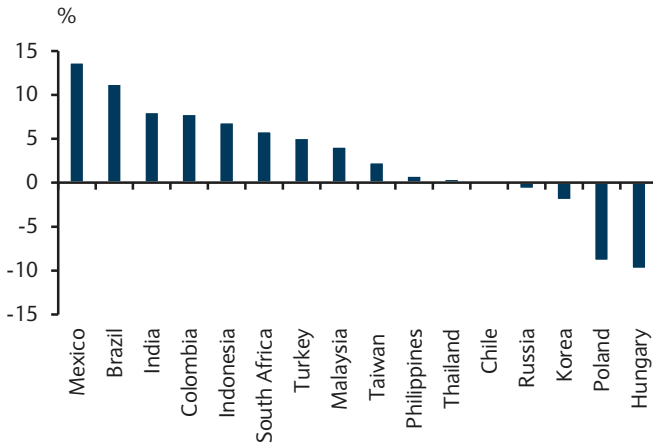
FIGURE 43

EM vulnerability to higher US rates (correlation of EM assets* and US rates vol, higher = more vulnerable)



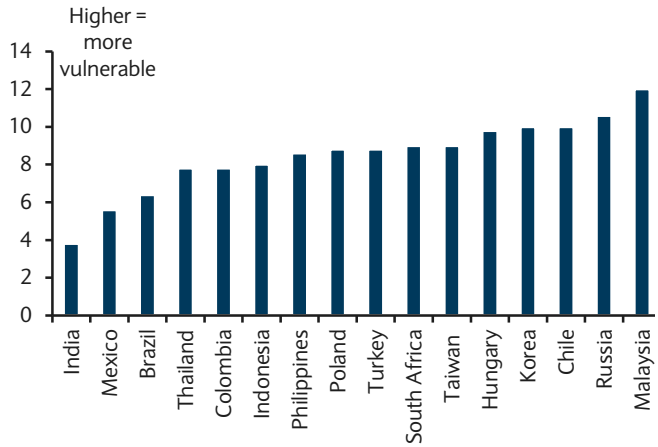
Source: Bloomberg, Barclays Research. EM assets include CDS, FX and equities.

FIGURE 44
EM vulnerability to stronger USD (12m EM FX appreciation vs USD + 5y bond yields, lower = more vulnerable)



Source: Bloomberg, Barclays Research

FIGURE 45
Ranking of EM vulnerability (higher = more vulnerable)



Source: Haver Analytics, Bloomberg, Barclays Research

EM macroeconomic and governance indicators

FIGURE 46

EM macroeconomic indicators in bust, boom and landing cycles

	Real GDP growth (% YoY)			Average inflation (% YoY)			Current account balance (% GDP)			General government net lending/borrowing (% GDP)		
	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014
Argentina	-1.2	5.0	2.7	-0.6	10.9	10.1	-2.8	2.7	-0.6	-3.3	-3.1	-3.3
Brazil	1.5	3.9	1.6	5.5	6.7	6.1	-4.1	-0.2	-2.9	-4.7	-3.4	-3.1
Chile	2.6	4.2	4.3	4.0	3.2	3.1	-1.8	1.3	-2.5	-0.7	2.2	-0.1
China	8.0	10.7	8.0	-0.3	2.3	3.2	2.0	5.6	2.0	-2.2	-1.4	-0.3
Colombia	0.2	4.4	5.0	11.7	5.3	2.9	-1.0	-1.8	-3.3	-3.8	-1.7	-1.1
Czech Republic	2.2	3.5	0.6	5.3	2.3	1.8	-3.5	-3.6	-1.5	-4.4	-3.9	-2.5
Hungary	3.8	1.8	1.0	10.8	5.2	2.9	-7.4	-5.9	1.7	-3.7	-6.4	-0.8
India	5.9	7.8	5.5	6.2	6.5	9.2	-0.5	-0.9	-3.2	-8.3	-8.2	-7.4
Indonesia	-1.1	5.4	5.9	23.5	8.3	5.4	4.4	1.9	-2.3	-1.8	-0.6	-1.7
Korea	4.6	4.4	3.2	3.7	3.1	2.3	4.4	1.8	4.4	2.3	1.4	1.1
Malaysia	2.0	5.1	5.4	2.8	2.3	2.5	11.5	13.4	6.4	-3.8	-4.0	-3.9
Mexico	3.0	2.1	2.9	12.1	4.5	3.8	-2.7	-1.2	-1.6	-4.3	-2.3	-3.8
Peru	1.7	6.0	5.4	4.1	2.4	3.3	-3.6	-0.5	-3.7	-2.1	0.2	1.2
Philippines	2.5	5.0	6.0	6.9	4.6	3.8	-1.6	2.6	3.0	-2.7	-1.9	-0.4
Poland	3.7	4.2	2.8	8.7	2.5	2.2	-5.2	-4.3	-2.9	-3.7	-5.0	-4.1
Russia	4.0	4.9	2.3	38.9	11.6	6.9	10.4	7.5	3.2	-1.3	2.8	-0.1
South Africa	2.4	3.6	2.3	5.8	6.1	5.7	-0.5	-3.6	-4.8	-1.4	-1.4	-4.4
Taiwan	3.4	4.5	2.8	0.8	1.1	1.4	3.3	8.1	10.8	-4.6	-3.8	-3.4
Thailand	0.2	4.6	2.6	2.9	2.7	2.8	8.7	2.7	1.1	-4.7	-0.4	-1.3
Turkey	0.2	5.1	4.5	64.7	14.5	8.0	-0.3	-4.0	-7.4	n.a.	-5.0	-1.4
Venezuela	0.4	3.5	2.0	22.0	23.2	38.0	2.3	10.1	6.1	-1.0	-2.4	-14.3

Source: Barclays Research, IMF.

EM macroeconomic indicators in bust, boom and landing cycles (continued)

	General government gross debt (% GDP)			Gross external debt (% GDP)			Credit ratings			WB governance		
	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014	1998-2001	2002-2010	2011-2014
Argentina	37.8	75.6	40.9	42.8	60.0	22.7	13.7	17.3	17.2	0.0	-0.3	-0.3
Brazil	68.7	69.0	66.2	37.4	25.4	19.1	14.0	12.3	9.3	0.0	0.0	0.0
Chile	13.3	8.1	12.4	46.9	41.3	43.5	7.3	6.3	4.2	1.1	1.2	1.2
China	37.2	34.9	38.5	13.5	11.1	9.4	7.8	6.3	4.0	-0.5	-0.5	-0.5
Colombia	35.0	38.2	34.4	35.5	26.3	22.9	11.2	11.6	9.8	-0.6	-0.5	-0.3
Czech Republic	18.0	30.1	44.5	35.0	38.0	52.5	7.4	6.0	4.6	0.6	0.9	0.9
Hungary	57.3	67.0	80.1	61.5	113.9	152.5	8.3	7.1	11.1	0.9	0.9	0.7
India	72.6	77.4	63.8	21.5	17.6	20.7	11.8	10.6	10.0	-0.2	-0.3	-0.3
Indonesia	87.6	43.6	25.2	109.2	43.3	27.9	16.8	14.2	10.7	-0.8	-0.7	-0.4
Korea	16.5	26.3	33.3	28.7	25.9	33.0	9.7	6.5	4.9	0.5	0.7	0.8
Malaysia	37.7	45.2	56.2	51.3	48.3	60.9	9.0	7.3	7.0	0.3	0.4	0.3
Mexico	43.3	41.4	45.2	26.4	21.1	30.9	11.3	8.7	8.3	-0.1	-0.1	-0.1
Peru	44.0	36.7	20.9	56.5	38.1	27.5	12.5	11.9	9.0	-0.3	-0.3	-0.2
Philippines	55.6	53.8	39.3	73.4	50.7	24.7	11.0	12.7	11.0	-0.2	-0.5	-0.4
Poland	38.2	47.5	54.6	37.2	51.7	69.3	8.9	6.9	6.5	0.7	0.6	0.8
Russia	68.8	17.6	13.5	79.0	35.8	31.7	16.9	9.7	8.7	-0.8	-0.7	-0.7
South Africa	43.4	32.9	43.5	19.2	24.7	35.5	10.2	8.3	8.2	0.4	0.3	0.2
Taiwan	26.4	34.5	40.5	11.5	21.3	28.3	3.1	3.9	4.0	0.8	0.9	1.0
Thailand	55.5	45.3	45.2	74.0	33.8	34.5	10.3	8.4	8.0	0.3	-0.1	-0.3
Turkey	77.9	52.1	36.3	44.5	42.6	43.1	14.5	13.4	11.2	-0.3	-0.1	-0.1
Venezuela	31.8	40.2	46.9	40.4	30.1	31.1	14.6	14.8	15.1	-0.6	-1.1	-1.3

Source: Barclays Research, IMF, World Bank, Moody's and S&P.

Note: Credit rating numbers above reflect average rating by Moody's and S&P. Credit ratings by Moody and S&P have been converted into a numerical scale. AAA by S&P and Aaa by Moody's is the highest rating. BBB- And Baa3 = lowest investment grade rating.

CHAPTER 4

The great destruction

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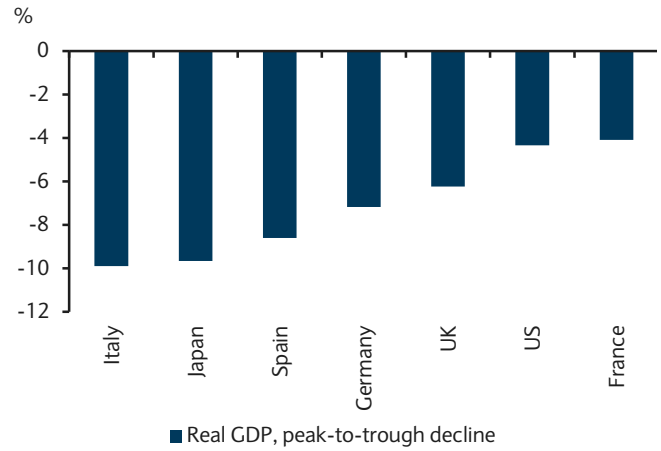
- **Severe recessions intertwined with financial crises have historically been associated with lost output and slower potential growth. More than five years after the end of the global recession, we feel enough time has passed to assess the extent of the destruction of output in developed economies.**
- **In applying a uniform framework across seven developed economies that account for nearly half of world output, we estimate that potential growth in these economies has fallen by 1.5pp since 1999 and, in turn, has reduced global potential growth by 0.7pp.**
- **Our finding that slower growth in developed economies could slow global growth by 0.7pp is of similar magnitude to the effect of a slowing China on global growth. Slower potential growth in developed economies and a decelerating Chinese economy have reduced global potential growth by 1.5pp – a significant deceleration.**
- **We estimate that the effects of the recession accounted for about two-thirds of the 1.5pp decline in potential growth in developed economies, with the remaining one-third pre-dating the global recession. Policymakers' efforts to stem the tide have been effective, but we doubt policy can fully reverse the slowing in trend output growth before the end of the decade.**

Financial crises destroy output

The 2008-09 global recession was severe from a historical perspective

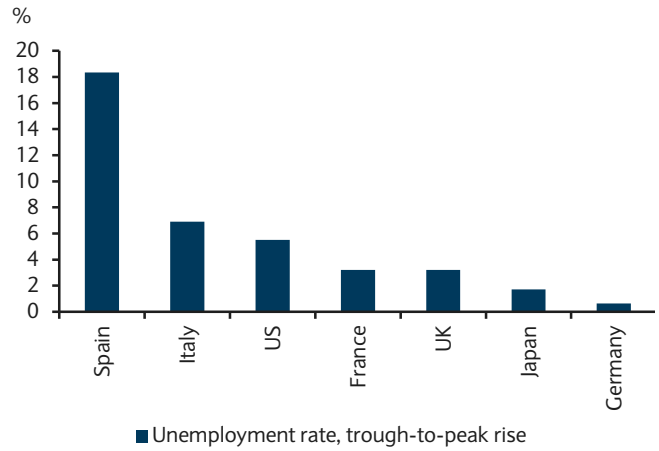
Economic downturns that coincide with severe financial crises destroy output and lower potential growth. In this chapter, we examine the experience of seven large developed economies that comprise nearly half of world GDP based on purchasing power weights – France, Germany, Italy, Japan, Spain, the UK, and the US – to estimate the damage to output and trend growth from the recent recession. The recession hit when many of these countries were already experiencing a deceleration in trend growth related to demographic factors and the fading of the effects of the technology revolution. The slowing of population growth and rising dependency ratios across much of the economically advanced world was a subject we took up in last year's *Equity Gilt Study* (see "*Economic implications of demographic change*", *Equity Gilt Study 2014*, 13 February 2014). We also take up the importance of demographic trends in boosting saving rates and asset prices in Chapter 1 of this year's *Equity Gilt Study*,

FIGURE 1
Peak-to-trough decline in real GDP



Source: BEA, INSEE, ISTAT, OECD, ONS, StBA, Haver Analytics, Barclays Research

FIGURE 2
Trough-to-peak rise in the unemployment rate



Source: BLS, INE, INSEE, ISTAT, OECD, ONS, Haver Analytics, Barclays Research

"Population dynamics and the (soon-to-be-disappearing) global 'savings glut'". As a result of inflection points in demographics and the passage of the technology boom, trend growth in the developed world is likely to have slowed significantly from the robust rates of growth achieved in the 1990s. Active monetary and fiscal policies may be able to mitigate or reverse some of the negative effect on trend growth, but not all. We believe potential growth in the developed world has entered a new phase. In our view, the Great Destruction of output following the recession left potential growth permanently slower.

After applying a common methodology to each country to estimate the rate of potential output growth, we find that trend growth in these seven developed economies fell by 1.5pp per year in 2000-2014, with about two-thirds of the decline occurring after 2007. Given the relative weight of each economy in world output, the slowing in developed economy growth reduced potential global growth by 0.7pp annually. We find this deceleration significant, given that real global growth averaged 3.7% annually between 1990 and 2007.

Potential growth in developed economies was already slowing in advance of the recession

The destruction of output and slowing of potential growth in the developed world comes just as growth outside the developed world is also slowing. We do not find this surprising, given the extent of globalization and linkages among developed and emerging economies. We expect potential GDP growth in China to slow from about 9-10% in the 1990s to about 6.0% in the coming 5-10 years as it transitions from investment-led to consumption-led growth.[1] If realized, this would lower the growth rate of potential global GDP by another 0.6-0.7pp, given China's burgeoning share of world output.

Taken together, and assuming policy cannot significantly reverse the effects of the global recession, slower potential growth in developed economies and a decelerating Chinese economy could reduce global potential growth by 1.5pp annually. Growth in emerging market economies outside of China are also slowing in part because of the rebalancing of the global economy following the recession and financial crisis, which helped to narrow the current account deficit in the US. For our view on how this will impact risk premia and asset returns in emerging markets, see Chapter 3, "EM is still an attractive asset class". Outside of India, where the growth outlook appears more promising, we see the bulk of the evidence as pointing to a significant deceleration in potential growth. Much that once was, now appears lost.

History repeats itself

History suggests that economies face deeper recessions and weaker recoveries after financial crises and credit booms. The evidence also indicates that the severity of the downturn is proportional to the size of the boom, validating the adage "the bigger they are, the harder they fall." Examining 18 episodes of severe financial crises, Carmen Reinhart and Kenneth Rogoff find that real GDP per capita declines by an average of 9.3%, with output reaching its trough an average of 1.9 years after the prior peak.[2] In these cases, unemployment rose by an average of 7%, with unemployment peaking 4.8 years after the crisis, while real home and equity prices declined by an average of 35.5% and 55.9%, respectively.

The global recession of 2008-09 is on a par with these examples. Based on the experience of seven developed market economies, Figure 1 shows that the peak-to-trough decline in real GDP ranged between 4.1% and 9.9%, with an average decline of 7.1%. The associated rise in unemployment has been more varied, ranging from very mild episodes in Germany and Japan, to the staggering 18.3% rise in unemployment in Spain (Figure 2).

[1] See "*China: Beyond the miracle – The complete series*," 1 March 2013.
[2] Carmen M. Reinhart and Kenneth S. Rogoff, *This time is different: Eight centuries of financial folly*, Princeton NJ: Princeton University Press, 2009.The statistics cited herein are from eighteen post-war financial crises, including five severe cases (Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991; and Japan, 1991) along with other examples from East Asia and Latin America.

Germany and Japan experienced relatively short four-quarter declines in output, while the downturns in Italy and Spain have lasted much longer

The duration of the decline in real output varied substantially, with Germany and Japan experiencing relatively short four-quarter declines in output, while the downturns in Italy and Spain have lasted much longer. The duration of the declines in Italy and Spain is open to debate. In Italy, real output peaked in Q1 2008 and fell for seven quarters through the end of 2009, before rising for six consecutive quarters thereafter. However, beginning in Q3 2011, real output has fallen steadily and, 27 quarters since 2008 Q1, output in Italy has yet to stage a convincing turnaround. Spain posted a similar double dip, with output falling for six quarters before staging a brief rebound, only to fall further in 2011-12. More recently, Spain has achieved five consecutive quarters of positive growth through 2014 Q3.

There are several channels through which potential output is lost following severe economic downturns. The most common include:

- **Contractions in finance, insurance, real estate, and construction**. Recessions associated with deep financial crises often cause permanent contractions in finance, insurance, and real estate. The booms in many developed economies – particularly the US, UK, and Spain – were also fuelled by housing bubbles that led to severe contractions in construction and housing-related sectors. The tighter regulatory environment likely means that potential output in these sectors is permanently lost.
- **Slower capital accumulation and distortions to the efficient allocation of capital.** Weak profitability reduced the ability of firms to self finance in an environment of tighter credit standards. Sluggish economic growth and heightened uncertainty stemming from the severity of the downturn also weighed on business sentiment and suppressed capital accumulation. Finally, tighter credit conditions and a reluctance to lend reflect increased risk aversion. We find features of this in each of the developed economies investigated.
- **A skills gap in labor markets leading to structural unemployment.** Contractions focused in certain sectors, like finance and construction, while job growth occurs in other sectors lead to a skills gap and a misallocation of labor resources. Long and deep recessions may also depress participation and raise the long-term unemployment rate. Hysteresis then leads to structural unemployment and fewer potential hours. Finally, dual labor market structures often mean the downturn is felt disproportionately by one segment of the labor force. We find evidence of this in the US and UK, but most prominently in Europe and Japan.

Applying a business cycle framework to assess trend growth

We apply a common framework across seven developed economies to estimate potential growth and its components

To estimate the degree of slowing in potential developed economy output, we apply a business cycle framework to seven economies – France, Germany, Italy, Japan, Spain, the UK, and the US – and break down observed output data into its cyclical and trend components. We then identify potential growth as the trend component and the difference between actual and trend, or the output gap, as the cyclical component.

Potential output and the output gap are key variables in the setting of monetary and fiscal policy and serve as anchors to economic models. However, they are also unobservable. The framework we apply in this chapter constructs estimates of these key variables using a generalized multivariate unobserved components framework; inputs on working hours, output, employment, population, and participation are used in a comprehensive framework to generate a decomposition of potential output growth into its component parts.[3,4] The

[3] For the US, our approach follows Charles Fleischman and John M. Roberts, 2011, "*From many series, one cycle: Improved estimates of the business cycle from a multivariate unobserved components model*," *Finance and Economics Discussion Series* 2011-46. The US framework includes nine variables: real gross domestic product, real gross domestic income, real nonfarm business output, real nonfarm business income, nonfarm business employment, the work week, labor force participation rate, the employment rate, and core CPI inflation. For the remaining countries, a scaled down model and six variables are used: real gross domestic product, real gross domestic income (if available), employment, working hours, output per hour, employment, participation, and inflation. Variables in both models are detrended by population growth. See the appendix for further details.

[4] See Jun Ma and Mark Wohar, "An unobserved components model that yields business and medium-run cycles," *Journal of Money, Credit, and Banking*, 45(7), October 2013, for further discussion on the benefits of the unobserved components model.

models are estimated using quarterly data from 1963 Q1-Q1 2014 for the US, 1975 Q1-Q1 2014 for the UK, 1975 Q1-Q1 2014 for France, 1973 Q1-Q1 2014 for Germany, 1993 Q1-Q1 2014 for Italy, 1996 Q1-Q1 2014 for Spain, and 1981 Q1-Q1 2014 for Japan.

We see several advantages to using a multivariate approach. Although it is more difficult to implement, academic research has shown that multivariate analysis improves the accuracy of cycle estimates and using a single system means the framework uniformly accounts for trade-offs between alternative signals.[5] Applying the framework across countries also ensures that trade-offs between competing signals are treated in similar fashion. Our common framework, detailed in the appendix to this chapter, makes several important assumptions. First, we assume that each measure of economic activity and labor markets can be represented as the sum of cyclical and trend components. Second, we assume that the cyclical component is common across all the inputs, with the understanding that a wider set of data should enable estimation of the trend with improved accuracy. Third, the cyclical component is allowed to have both contemporaneous and lagged effects to account for variables that may lag the cycle, yet still inform its estimation. Fourth, while each variable has a common cyclical component, we permit each variable to have its own unique trend. Finally, we allow cyclical deviations in output to affect inflation, creating a natural rate interpretation.

Our methodology allows for cycles in both permanent (trend) and transitory (cycle) components

The benefit of the generalized unobserved components model is that it allows for dynamics in both cyclical and trend components. Many traditional frameworks assume a smooth trend and view recessions as "temporary" events that only inform the cycle. In other words, volatility in the data is restricted to inform the estimate of the cycle, but not necessarily the trend. Our methodology allows for cycles in both permanent (trend) and transitory (cycle) components. Academic research has shown that this generalized framework is more appropriate for capturing both short-term and medium-term cycles, where the latter may be more suitable when dealing with movements in technology, research and development, and efficiency of resource utilization.[6] Our preference is to let the data speak for themselves about whether volatility is related to transitory outcomes or structural phenomenon.

Slower rates of potential growth in developed economies

We organize the results of the common business cycle framework across countries around two themes; the movement in trend variables that comprise potential growth and the estimates of the cycle. The presentation follows the traditional exposition of potential growth; namely that the growth in output depends on the growth rate of factor inputs – labor and capital – and the efficiency with which these are combined to produce output. We impose the structural relationship that

Potential output = Hours worked * Productivity per hour,

where the trend in hours worked comprises trend employment and the trend work week according to

Hours worked = Employment * Work week.

We assume that trend employment is made up of

Employment = Employment rate * participation rate

where the employment rate is assumed to be one minus the unemployment rate. The trend employment rate is therefore a transformation of the non-accelerating inflation rate of unemployment (NAIRU). Potential output and employment are scaled by population since this is a common trend in both variables.

[5] Arabinda Basistha and Richard Startz, 2008, "Measuring the NAIRU with reduced uncertainty: A multiple-indicator common-cycle approach," *Review of Economics and Statistics*, 90, 805-11. Also see James H. Stock and Mark W. Watson, 1989, "New indices of coincident and leading economic indicators," *NBER Macroeconomics Annual 1989*, Oliver Blanchard and Stanley Fischer, eds., 351-394.
[6] See Diego Comin and Mark Gertler, "Medium-Term Business Cycles," *American Economic Review*, 96, 523-551.

Figure 5 presents the results of the estimation across each economy related to the estimation of the trend. Where possible, we present the results in decade-averages to smooth through the variability in annual estimates. As the figure shows, potential growth has decelerated in recent years in five of the seven economies in our sample, with Japan and Germany the exceptions to the deceleration trend.

US: An ageing population and productivity slowdown

US potential GDP growth slowed to 2.5% in the 10 years ending 2009 and 1.2% in the post-recession period

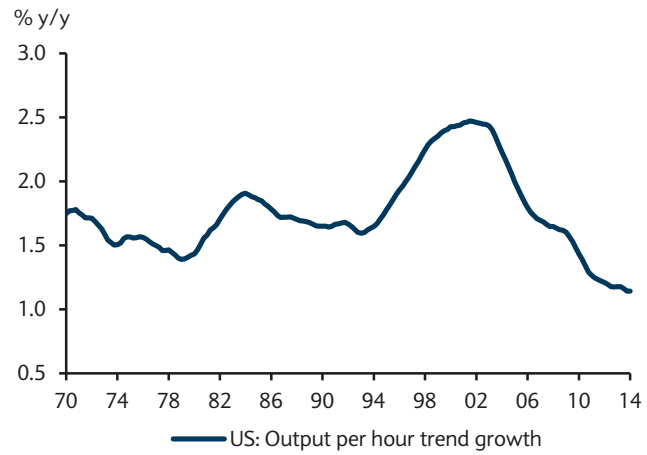
Beginning with the US, trend growth is estimated at 3.0-3.4% for the three decades ending in 1999, with the decades of the 1970s and 1980s buoyed by trend growth in both hours and productivity. In the 10 years ending in 2009, however, potential growth began to slow as the trend labor input slowed. This slowing was initially offset by faster productivity growth, which we attribute to the technology revolution that began in the US in the mid-1990s and supported faster rates of productivity growth (Figure 3).

The ageing of the population naturally reduces aggregate labor force participation, leading to a structural decline in potential growth

We estimate that trend growth in output in the US began to slow in 2001, falling from 2.5% to 1.5% by 2009, as the benefits of technological progress began to fade and the workforce aged. Our US economics team has written frequently about US demographic trends and their contribution to slower potential growth.[7] In our view, the decline in labor force participation since its peak in the early 2000s mainly reflects the ageing of the baby boomers. While labor force participation among the 55+ age cohort has risen during this time period, it nonetheless is half of the participation rate for the prime working age population (those aged 25-54). Therefore, the ageing of the population naturally reduces aggregate labor force participation despite the upward trend in participation among older people, leading to a structural decline in potential growth. The model estimates that the participation rate dropped 2.5pp from 2007 to 2013, accounting for around three-quarters of the 3.2pp decline in the actual participation rate (Figure 4) during the same period. This is consistent with the view that most of the decline in the participation rate is structural and unlikely to be reversed.

In addition to the above, the US has been in a gradual transition from a goods-oriented economy to a services economy, the latter of which is associated with more part-time employment and a shorter average work week.[8] Altogether, we estimate that these factors caused US potential GDP growth to slow to 2.5% in the 10 years ending 2009 and 1.2% in the post-recession period from 2010 through Q1 2014.

FIGURE 3
Trend growth in US output per hour



Source: Barclays Research

FIGURE 4
Trend US labor force participation

Source: Barclays Research

[7] See *Beyond the cycle: Weaker growth, higher unemployment*, 15 December 2010 and *Dispelling an urban legend: US labor force participation will not stop the unemployment rate decline*, 1 March 2012

[8] Employment in the goods sector in the US was nearly 40% of total private employment in 1965. The share has fallen to around 15% in recent years, leaving the remainder (85%) in services. Since average weekly hours in the service sector averages about 33 hours, compared to 41 hours for the goods sector, the relative shift into services has caused average weekly hours for the overall US private sector to decline from 39 in 1965 to 34 today. See "*U-6 unemployment may not reach normal*," 11 July 2014.

FIGURE 5

Potential growth and its trend components

United States (% saar)	1970-79	1980-89	1990-99	2000-09	2010-Q1 2014
Potential output	3.4	3.1	3.0	2.5	1.2
Total hours	2.2	1.4	1.1	0.8	0.2
Population	2.0	1.2	0.1	1.3	1.0
LFPR	0.6	0.4	0.1	-0.2	-0.8
Employment rate	0.0	0.0	0.0	-0.1	-0.1
Non-farm work week	-0.5	-0.3	-0.1	-0.2	0.1
Non-farm productivity	1.6	1.8	1.8	2.3	1.1
GDO to NFBO	-0.4	-0.2	-0.3	-0.3	-0.3
NFB employment to total employment	0.1	0.1	0.5	-0.2	0.2
United Kingdom (% saar)	**1972-79**	**1980-89**	**1990-99**	**2000-09**	**2010-Q1 2014**
Potential output	1.8	2.7	2.3	1.8	1.6
Total hours	-0.8	0.0	0.1	0.1	1.5
Population	0.1	0.1	0.3	0.6	0.7
LFPR	-0.1	0.2	-0.2	0.0	0.1
Employment rate	-0.4	-0.1	0.2	-0.2	0.3
Average working hours	-0.4	-0.3	-0.2	-0.3	0.3
Productivity	2.6	2.7	2.2	1.7	0.1
Germany (% saar)	**1972-79**	**1980-89**	**1994-99***	**2000-09**	**2010-Q1 2014**
Potential output	2.3	1.7	1.2	1.1	1.2
Total hours	-0.8	-0.1	-0.1	-0.2	0.3
Population	0.0	0.1	0.2	0.0	0.1
LFPR	0.3	1.1	0.5	0.4	0.3
Employment rate	-0.1	-0.4	0.1	0.1	0.4
Average working hours	-1.0	-0.9	-0.8	-0.6	-0.5
Productivity	3.1	1.8	1.3	1.2	1.0
France (% saar)		**1980-89**	**1990-99**	**2000-09**	**2010-Q1 2014**
Potential output		2.7	2.1	1.3	0.9
Total hours		-1.0	-0.5	0.3	0.1
Population		0.5	0.4	0.6	0.5
LFPR		-0.4	0.0	0.1	-0.1
Employment rate		-0.3	-0.1	0.0	-0.2
Average working hours		-0.8	-0.8	-0.4	-0.1
Productivity		3.7	2.6	1.0	0.8
Italy (% saar)			**1994-1999**	**2000-2009**	**2010-Q1 2014**
Potential output			2.0	0.4	-0.7
Total hours			1.1	1.1	-0.3
Population			0.0	0.4	0.5
LFPR			1.1	0.5	0.3
Employment rate			-0.1	0.2	-1.2
Average working hours			0.1	0.1	0.1
Productivity			0.8	-0.7	-0.5
Spain (% saar)			**1996-1999**	**2000-2009**	**2010-Q1 2014**
Potential output			4.1	2.2	-0.3
Total hours			4.5	1.9	-2.4
Population			0.4	1.4	0.6
LFPR			1.6	1.1	-1.0
Employment rate			2.3	-0.5	-1.7
Average working hours			0.2	-0.1	-0.3
Productivity			-0.4	0.2	2.1

FIGURE 5, CONTD.

Potential growth and its trend components (continued)

Japan (% saar)	1981-1989	1990-1999	2000-2009	2010-Q1 2014
Potential output	3.8	1.3	0.2	0.4
Total hours	0.2	-0.9	-0.9	-0.5
Population	0.6	0.3	0.1	-0.1
LFPR	0.0	-0.1	-0.5	-0.1
Employment rate	0.0	-0.3	0.0	0.3
Average working hours	-0.3	-0.7	-0.5	-0.7
Productivity	3.5	2.2	1.2	0.9

Note: The reunification of West and East Germany in the early 1990s is omitted since the event creates an "artificial recession" in model estimates. The population surge boosts potential GDP growth via a stronger labor contribution. The business cycle framework accounts for this by estimating a positive output gap prior to reunification and a negative output gap immediately afterward. In terms of the effect on the trend, the reunification pushes trend output per hour down discretely in 1991 and the series resumes its trend growth thereafter. We omit the 1990-93 model estimates for this reason. Source: Barclays Research

UK: A "productivity puzzle"

Productivity has slowed markedly in the UK…

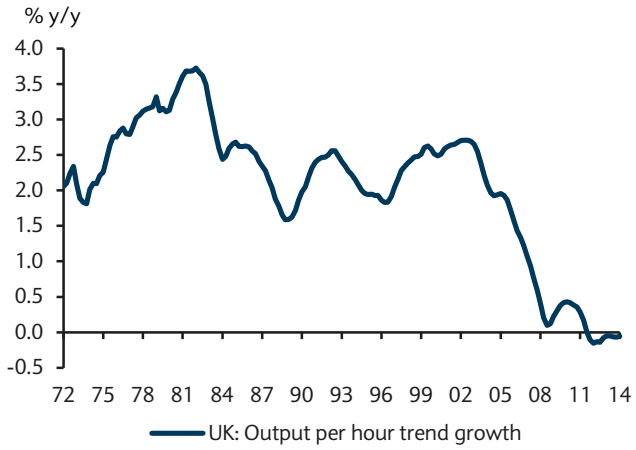
In the UK, the slowing in the rate of trend output is clearly related to a slowdown in trend productivity growth. We find that productivity growth in terms of output per hour grew between 2.2% and 2.7% per year in the three decades ending 1999. We then estimate that productivity growth fell steadily from 2.6% in 2002, down to zero by 2008, and has stayed near this level through Q1 2014 (Figure 6). This fall in labor productivity growth, or the "productivity puzzle," has been heavily investigated and several factors put forward to explain the slowdown. A report from the Bank of England points to labor hoarding during the early stages of the recession, reduced investment in physical and tangible capital, and misallocation of resources in low to high productivity sectors.[9] A higher cost of capital would encourage firms to substitute less expensive labor for capital, but this explanation is often discounted because aggressive monetary policy kept the cost of capital low for a portion of the post-recession period and modest rates of investment have meant the aggregate stock of capital has not fallen enough (as a share of GDP) to fully account for the productivity slowdown.

…broad-based capital mismatch is cited as the most likely explanatory factor

Broad-based capital mismatch is cited as a more likely explanatory factor. As discussed by Ben Broadbent, external member of the Monetary Policy Committee, data from the UK Office of National Statistics show that the dispersion of output and relative prices across sectors widened markedly following the recession.[10] A reallocation of capital and labor would reduce the dispersion across sectors, but this process takes time and, in the interim,

FIGURE 6

Trend growth in UK output per hour has slowed sharply…



Source: Barclays Research

FIGURE 7

…amid modest growth and a surge in trend employment

Source: Barclays Research

[9] See "*The UK productivity puzzle*" by Alina Barnett, Sandra Batten, Adrian Chiu, Jeremy Franklin, and Maria Sebastia-Barriel of the Bank of England's Monetary Analysis Directorate, Bank of England Quarterly Bulletin, 2014 Q2.

[10] See "*Productivity and the allocation of resources*," Ben Broadbent, External Member of the Monetary Policy Committee, Bank of England, 12 September 2012.

productivity growth stalls. The financial sector is often cited as one that is likely to have persistently slower productivity growth following the recession. A tighter regulatory environment and higher capital requirements have raised the cost of capital and necessitated more spending to cover infrastructure, system, and regulatory requirements. The new regulatory environment will likely mean trend productivity growth in the financial services sector will be persistently lower relative to pre-2008 levels. Research from the Bank of England estimates that slower financial sector productivity growth could account for about half (eg, 1pp) of the decline in trend productivity.

UK potential growth has been supported by a surge in trend hours worked

The other piece of the "productivity puzzle," in terms of estimating the net effect on trend potential growth, is the contribution from labor. The trend growth of hours worked in the UK has provided an important offset to the slowing in trend productivity. Growth in the labor force, due to a steady trend participation rate and growing population, along with a rapid boost in trend employment following the recession (Figure 7), has provided important support for trend output growth. In addition, trend growth in average working hours has turned positive for the first time since the mid-1970s. Together, these have caused trend hours to rise to 1.5% in the post-crisis period. However, growth in trend hours has not been enough to fully offset the sharp slowing in productivity, and trend output growth fell to 1.8% between 2000 and 2009 and to 1.6% in the post-recession period from 2010 to Q 2014.

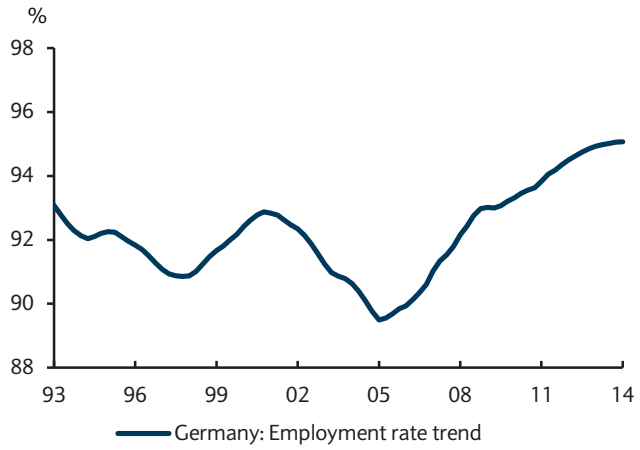
Germany: A decade after labor market reforms

In Germany, the timing of the productivity slowdown matches that of the US and UK, but the amplitude of the peak to trough decline has been more muted

The model results for Germany clearly show the effects of reunification in the early 1990s: data prior to 1990 are from West Germany and post-reunification data include both East and West Germany. The surge in population from reunification leads to an "artificial recession." The burst in potential labor contribution boosts trend growth and the business cycle framework accounts for this by estimating a positive output gap prior to reunification and a negative output gap immediately afterward. In terms of the effect on the trend, reunification pushes trend output per hour down discretely in 1991 and then the series resumes its trend growth thereafter. We suggest interpreting the "artificial recession" and the results for 1990-93 with caution. We exclude these years from the data and focus our attention on the remaining sample period.

Like other countries in our developed economy sample, output per hour in Germany has slowed in recent years, but we find that trend productivity growth did not decelerate as sharply in Germany as it did in the US and UK in 2001 and 2002, respectively. Productivity growth was estimated at 1.8% annually in 1980-89, 1.2% per year from 2000-09, and 1.0% from 2010-14 Q1.[11] Output per hour slowly accelerated from just under 1.0% per year in the

FIGURE 8
German labor market reforms boosted trend employment…



Source: Barclays Research

FIGURE 9
…with consistent employment rate growth since 2005

Source: Barclays Research

[11] Our estimates of the decomposition of potential growth closely match those of the Council of Economic Experts. See Peter Bofinger, Lars Feld, Christoph Schmidt, Isabel Schnabel, and Volker Wieland,"Mehr Vertrauen in Marktprozesse," Jahresgutachten 2014-2015.

early 1990s to 1.4% per year in 2000. Thereafter, trend productivity growth slowed and reached 0.9% y/y in recent years. Overall, the timing of the productivity slowdown matches that of the US and UK, but the amplitude of the peak to trough decline has been more muted.

As in the UK, however, the deceleration in productivity has been matched by a rise in trend employment growth (Figure 8). The trend employment rate (eg, one minus the long-run unemployment rate) has trended steadily higher since 2005 and now stands at a multi-decade high. Except for a brief period during 2009, likely an effect of the global recession, year-on-year growth in trend employment has remained in positive territory for the past decade (Figure 9). In addition, and in contrast to many of its developed economy peers, Germany's trend labor force participation has been on a steady upward path (Figure 10), rising by just over 2pp since end-2001. Together, faster growth in trend employment and participation added about 0.6pp to potential growth in Germany over the past decade.

Extensive labor market reform boosted trend employment and participation in Germany…

In our view, the model results likely reflect the Hartz reforms to the German labor market enacted between 2002 and 2005. In response to a steadily rising unemployment rate over several decades, Germany implemented a series of wide-ranging reforms to improve the efficiency of labor markets with the aim of lowering unemployment, reducing the duration of unemployment, and curbing unemployment benefits as part of an overhaul of the benefit system. The Hartz reforms are generally credited with boosting employment and participation rates, particularly among women, while leading to a reduction in long-term unemployment. Our model estimates confirm these findings. As Figures 8 and 10 show, the acceleration in the growth rates of trend employment and participation occurred after Hartz reforms were implemented. We find that, on net, long-term unemployment (NAIRU) fell by 2pp by end-2013, in line with estimates from other sources (Figure 11).[12]

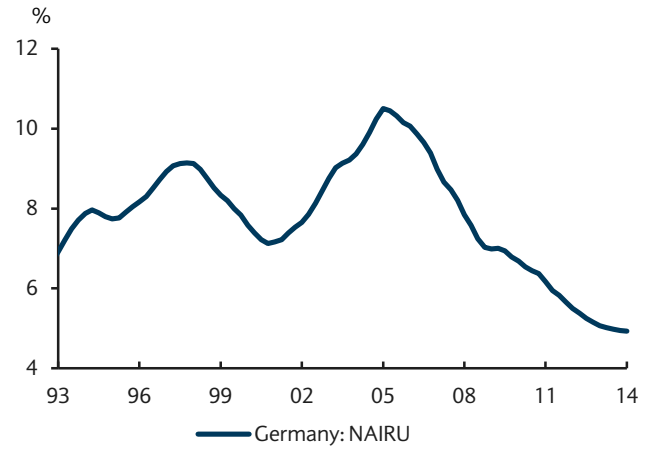
…but a slowing in trend working hours meant trend growth was largely unchanged

Labor market reform that boosted trend employment and participation, however, was unable to cause potential GDP growth to accelerate because average working hours in Germany have been on a steady decline. We find that trend working hours subtracted 0.6pp and 0.5pp from potential growth in 2000-09 and 2010-Q1 2014, respectively. This, together with a gradual slowdown in productivity, left potential GDP growth largely unchanged.

FIGURE 10
German labor market reforms boosted trend participation…

Source: Barclays Research

FIGURE 11
…with a surge in participation between 2002 and 2005



Source: Barclays Research

[12] See Tom Krebs and Martin Scheffel, "*Macroeconomic Evaluation of Labor Market Reform in Germany*," IMF Working Paper 13/42, February 2013. The authors find that long-term (non-cyclical) unemployment was reduced by 1.4pp due to the Hartz IV reforms. Our results indicate that long-term unemployment initially rose in Germany after reforms were implemented, but then fell after 2005. On net, we find NAIRU fell by about 2pp relative to late 1990s levels.

France: Productivity slowing amid inflexible labor markets

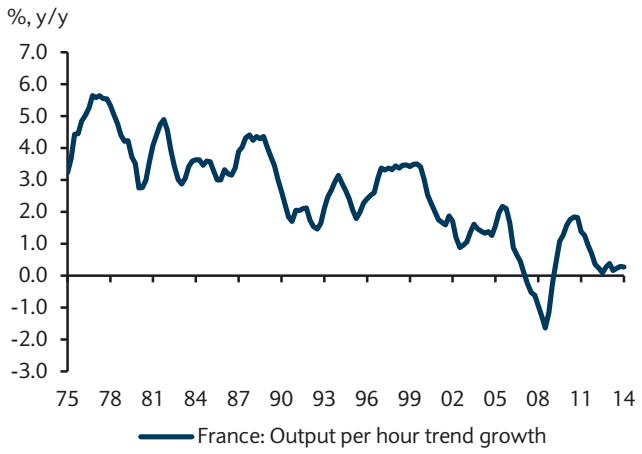
We estimate the current rate of productivity growth in France at just under 1.0%

The recession appeared to accentuate a trend slowing in productivity growth in France. Potential GDP growth slowed from 2.7% in 1980-89 to 2.1% in 1990-99, with the estimated rate of productivity growth falling from 3.7% to 2.6% (Figure 12). From there, potential growth slowed modestly, to 1.9% per year between 2000 and 2007, before falling below 1.0% during and after the recession. We estimate the current rate of productivity growth at just 0.8%. The gradual shift from higher productivity manufacturing to lower productivity services over time is likely a large explanatory factor behind the slowdown in productivity before the recession. Since 1980, the share of services employment to total employment (including agriculture, forestry and fishing) has risen from 69% to 86% through Q3 2014. In contrast, the share of manufacturing employment has fallen from 22% in 1981 to just under 10% currently.

A likely contributor to soft productivity growth in France has been lackluster business investment

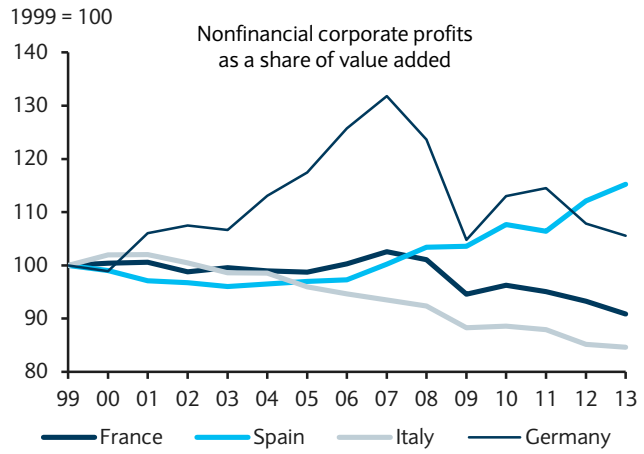
Following the recession, a likely contributing factor to soft productivity growth in France has been lackluster business investment. Since 2010, gross fixed capital formation in France, which includes public, private (financial companies and nonfinancial corporations), and household entities, has grown by only 1.2% per year on average and contributed less than 0.1pp to real GDP growth. In level terms, gross fixed capital formation still stands nearly 10% below the pre-recession peak in Q4 2007. Standard economic theory suggests the behavior of business investment is influenced by long-run factors like potential GDP growth and short-run cyclical economic factors, including the rate of growth in economic activity, credit conditions, and uncertainty.[13] The sluggish domestic economic recovery and heightened uncertainty stemming from the episodic concerns about sovereign debt sustainability in Europe are likely to have weighed on business sentiment, as have poor corporate profitability. As Figure 13 shows, corporate profitability in France has declined steadily following the recession, reducing the ability of the nonfinancial corporate sector to engage in internally financed investment. Declining corporate profitability has also been a feature of Italy's economy in the past decade, whereas trends in corporate profitability in Germany and Spain have been more favorable.

FIGURE 12
France: Trend productivity growth



Source: Barclays Research

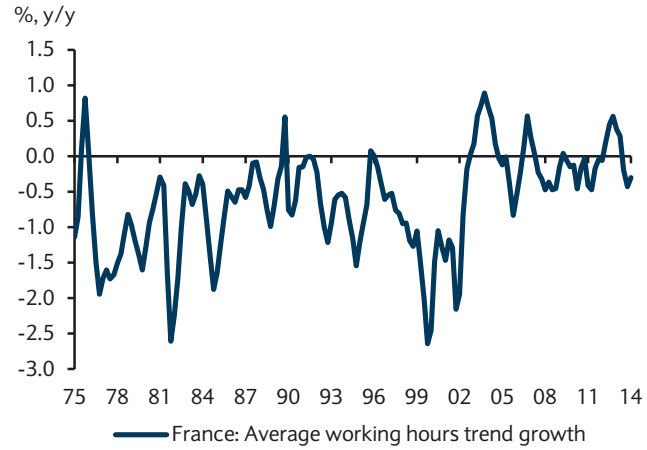
FIGURE 13
Weak corporate profitability has constrained investment in France and Italy



Source: INE, INSEE, ISTAT, StBa, Haver Analytics

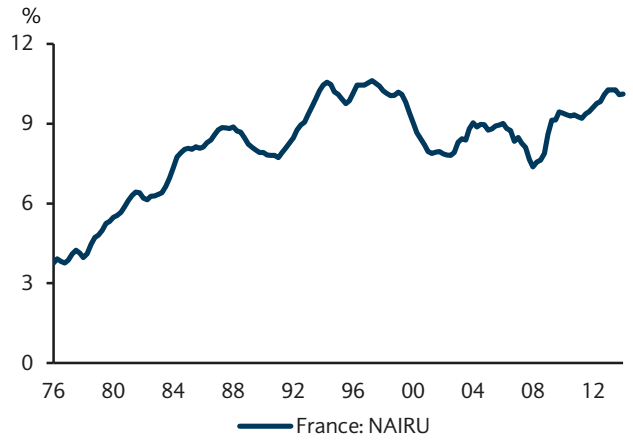
[13] See *France: IMF Selected Issues*, IMF Country Report No. 14/183, July 2014 for discussion of business investment in France. Also, see Eugenio Pinto and Stacey Tevlin, "*Perspectives on the recent weakness in investment*," FEDS Notes, May 21, 2014 for an analysis of accelerator and long-run growth models applied to US investment

FIGURE 14
France: year-on-year growth in trend average working hours



Source: Barclays Research

FIGURE 15
France: Modest rise in NAIRU following the recent recession



Source: Barclays Research

Weak productivity growth, however, is not the sole factor behind France's slowing in trend GDP growth. Since 1980, average working hours have been on a downward trend (Figure 14), dragging potential growth 0.8pp lower in the two decades ending 1999, and somewhat less since then. The downtrend in average working hours may also be related to the structural shift away from goods production and toward services, where part-time employment and shorter-work weeks are more prevalent. We also find that a modest increase in structural unemployment has occurred, with NAIRU rising from an average of 8.4% in 2006-07 to 10.5% now. This rise in structural employment and decline in trend working hours has, on average, offset population growth and meant that total hours have been approximately neutral in terms of contribution to GDP potential. However, we find the rise in structural unemployment in France has been much more modest than in either Spain or Italy, as discussed further below.

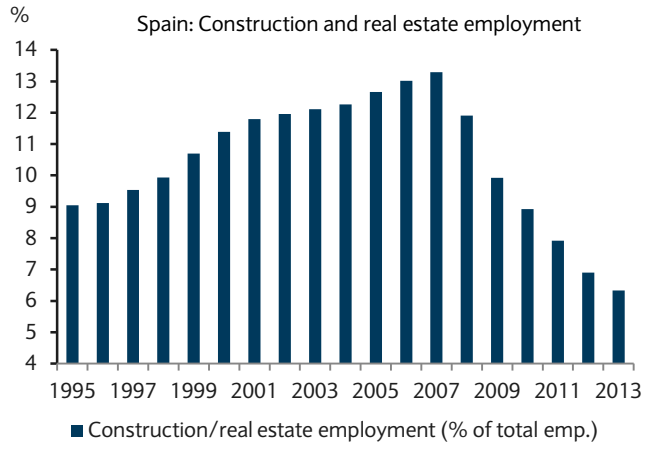
A high labor tax wedge in France remains a constraining factor on growth

France also has a fairly high tax wedge, or the difference between before-tax and after-tax wages. A high tax wedge translates into high labor costs for employers and low net take-home pay for employees. High tax wedges are generally associated with higher structural rates of unemployment, lower hours worked, and lower productivity.[14] According to OECD estimates, the tax burden in France has risen from 49.6% in 2000 to 50.1% in 2005, well above the 37.3% average for OECD countries and higher than the European average of 42.1% as of 2005.[15] The European average, however has drifted modestly lower in recent years.

Our estimates of potential GDP and its components in France are similar to those found elsewhere, including in two recent IMF studies that find potential output grew at an average rate of more than 2% during the 1980s and 1990s, but decelerated to around 1.7-1.8% in the 2000s before the crisis.[16] During and after the crisis, IMF staff found that potential output fell to below 1%. Across both exercises, Fund staff use a variety of methodologies, including statistical filters, production function approaches, and a multivariate approach similar to the one used in this analysis. The authors conclude that a multivariate approach provides more robust estimates than the remaining approaches, although none of the approaches is fully robust to data revisions and uncertainty about the true level of potential output should be an accepted fact of life for policymakers and investors.

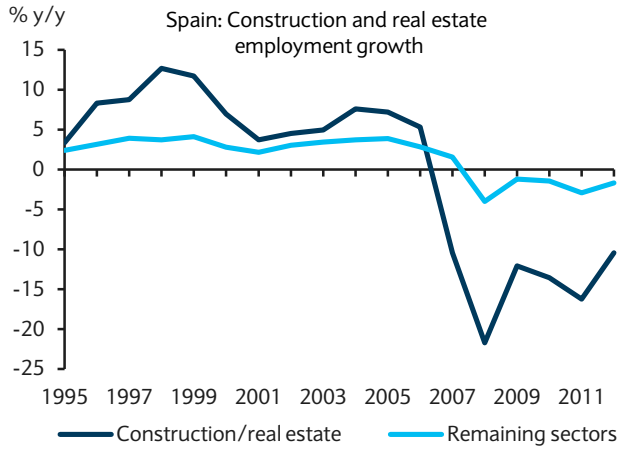
[14] Hong Ding, "*Can tax wedge affect labor productivity? A TSLS fixed model on OECD panel data*," International Journal of Applied Econometrics and Quantitative Studies, Vol. 5-1, 2008.
[15] See *Tax wedges on earning vary sharply in OECD countries*, OECD. The tax burden is measured as income tax plus employee and employer contributions, less cash benefits, as a % of labor costs. Data is for single persons without children at 100% of average earnings.
[16] See *France: Selected Issues*, IMF Country Report No. 11/212, July 2011 and *France: Selected Issues*, IMF Country Report No.13/252, August 2013.

FIGURE 16
Housing-related employment surged in Spain before 2007…



Source: INE, Haver Analytics

FIGURE 17
…boosting trend employment and total hours



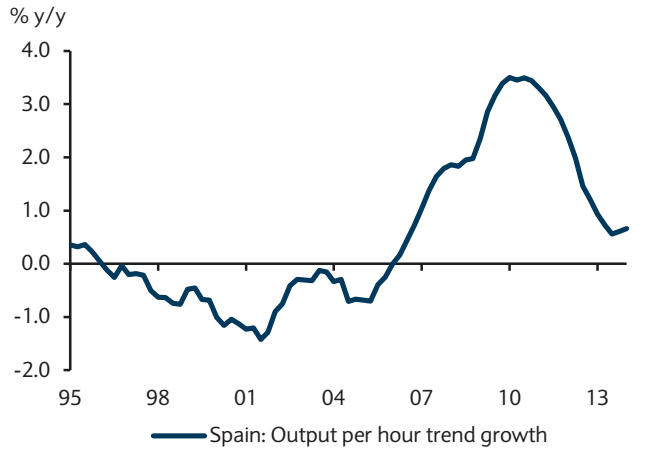
Source: INE, Haver Analytics

Spain and Italy: Labor market rigidities and weak productivity

Because of data restrictions on the historical capabilities of our estimation procedure, we report only the results for Italy and Spain since the 1990s and, as a result, combine the analysis into one section. As is well documented, substantial immigration, in part related to the housing boom and demand for construction labor, boosted the labor force participation rate, employment, and total hours. Employment in the construction and real estate sectors as a share of total employment rose from 8.7% in 1995 to 12.2% by 2007 (Figure 16) and the annual pace of employment growth in these sectors was several times larger than in remaining sectors (Figure 17). As a result, we estimate that potential GDP grew rapidly, exceeding 4.0% in the second half of the 1990s and 3.3% in 2000-07. Nearly all the boost to potential came in the form of the labor contribution, as we find total hours added 4.5pp and 3.6pp to potential growth, respectively, during the same periods.

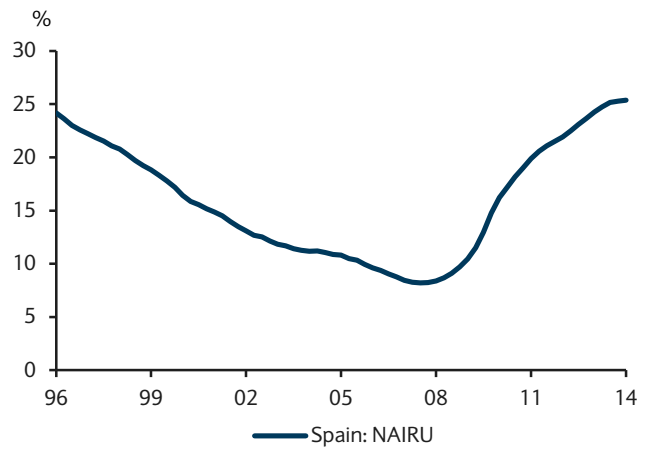
Underneath, however, was an economy that experienced weak productivity growth. We estimate that productivity growth was actually negative between 1996 and 2007, subtracting between 0.3-0.4pp from potential growth (Figure 18). Our results are similar to findings by the IMF, OECD, and Eurostat that suggest trend productivity growth weakened considerably from 2-3% in the 1970s and 1980s to 0.0-0.5% in the past two decades. Some analysts argue that the housing boom itself is partly responsible for the weak productivity performance, while

FIGURE 18
Productivity growth initially rebounded following the crisis…



Source: Barclays Research

FIGURE 19
…and structural unemployment in Spain has trended higher



Source: Barclays Research

others argue that sectors outside of housing exhibited poor productivity and Spain's rigid dual labor market limited flexibility and kept inefficiencies high.[17]

Following the recession, we find that potential growth in Spain has fallen to -0.3%

Following the recession, we find that potential growth has fallen to -0.3%, modestly below IMF and OECD estimates and in line with estimates from the European Commission.[18] Population growth has slowed in recent years and is likely to be a feature of the Spanish economy in the years ahead, as the working age population is projected to decline. In addition, we find that NAIRU has risen substantially and, together with demographic trends, mean labor force participation and trend total hours are major constraints on potential GDP. We find that NAIRU increased sharply from just under 10% in 2008 to more than 25% currently (Figure 19). Only recently has the rise in trend structural unemployment begun to moderate. The shedding of employment, in our view, is the main reason trend productivity exhibited a medium-term bounce in 2007-13. As Figure 18 shows, productivity growth rose to 3.5% in 2010 before falling back to 0.7% in 2013.

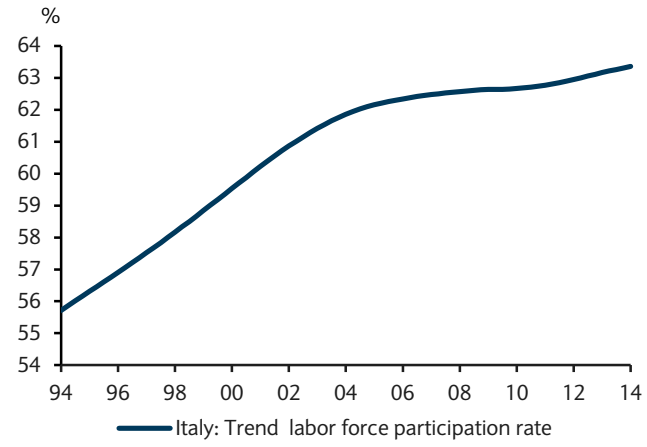
Italy shows the signs of an economy limited by structural rigidities and inefficiencies

In contrast to the more dramatic turn of events in Spain and elsewhere that reflect more of a boom-bust phenomenon, Italy shows the signs of an economy limited by structural rigidities and inefficiencies. We find that potential growth in the second half of the 1990s was a modest 2.0%, with half coming from a trend increase in labor force participation and half from productivity gains. Post-recession, we find a fairly sharp reduction in both productivity growth and hours, with productivity growth negative, on average, since the beginning of the last decade. This result is similar to estimates of trend growth in total factor productivity from the OCED, which shows productivity in Italy declining by 0.4% per year in 2001-10.[19]

Labor force participation has trended steadily higher throughout the sample period, rising from nearly 56% of the total population to around 63% in 2013, although most of this increase took place prior to the recession (Figure 20). Previous labor market reforms – the Treu reform in 1997 and the Biagi reform in 2003 – provided for non-standard work arrangements and part-time employment. Data indicate that these reforms were most helpful in boosting participation among workers in the 15-24 age group and among women. According to data from Eurostat, youth employment increased from 25% 1997 to a high of 27.6% in 2004, while employment among women rose from 36.5% in 1999 to a high of 47.2% in 2008. Although the reforms boosted participation, they also tended to reduce

FIGURE 20

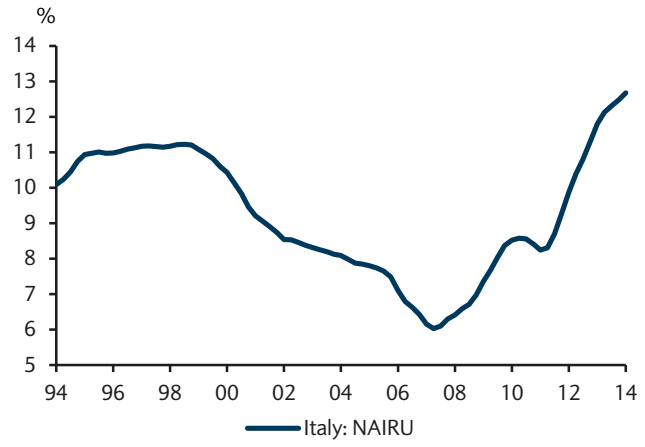
Labor market reforms in Italy helped boost participation, particularly among youth and women…



Source: Barclays Research

FIGURE 21

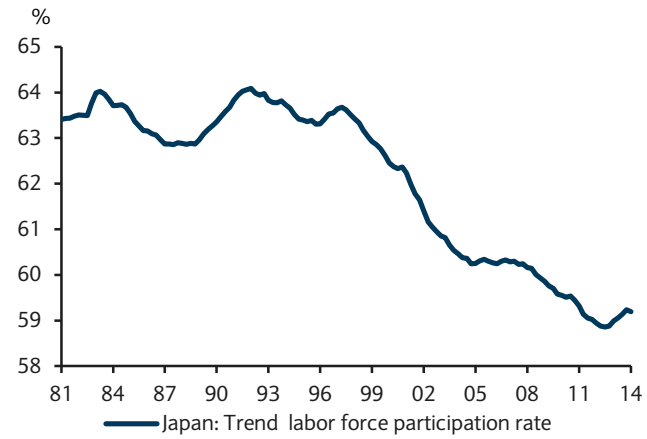
…but attachment was low and the downturn sent structural unemployment higher



Source: Barclays Research

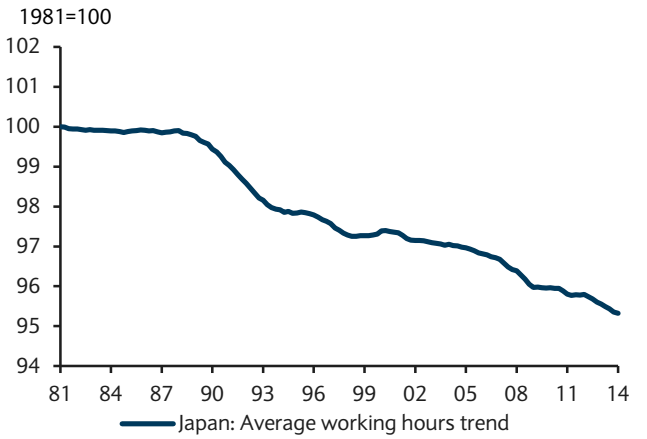
[17] See López-García, P., Puente, S. and A. L. Gómez, 2007, "Firm Productivity Dynamics in Spain," Documento de trabajo No. 0739 (Madrid: Bank of Spain).
[18] See *Spain: Selected Issues*, IMF Country Report No. 14/193, July 2014.
[19] See *Italy: Selected Issues*, IMF Country Report No. 12/168, July 2012.

FIGURE 22
An ageing population sent participation rates lower in Japan…



Source: Barclays Research

FIGURE 23
…and a shift to part-time employment reduced average working hours



Source: Barclays Research

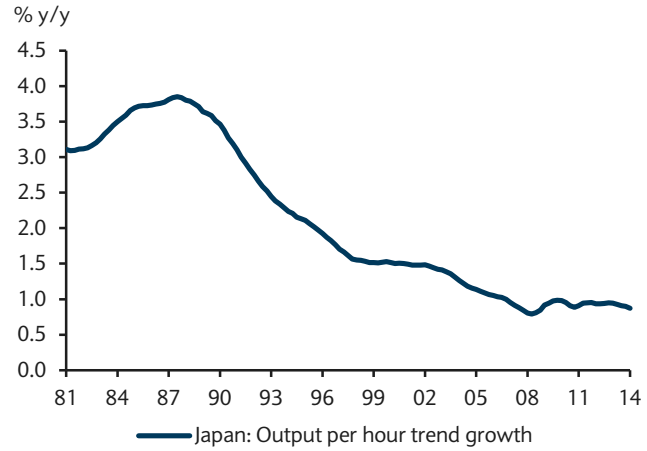
average weekly hours because of the increase in temporary and part-time employment. As in Spain, Italian labor markets exhibit a dual structure, with the core of the labor market more rigid and inflexible and the margins – youth and female employment in Italy – more susceptible in downturns. As a result, we find that structural unemployment moved sharply higher beginning in 2007, more than doubling from 6.0% to 12.7% at present.

Japan: Shaking off the effects of the recession

Demographics in Japan are a clear factor in the slowing in potential GDP

Japan's economic performance has been widely studied and our findings correspond with others, including official sources.[20] We find that potential growth slowed significantly from nearly 4.0% in the 1980s to around 1.0-1.5% heading into the recession. In 1990-99, the slowdown in potential growth came mainly from a reduction in trend hours driven by softer participation (Figure 22) and a trend decline in average working hours (Figure 23). Demographics in Japan are a clear factor in the slowing of potential GDP as the labor force participation rate began to turn sharply lower in the mid-1990s, similar to the behavior of the labor force participation rate in the US after 2000. We find that the trend participation rate fell

FIGURE 24
The recession led to a modest slowing in trend productivity growth in Japan



Source: Barclays Research

FIGURE 25
The trend employment rate in Japan has bounced back to pre-crisis levels

Source: Barclays Research

[20] See "*Measuring potential growth in Japan: Some practical caveats*," Bank of Japan Review, February 2010. For further decomposition of labor markets and the effect of demographics on potential growth in Japan, see "*The new estimates of output gap and potential growth rate*," Bank of Japan Research Review, May 2006. Our findings are also similar to results presented by Ms. Sayuri Shirai, "Japan's economic activity, prices, and monetary policy – relationships between the output gap, prices, and wages," Okinawa, May 29, 2014.

from 63.5% in the mid-1990s to 60.5% heading into the recession, roughly in line with official Bank of Japan estimates. At the same time, Japan underwent a shift toward part-time employment, as have most developed countries in recent decades. We view demographics, the transition to a more service-based economy, and a decelerating trend in average weekly hours as explaining most of the fall in potential growth heading into the recession.

Following the recession, potential GDP growth slowed further as productivity growth fell to below 1.0%. Like many of the countries in our developed market sample, capital accumulation slowed during the recession and trend employment and participation declined for a relatively brief period between 2007 and 2009. Since then, however, we find that the trend employment rate has rebounded to pre-crisis levels (Figure 25) and, in the process, reversed the rise in NAIRU. We also find that the trend participation rate has ticked higher since late 2012. Our multivariate framework estimates structural unemployment at only 4.0%, down from a peak of 5.8% in 2009. Altogether, while we estimate that potential growth has averaged only 0.4% between 2010 and Q1 2014, there is evidence in recent years that the Japanese economy is shaking off some of the adverse effects of the recession on employment and hours, and we do not find evidence that the recession has severely affected trend productivity growth.

The growth slowdown: How large and how permanent?

The results in the previous section tell a clear story. First, potential growth in many developed economies was already slowing before the recession as workforces aged, the boost to productivity from the technology revolution faded, economies slowly transitioned away from manufacturing toward less-productive services as competitiveness worsened, and trends toward part-time work and more flexible working arrangements weighed on hours. Second, the recession has had a notable effect on potential growth in some developed economies by damaging construction and finance-related activities, distorting the efficient allocation of capital, suppressing rates of capital accumulation, and boosting structural unemployment, among other factors.

The accounting: A significant drag on global growth

The seven developed economies in our sample comprise 43% of world GDP based on purchasing power parity (PPP) weights from the IMF. Using the changes in our estimates of potential growth between 1990-99 and 2010-Q1 2014 in Figure 5, we find that potential growth in these developed economies fell by 1.5pp. Given their PPP weights, the slowing in developed economy growth subtracts about 0.7pp from potential global output growth.[21] This amount of slowing is significant given IMF estimates that real global growth has averaged 3.7% annually from 1990 to 2007.

Our finding that slower growth in developed economies could slow global growth by 0.7pp is of similar magnitude to the effect that a slowing China has on global growth

To put this number further into perspective, our finding that slower growth in developed economies could slow global growth by 0.7pp is of similar magnitude to the effect that a slowing China has on global growth. China, which accounts for 18.6% of world GDP on a PPP basis, is expected to see its potential GDP growth slow from about 9-10% in the 1990s to about 6.0% in the coming 5-10-year period as the country transitions from its previous investment-led growth strategy to a consumption-led economy. If realized, the slowing in China's potential growth would lower the growth rate of potential global GDP by 0.6-0.7pp. The developed economies in our sample plus China account for nearly 62% of world GDP on a PPP-adjusted basis; slower potential growth in developed economies and a decelerating Chinese economy constitute a significant drag on global growth. Taken together, the two forces may slow potential global growth by 1.5pp.

[21] This implies that potential growth across the countries in our sample slowed by about 1.5pp. The five-year centered moving average IMF purchasing power parity adjusted weights in 2014 were: US: 22.3%, Japan: 6.1%, Germany: 4.2%, UK: 3.2%, France: 3.0%, Italy: 2.4%, and Spain: 1.8%. To estimate the effect on global potential, we multiply these weights by the 1990-99 estimate for potential growth in each economy less the 2010-14 period. We then sum across countries to yield the full estimate.

Approximately two-thirds of the slowdown in potential growth occurred after 2007

We compute the change in our estimate of potential growth between 1990-99 and Q4 2007 to form an estimate for the fraction of the slowdown attributable to the recession. Taking Q4 2007 as the cut-off date, we estimate that the pre-recession slowing in potential developed economy output was about 0.5pp, or one-third of the total decline over the full sample period. This represents about a 0.2pp drag on global growth based on relative PPP weights. Consequently, about two-thirds of the decline in developed market potential output growth came after the onset of the recession. Although it is difficult to fully isolate the effect of the recession on trend growth from the slowing already in place prior to the recession, we present these results as a useful starting point.

The destruction of output need not be permanent

Our accounting of the slowdown in developed economy growth is somewhat mechanical since it uses the change in our estimates of potential growth and weights these changes based on the relative size of each economy. The new lower trend growth in hours and productivity, however, may not be permanent. Just as actual growth deviates from potential growth, creating a business cycle, economic shocks and reforms to the structure of the economy may also affect the trend itself. Therefore, any forward-looking assessment of developed economy growth prospects must also account for the efforts of policymakers to reverse any negative effects of the recession.

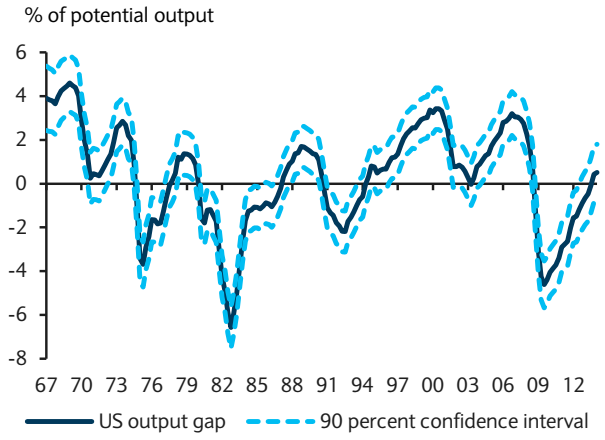
To combat the effects of the downturn, policymakers must respond along two lines: implementation of robust countercyclical monetary and fiscal policy and structural reforms to improve the efficient reallocation of capital and labor. Countercyclical policy is needed to prevent cyclical disturbances from becoming more long-lasting (eg, hysteresis from long-term unemployment to structural unemployment), while also giving structural reforms time to take effect. Here we briefly examine some of the policy actions that have been undertaken and that may mitigate the slowing in potential developed economy growth, with the understanding that a comprehensive account is beyond the scope of this paper.[22]

Countercyclical policies work when the underlying economy is dynamic

The monetary policy response was unprecedented

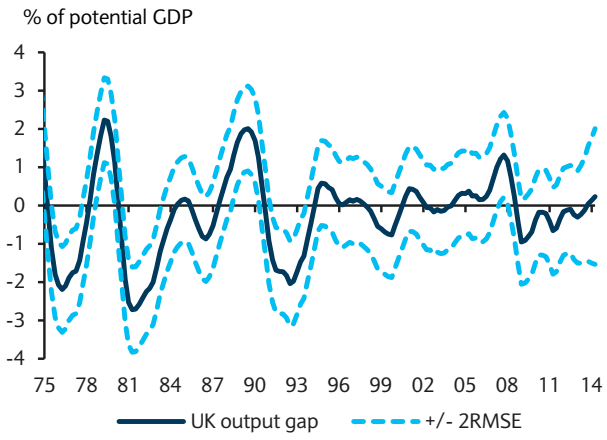
All the countries in our developed economy sample implemented countercyclical policies, although these were mainly implemented through conventional and unconventional easing of monetary policy.[23] Advanced economy central banks responded to the crisis by lowering target interest rates to zero (or below), providing abundant liquidity to traditional and non-traditional counterparties at various maturities, and initiating asset purchase programs in an

FIGURE 26
US output gap



Source: Barclays Research

FIGURE 27
UK output gap



Source: Barclays Research

[22] In addition, structural reforms intended to boost long-run potential growth often make near-term outcomes worse. The example of Germany following labor market reforms of 2002-05 illustrates how labor market outcomes initially deteriorated before later improving. Any full assessment of structural reforms must include the netting of short-term losses against long-term improvement.

[23] For a more complete listing of the policy response by global central banks to the recession, see "*Global themes: A quantum shift in central bank communication*," 12 September 2013.

effort to lower interest rate term premia on safe assets and risk premiums on risky assets. Following the ECB's most recent announcement in late January that it would launch outright QE that included government bonds, every central bank in our sample has now engaged all three of these policy tools to a significant degree. In addition, the extensive use of unconventional policy tools required central banks to enhance their communication efforts to achieve greater transmission of monetary policy into the real economy.

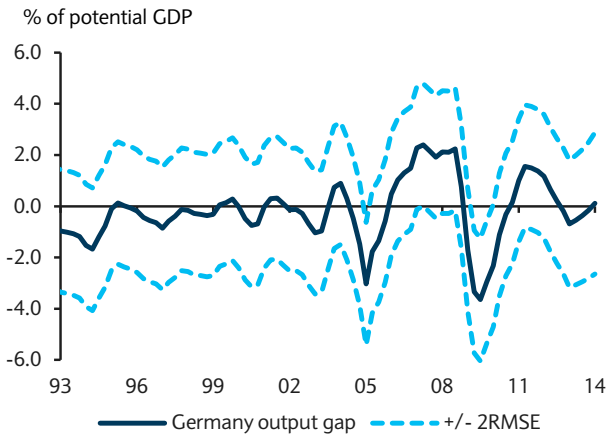
Accommodative fiscal policies were more modest in scope and ultimately reversed

Expansionary fiscal policy was used to a much lesser degree, particularly in Europe, where the rules of monetary union prohibit significant swings in the budget balance and fears over debt sustainability were more pronounced. Fiscal policy in the UK was countercyclical during 2008-09, but policy reversed course sharply in 2010 on concerns about deficits and the sustainability of government debt.[24] Expansionary fiscal policy was used early on in the recovery in the US, but the size of the effort was relatively modest and ultimately reversed through sequestration and the expiration of some upper income tax rate cuts. In Japan, the "first arrow" of Abenomics consisted of a large fiscal stimulus bill, which policymakers described as part of an offensive strategy to boost growth. That said, the policy framework also used an increase in the consumption tax as part of a defensive strategy to preserve the medium-term sustainability of the budget. Altogether, countercyclical policies in advanced economics were generally small and front-loaded, and were either reversed or offset by other actions in later years. In our view, the lack of coordination between fiscal and monetary policy has limited the ability of policy to mitigate the effects of the recession on potential output.

Economic shocks will be transmitted to trend variables more quickly in economies that are less dynamic and inflexible

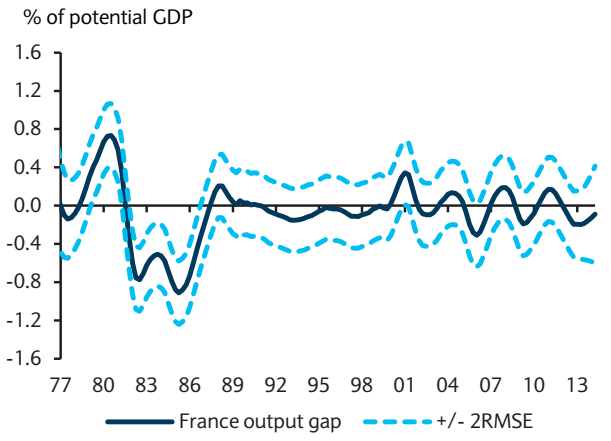
Whether countercyclical policies are effective at facilitating the reallocation of labor and capital across different sectors of the economy, improving the efficiency of matching available jobs and properly skilled workers. and limiting the rise in structural unemployment depends, in part, on how responsive the underlying economy is to the incentives created by accommodative policies. In the context of our analysis, economies that are more dynamic and flexible will be better able to absorb shocks and, as a result, will likely exhibit greater cyclical amplitudes and stable trends. In other words, recessions and shocks cause the economy to deviate from potential in the short run, but the rate of potential growth is generally undisturbed over the long run. In contrast, economic shocks will be transmitted to trend variables more quickly in economies that are less dynamic and inflexible. These economies will have smaller business cycles and more volatile trend variables.

FIGURE 28
Germany ouput gap



Source: Barclays Research

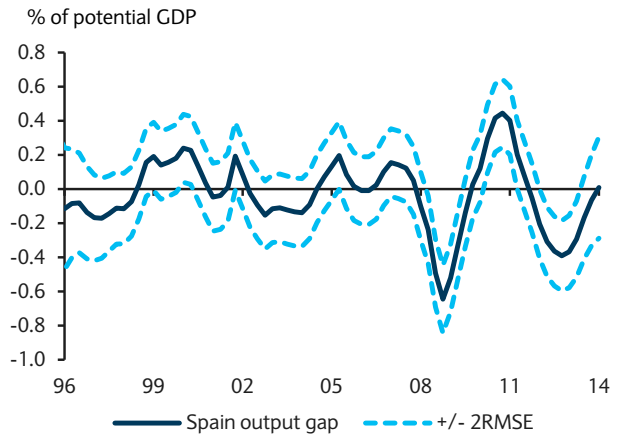
FIGURE 29
France output gap



Source: Barclays Research

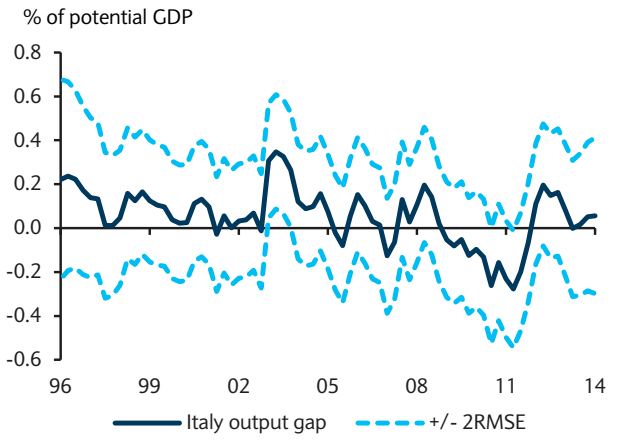
[24] The fiscal tightening in the UK was later paused due to concerns that it was choking off the recovery.

FIGURE 30
Spain output gap



Source: Barclays Research

FIGURE 31
Italy output gap



Source: Barclays Research

In Figures 27-31, we present the estimates of the output gaps for six of the seven developed economies in our sample. We find that the amplitude of the business cycle in the US, UK, and Germany is larger than in France, Spain, and Italy, including in the most recent recession.[25] One interpretation of these results is that the recession was characterized by large reductions in aggregate demand and smaller reductions in productive potential in the US, UK, and Germany. When applied to the other three economies, the model estimates could be interpreted as suggesting either the large cyclical shortfall in aggregate demand was quickly transmitted to trend variables and lower potential output, or the shock itself was a supply-side disturbance that could be immune to countercyclical policies.

The results have significant implications for the ability of policy to mitigate a recession-related decline in potential GDP. Conventional countercyclical monetary and fiscal policies are likely to be more effective in the US, UK, and Germany if they are successful in quickly reversing the decline in aggregate demand. Dynamic economies with more flexible labor and product markets are likely to be more responsive to activist policies. This argument has been made explicitly by the Federal Reserve to justify its aggressive policy stance as a way to limit the amount of supply side-damage that occurred initially following the downturn, and potentially to help reverse a portion of the damage at a later stage.[26] That the output gaps in these three economies have closed suggests policy has had success in reversing the shortfall in aggregate demand and ameliorating some of the damage done to long-term productive potential.

Structural reform is needed when factor markets are inflexible

Structural reform is essential to mitigate any damage done to long-term productive potential

In the remaining economies, including Japan, where the model estimates indicate a more rapid transmission of the economic downturn into trend variables, the results validate the emphasis on appropriate structural reforms to complement countercyclical policy. If successful, these policies would reduce structural unemployment, raise participation rates to boost the size of the labor force, increase hours, encourage capital accumulation, rebalance capital and labor to more efficient uses, and boost productivity. Significant reform agendas are already under way in several countries, including:

[25] Our findings for the size of the output gap in the US, UK, and Germany are similar to those of the Federal Reserve, IMF, and OECD. However, the European Commission, IMF, OECD, ECB, our Barclays European economics research team, and others find wider output gaps in France, Italy, and particularly Spain, where other studies find output gaps as large as 6% during the boom and -4% thereafter (see Borio, C., P. Disyatat, and M. Juselius, "Rethinking potential output: Embedded information about the financial cycle, BIS Working Papers No. 404, 2013. The differences may be methodological in that traditional HP filters, bandpass filters, and other similar techniques used to estimate potential growth often assume a smooth trend, whereas the multivariate approach we apply in this chapter does not. We offer interpretations for what our findings could imply without seeking to validate one estimation approach over another.

[26] See "*Aggregate supply in the United States: Recent developments and implications for the conduct of monetary policy*," David Reifschneider, William Wascher, and David Wilcox, Finance and Economics Discussion Series 2013-77, 2013.

- **Spain.** A series of structural reforms has been implemented with the goal of strengthening the financial system, increasing the efficiency of public services, improving competitiveness, and lowering regulatory barriers, among others.[27] A highly fragmented labor market remains an issue, as does low productivity.
- **Italy.** Reforms to liberalize product markets and improve competitiveness began in 2011 and 2012 in energy, transportation, professional services, and public services.[28] Current reform proposals are aimed at making labor markets more flexible. As in Spain, a dual labor market structure remains an obstacle.
- **France.** In 2013, France passed a labor reform law intended to improve mobility, allow for more flexibility to adjust pay and hours in response to changes in the business cycle, and streamline the dismissal procedure. In addition, pension reform is anticipated to raise labor force participation rates over the long run. If realized, it would help offset a less favorable demographic environment where growth in the labor force is expected to slow to 0.2% per year between 2021-2030.
- **Japan.** Reforms comprise the tri-arrow policies of aggressive monetary easing (1st arrow), expansionary fiscal policies (2nd arrow), and structural reforms (3rd arrow), with the last including efforts at electricity sector reform, governance and investment reforms at the Government Pension Investment Fund, coordinated wage setting, and other changes to increase participation and reduce fragmentation in labor markets.

Although structural reforms hold much promise…

Efforts on the structural reform front are bearing fruit, particularly in Spain, where real output grew for five consecutive quarters through Q3 2014 and the unemployment rate has fallen 2.5% from its peak. Despite this progress, the legacy of the recession persists, with the unemployment rate at 23.7% and approximately 3.5m persons (15% of the labor force) unemployed for over a year. Even under a decidedly optimistic scenario of productivity growing at twice its pre-crisis rate and NAIRU falling to 14% by 2019, the IMF finds that the unemployment rate would still be 16.0%.[29] Turning to Italy, IMF staff estimate that a simultaneous implementation of product and labor market reforms would lift potential growth by about 0.8-9pp annually relative to baseline assumptions, recovering about half of our estimate of the decline in Italy's potential growth since 1994-1999. Finally, IMF staff estimate that potential growth in France could rise by 0.7pp if appropriate structural reforms are enacted.

… we do not see them as fully reversing the growth slowdown…

In Japan, the first and second arrows have supported economic activity and inflation, but progress on the third arrow has been slower. IMF staff estimate that potential growth is likely to remain below 1.0% through 2017. Against our estimate of potential output growth of 0.4pp per year between 2010 and Q1 2014, IMF estimates imply that full adoption of third arrow policies may improve trend growth by 0.5-0.6pp on a 5-10-year horizon.

…and view potential growth in the developed world as slowing substantially in the years ahead

In sum, the amount of policy accommodation and structural reforms implemented to counter the effects of the recession are unprecedented in both size and scope. We believe these policies were effective in limiting the initial declines in economic activity and distortions to capital and labor. As a result, our 1.5pp estimate of the decline in potential developed economy growth and 0.7pp decline in global growth already capture some of the effectiveness of policy in ameliorating the destruction of output from the recession; a true counterfactual is not available. Reversing more of the decline in trend growth remains a possibility, but estimates from official sources suggest that it is unlikely to be fully reversed and further progress toward this end is dependent on structural reforms, many of which are contentious. Even if successful – and history suggests these efforts often fall short – their benefit will be realized only gradually over time. As a result, we retain our view that potential growth in developed economies has slowed substantially.

[27] See *Spain: Article IV Consultation*, IMF Country Report No. 14/192, July 2014.
[28] See *Italy: Selected Issues*, IMF Country Report No. 12/168, July 2012.
[29] See *Spain: Selected Issues*, IMF Country Report No. 14/193, July 2014.

Appendix: Business cycle framework

Potential output and the output gap are key variables in the setting of monetary and fiscal policy and serve as anchors to economic models. However, they are unobservable and statistical methods are needed to break down movements in observable variables into trend growth and the business cycle. The framework applied in this analysis constructs estimates of potential output and the output gap using a multivariate approach; inputs on working hours, output, employment, unemployment, and the labor force are used in a multivariate framework to generate a decomposition of potential output growth into its components.[30]

There are several advantages to a multivariate approach. Academic research has shown that it improves the accuracy of cycle estimates and using a single system means the framework uniformly accounts for trade-offs between alternative signals.[31] Each measure of economic activity and labor markets is represented as the sum of cyclical and trend components, with an idiosyncratic residual. The cyclical component (cyc) is assumed to be common across all the inputs with contemporaneous and lagged effects, while each variable is permitted to have its own unique trend. In addition, the data availability in the US allows for the use of both product- and income-side measures to improve the accuracy of trend and cycle estimates. For non-US countries, a smaller set of data is used.

The US multivariate framework

The US framework includes the following variables: real gross domestic product (GDP), real gross domestic income (GDI), real nonfarm business output (NFBP), real nonfarm business income (NFBI), nonfarm business employment (ENFB), the work week (WW), the labor force participation rate (LR), the employment rate (ER), and core CPI inflation (CPI). The use of variables from both the product side and income side should improve our ability to estimate the common cycle. All variables are in log terms and the civilian working-age population is subtracted from real gross domestic product, real gross domestic income, real nonfarm business output, real nonfarm business income, and nonfarm business employment.

The GDP, GDI, NFBP, and NFBI equations are given by

$$GDP_t = GDO_t^* + cyc_t + u_{it}$$

$$GDI_t = GDO_t^* + cyc_t + u_{2t}$$

$$NFBP_t = NFBO_t^* + \gamma_{10} cyc_t + u_{3t}$$

$$NFBI_t = NFBO_t^* + \gamma_{10} cyc_t + u_{4t}$$

where GDO* represents the common trend component of GDP and GDI (eg. potential output) and NFBO* the common trend between NFBP and NFBI.[32,33] The framework assumes the residuals are measurement errors which can be decomposed into a sum of a common component and idiosyncratic components.

[30] Our approach follows Charles Fleischman and John M. Roberts, 2011, "From many series, one cycle: Improved estimates of the business cycle from a multivariate unobserved components model," *Finance and Economics Discussion Series* 2011-46; and Jun Ma and Mark Wohar, "An unobserved components model that yields business and medium run cycles," August 2012.

[31] Arabinda Basistha and Richard Startz, 2008, "Measuring the NAIRU with reduced uncertainty: A multiple-indicator common-cycle approach," *Review of Economics and Statistics*, 90, 805-11. Also see James H. Stock and Mark W. Watson, 1989, "New indices of coincident and leading economic indicators," *NBER Macroeconomics Annual 1989*, Oliver Blanchard and Stanley Fischer, eds., 351-394.

[32] The cycle is assumed to be a stationary AR(2) process equal to $cyc_t = \rho_1 cyc_{t-1} + \rho_2 cyc_{t-2} + \omega_t$.Typically $\rho_1 > 0$ and $\rho_2 < 0$ which implies the cycle is hump-shaped in response to a shock. The sum of the coefficients is assumed to be close to 1, but less than 1, meaning the business cycle is persistent.

[33] Since NFBO is not the same as GDO (since it exclude the farm and public sectors), γ=1 cannot be assumed for a contemporaneous, normalized cycle. We estimate $\gamma = \gamma_{10}$ and assume it is the same across both variables with the prior that nonfarm business output likely has larger amplitude than GDO since the latter includes the public sector.

Potential output and nonfarm business output can be further broken down into

$$GDO_t^* = NFBO_t^* + OSR_t^*$$

$$NFBO_t^* = HNFB_t^* + OPH_t^*$$

$$HNFB_t^* = ENFB_t^* + WW_t^*$$

$$ENFB_t^* = ECPS_t^* + ESR_t^*$$

$$ECPS_t^* = ER_t^* + LP_t^*$$

where OSR* is the output sector ratio between gross domestic output and nonfarm business output, HNFB* is the trend of total working hours, OPH* is the trend of output per hour or productivity, ENFB* is the trend in total employment, WW* is the trend of average working hours, ER* is the employment rate, and LP* is the labor force participation rate. ECPS* is the trend in employment from the current population survey and ESR* is the employment sector ratio between total employment and the current population survey.

The observed data on employment, the work week, the employment rate, and participation are broken down into the sum of a trend and cyclical components

$$ENFB_t = ENFB_t^* + \gamma_{20} cyc_t + \gamma_{21} cyc_{t-1} + \gamma_{22} cyc_{t-2} + u_{5t}$$

$$WW_t = WW_t^* + \gamma_{30} cyc_t + \gamma_{31} cyc_{t-1} + \gamma_{32} cyc_{t-2} + u_{6t}$$

$$ER_t = ER_t^* + \alpha EEB_t + \gamma_{40} cyc_t + \gamma_{41} cyc_{t-1} + \gamma_{42} cyc_{t-2} + u_{7t}$$

$$LP_t = LP_t^* - \alpha EEB_t + \gamma_{50} cyc_t + \gamma_{51} cyc_{t-1} + \gamma_{52} cyc_{t-2} + u_{8t}$$

where the framework allows for some deviation between shocks to output and the response of employment hours and labor force participation. The rationale for this specification would include adjustment costs; whereby firms find it costly to adjust the factors of production so that changes in labor market activity may lag changes in output.[34] The introduction of state emergency and extended benefits (EEB) following the rise in long-term unemployment during the crisis is allowed to influence employment and participation, but not the cycle.[35]

Finally, the Phillips curve is given by

$$DCPIX_t = A(L)DCPIX_{t-1} + \beta_{11}(L)drpe_{t-1} + \beta_{12}(L)d85_t drpe_{t-1} + \beta_2(L)drpi_t$$
$$+\theta(ER_t - [ER_t^* + \alpha EEB_t + u_{1t}]) + u_{9t}$$

where DCPIX is core CPI inflation, drpe is the relative change in consumer energy prices, drpi is the change in the relative price of imports, d85 is a dummy from 1985 to the present to account for rising share of the import ratio in consumer spending, and (L) represents lagged values.[36] The inflation equation also assumes that cyclical deviations in output from its trend affect inflation and the employment rate gap is adjusted to account for extended and emergency unemployment benefits.

[34] As referenced in Fleischman and Roberts (2011), previous research suggests the unemployment rate, and therefore the employment rate, should be a lagged indicator of the business cycle whereas employment is considered a contemporaneous variable. These results could be imposed as explicit model assumptions, but we choose to let the data show whether this is the case.

[35] Like Fleischman and Roberts (2011), we measure EEB as the ratio of total quarterly payments of federal and state emergency and extended benefits programs to the four-quarter moving average of total private wages and salaries.

[36] We use ten lags of core CPI and six lags on the relative price of energy. We constrain the sum of the coefficients on lagged inflation to be equal to one and, in doing so, impose a unit root process to pin down the trend inflation rate.

The eight equations can be summarized in the following measurement equation:

$$\begin{bmatrix} GDP_t \\ NFBP_t \\ NFBI_t \\ ENFB_t \\ WW_t \\ ER_t \\ LR_t \\ DCPIX_t \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} OPH_t^* \\ WW_t^* \\ ER_t^* \\ LR_t^* \\ OSR_t^* \\ ESR_t^* \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 \\ \gamma_{10} & 0 & 0 \\ \gamma_{10} & 0 & 0 \\ \gamma_{20} & \gamma_{21} & \gamma_{22} \\ \gamma_{30} & \gamma_{31} & \gamma_{32} \\ \gamma_{40} & \gamma_{41} & \gamma_{42} \\ \gamma_{50} & \gamma_{51} & \gamma_{52} \\ \theta\gamma_{40} & \theta\gamma_{41} & \theta\gamma_{42} \end{bmatrix} \begin{bmatrix} cyc_t \\ cyc_{t-1} \\ cyc_{t-2} \end{bmatrix} +$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ \alpha & 0 & 0 & 0 & 0 \\ -\alpha & 0 & 0 & 0 & 0 \\ 0 & A(L) & \beta_{11}(L) & \beta_{12}(L) & \beta_2(L) \end{bmatrix} \begin{bmatrix} EEB_t \\ DCPIX_{t-1} \\ drpe_{t-1} \\ d85_t drpe_t \\ drpi_t \end{bmatrix} + \begin{bmatrix} 1 & \sigma & \sigma & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ v_{3t} \\ v_{4t} \\ u_{5t} \\ u_{6t} \\ u_{7t} \\ u_{8t} \\ u_{9t} \end{bmatrix}$$

The US model is estimated using quarterly data from 1963 Q1-Q1 2014 using maximum likelihood techniques in the state-space model estimation framework in Eviews, which uses the Kalman filter to estimate model coefficients while using numerical methods to ensure fitted values are close to observed data.

Multivariate framework: Non-US developing countries

For the UK, France, Germany, Italy, Spain, and Japan, a smaller multivariate framework is used given the generally smaller set of available data with sufficient history. The GDP and GDI equations are given by

$$GDP_t = GDO_t^* + cyc_t + u_{it}$$

$$GDI_t = GDO_t^* + cyc_t + u_{2t}$$

Where GDO* is potential output and cyc is the output gap. As before, the measurement errors can be decomposed into the sum of a common component and idiosyncratic components.

Potential output is further decomposed into

$$GDO_t^* = HGD_t^* + OPH_t^*$$

$$HGD_t^* = EGD_t^* + WW_t^*$$

$$EGD_t^* = ER_t^* + LP_t^*$$

Where HGD* is the trend of total working hours for the economy, OPH* is the trend in output per hour (eg, productivity), EGD* is the trend of total employment, WW*, is the trend of average working hours, ER* is the trend employment rate, and LP* is the trend labor force participation rate.

The observed data on the work week, the employment rate, and participation are decomposed into the sum of a trend and cyclical components

$$WW_t = WW_t^* + \gamma_{10} cyc_t + \gamma_{11} cyc_{t-1} + \gamma_{12} cyc_{t-2} + u_{3t}$$

$$ER_t = ER_t^* + \gamma_{20} cyc_t + \gamma_{21} cyc_{t-1} + \gamma_{22} cyc_{t-2} + u_{4t}$$

$$LP_t = LP_t^* + \gamma_{30} cyc_t + \gamma_{31} cyc_{t-1} + \gamma_{32} cyc_{t-2} + u_{5t}$$

and the cycle is assumed to be a stationary auto-regressive process.[37] Finally, the Phillips curve is for non-US developed economies is given by

$$DCPIX_t = A(L)DCPIX_{t-1} + \theta(\gamma_{20}cyc_t + \gamma_{21}cyc_{t-1} + \gamma_{22}cyc_{t-2}) + u_{6t}$$

which has a similar interpretation to the US specification in that it is assumed that cyclical deviations in output are allowed to affect inflation, creating a natural rate interpretation.

The six equations can be represented in the following measurement equation

$$\begin{bmatrix} GDP_t \\ GDI_t \\ WW_t \\ ER_t \\ LP_t \\ DCPIX_t \end{bmatrix} + \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & \gamma_{10} & \gamma_{11} & \gamma_{12} & 0 & 0 \\ 0 & 0 & 1 & 0 & \gamma_{20} & \gamma_{21} & \gamma_{22} & 0 & 0 \\ 0 & 0 & 0 & 1 & \gamma_{20} & \gamma_{31} & \gamma_{32} & 0 & 0 \\ 0 & 0 & 0 & 0 & \theta\gamma_{20} & \theta\gamma_{21} & \theta\gamma_{22} & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ A(L) \end{bmatrix} DCPIX_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{1t} \\ u_{3t} \\ u_{4t} \\ u_{5t} \\ u_{6t} \end{bmatrix}$$

The models are estimated using quarterly data for the UK (1975 Q1-Q1 2014), France (1975 Q1-Q1 2014), Germany (1973 Q1–Q1 2014), Italy (1993 Q1-Q1 2014), Spain (1996 Q1-Q1 2014), and Japan (1981 Q1-Q1 2014), using maximum likelihood techniques in the state-space model estimation framework in Eviews.

[37] The cycle is assumed to be a stationary AR(2) process equal to $cyc_t = \rho_1 cyc_{t-1} + \rho_2 cyc_{t-2} + \omega_t$.Typically $\rho_1 > 0$ and $\rho_2 < 0$ which implies the cycle is hump-shaped in response to a shock. The sum of the coefficients is assumed to be close to 1, but less than 1, meaning the business cycle is persistent.

CHAPTER 5

The decline in financial market liquidity

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- **Banking regulation has intensified since the financial and sovereign crises in a global effort to improve the safety and stability of the financial system. Regulators have forced banks to change their capital structures and their business models to enhance the safety of the banking system and make future financial crises less likely.**
- **These new regulations have materially improved the stability of the financial system. However, in an effort to reduce the risk of future fire-sales financed by short-term debt, they have also reduced the supply of safe, short-term, liquid assets such as repurchase agreements, causing them to trade at lower yields (and, by extension, higher prices).**
- **The reduction in the supply of short-dated safe assets and associated fall in the liquidity of fixed income markets has created incentives for investors to look to non-traditional sources of liquidity, such as ETFs and mutual funds. In turn, this may result in a transfer of fire-sale risk into assets such as leveraged loans and investment grade and high yield bonds, as liquidity in the underlying investments of these funds deteriorates, exposing end-investors to run risk.**

A changing landscape

Before the crisis that erupted in 2007, many banks operated with too little equity and were overly reliant on short-term wholesale financing, such as "repo", or repurchase agreements, to fund illiquid investments. When the crisis began, these banks did not have the capacity to absorb losses, given their limited capital base. Regulators have addressed this by forcing all banks to significantly increase their capital ratios, which are now higher than at any time since World War II. Excessive reliance on short-term financing exposed some banks to destabilizing runs when investors pulled their financing as the crisis began to mount, contributing to failures. More important from a systemic point of view, this precipitated the fire-sale of assets financed by short-term debt, driving down the prices of specific assets. This contributed to system-wide funding issues, even for banks with relatively strong balance sheets. To reduce the risk of future fire-sales, several of the new initiatives have targeted repo and other short-term liabilities, resulting in a more than 50% reduction in repo balances relative to their peak. In particular, the Volcker Rule was introduced to address illiquid and riskier investments that had burgeoned in the banking sector before the crisis.

The best evidence of the effect of new regulations probably comes from the credit market, where the spreads of bonds issued by the largest banks have narrowed significantly

Whether these steps will be sufficient to curb future crises remains an open question. But it is clear that the new regulatory environment has materially improved the stability of the system. The best evidence of the effect of new regulations on banks probably comes from the credit market, where the spreads of bonds issued by the largest banks have narrowed significantly and, in many cases, are now tighter than industrial spreads. In other words, bond investors believe bank safety has improved so much that they are once again willing to accept low spreads for bank risk[1].

Less well understood are the broader effects of improved stability on investors and the economy. Last year, we wrote that decreased bank lending was one potential implication (see *The cost of evolving bank regulation*, 13 February 2014). This year, we focus on the implications of two separate, but related, changes in financial markets.

[1] This argument is bolstered by the fact that banks arguably benefited from implicit government support (ie, bail-outs in the event of a disruption) pre-crisis, causing their credit spreads to be artificially low. Subsequent changes to regulation have likely reduced or eliminated the extent to which banks will benefit from bail-outs in any future crisis, which would bias bank spreads wider absent the improvements in credit quality that we cite.

- **The reduced size of the repo market.** This large, but relatively esoteric, part of the financial market is used by hedge funds and banks to finance securities and by money market funds to invest cash.
- **The fall in liquidity in fixed income markets, demonstrated by a decrease in turnover and an increase in bid-offer spreads.** This is related to the changes in repo, which is an important financing tool for banks' market-making operations, but is also driven by other changes that have made banks less willing to warehouse risk on behalf of investors.

These changes have important consequences for financial market participants, including hedge funds and insurance companies, which are having a harder time financing securities and positioning their portfolios and are paying higher transaction costs. Retail investors are also paying higher transaction costs in their mutual funds, and there is evidence that poor liquidity is affecting the behavior of active managers. However, these seem like relatively small prices to pay for a material decrease in the likelihood and magnitude of future financial crises.

The decline in repo has reduced the supply of safe, short-term assets…

We believe there are two broader implications that are more likely to be disruptive, particularly once (if) interest rates begin rising. First, the decline in repo has reduced the supply of safe, short-term assets. Relatively few assets fit this description: Treasury bills, bank deposits, and repo. The reduction in repo is happening as Treasury bill supply is shrinking and banks are less willing recipients of deposits, given lackluster loan demand. As overall supply of such assets declines, we believe investor demand for them is relatively inelastic and a function of financial wealth, which has been rising. We expect excess demand for short-dated safe assets to cause them to trade at lower yields (ie, higher prices), even as and when interest rates begin to normalize. This applies to deposit rates, which we believe will lag any rate hikes, such as we expect in the US later this year, as investors remain willing to accept low interest rates to maintain a base of liquid assets. Similarly, money market funds may need to accept lower rates to remain invested.

…creating incentives for investors to look to non-traditional sources of liquidity

Second, reducing the supply of these safe, short-dated assets creates incentives for investors to look to non-traditional sources of liquidity. Migration to seemingly liquid alternatives has happened before: in the pre-crisis period, safe short-dated assets were in limited supply (relative to financial wealth) because of the tremendous run-up in equity prices. The result was a massive spike in CP, repo on structured assets such as ABS and CDOs, and auction rate securities, all of which purported to offer the daily liquidity investors were seeking. But this liquidity dried up once the crisis began.

For various reasons, the same alternatives will not be chosen this time around: the changes in regulations, investors' collective experiences with those investments, and the simple fact that many of them no longer exist. However, there have been increased flows in other vehicles that offer daily liquidity, such as ETFs and mutual funds. The desire for liquidity may also be limiting demand for closed-end fixed income funds, which would seem a natural response to the decline in fixed income liquidity.

The inflows into ETFs and mutual funds are happening just as liquidity in the underlying investments that these funds purchase is deteriorating. This has raised new concerns about "retail runs" and fire-sale risks in such assets as leveraged loans and investment grade and high yield bonds, where either liquidity has dropped most severely and/or where the funds offering daily liquidity have grown the most. Ironically, these new fire-sale risks have arisen in part because the risks of a repo-driven fire-sale have fallen. The well intentioned and arguably successful efforts to make the banking system more robust and less susceptible to runs have transferred fire-sale risk out of the banking system and into the hands of end-investors.

Repo 101

A repurchase transaction (repo) is effectively a collateralized short-term (often overnight) loan. For example, an investor looking to borrow money pledges a security (eg, a Treasury) as collateral, and receives cash. The next day, the investor pays back the cash plus interest,

and receives his or her collateral back in return. A "reverse repo" is the same transaction but viewed through the lens of the lender.

Repurchase transactions have several important aspects. First, although much of the repo market is overnight, "term" repo, which can be measured in weeks or even months, is also possible. The structure is the same, but the collateral is not returned (and the loan paid off) until the end of the term. The second aspect is the interest rate of the transaction, which depends on the term and the specific collateral involved. For various reasons, some collateral may be specifically desirable to lenders and thus command lower interest rates. The final key dimension is the "haircut" – which defines just how much cash the borrower gets for the collateral. This is quoted in terms of a percentage of market value. Higher-quality collateral, such as Treasuries or agency debt, typically requires the lowest haircuts, eg, 2%. This means that it is possible to borrow $98 for every $100 of Treasuries that the borrower pledges as collateral. Lower-quality collateral (eg, corporate bonds) typically requires higher haircuts.

Banks engage in repo transactions for two related reasons. First, repos match cash-rich investors (such as money market funds) with investors (such as hedge funds) who own securities but need financing. This is done via a "matched book" – banks engage in reverse repo transactions with hedge funds, lending them money collateralized by securities. Banks then borrow from money market funds via repo transactions, collateralized by the same securities. The banks effectively act as middlemen, with the cash flowing from the money funds to the hedge funds, and the collateral moving in the opposite direction. The second reason banks engage in repo is to finance their own portfolio of securities, essentially playing the role of the hedge funds in the matched book example above.

Anatomy of a repo run

Although the repo market is large (measured in trillions of dollars; more on this below), it also seems, at first, fairly innocuous. Short-dated, collateralized loans sound safe, particularly relative to equities or the highly structured assets that featured so prominently in the credit crisis. In fact, these are safe investments for lenders. The short-term nature of the transaction means that if any concerns arise, the lender need not sell or unwind the transaction – it is closed out the next day, in the case of overnight repo. In case of default, the lender can sell the collateral and recoup his or her money. It is precisely the safety of repo that makes it an attractive investment for money market funds. They invest in safe, highly liquid short-term assets because their end-investors use these funds as cash substitutes.

The same features that make reverse repo a safe asset *for money funds make repo a risky* liability *for leveraged investors and banks*

However, the same features that make reverse repo a safe *asset* for money funds make repo a risky *liability* for leveraged investors and banks. At the slightest hint of trouble with either the collateral or the borrower, the funding can be withdrawn, which is as simple as not renewing an expiring contract. For example, if the collateral is downgraded, it may become harder to borrow against. Similarly, if the borrower (eg, hedge fund or bank) deteriorates in some way such that money funds or other lenders question its credit quality, borrowers may have a harder time securing funds regardless of the quality of their collateral. Essentially, borrowers reliant on repo need to continually roll over their financing, and are exposed to the risk of a run as a result, similar in concept to a deposit run.

This presents two concerns for regulators. First, banks finance significant securities portfolios via repo, and thus there is risk that an individual bank would need to liquidate assets in response to being locked out of the repo market – a pre-default fire-sale. This is problematic because the highest-quality assets are the easiest to sell – Treasuries, agencies, etc. A bank that was overly reliant on repo financing of lower quality securities and faced a repo run could be forced to sell assets quickly to raise liquidity, potentially driving down their market valuations and leading to asset write-downs that would impair capital, and increase the bank's risk of default or downgrade. It might also need to sell assets or draw down on its cash holdings to meet increases in haircuts on the collateral it is pledging.

Such a run could affect multiple (or even all) banks at once if bank credit quality deteriorated across the board, or if the entire repo market experienced a disruption. This could be caused by a systemic shock leading to a crisis of confidence in the broader financial system. In this scenario, with multiple borrowers trying to liquidate assets, the market could experience a fire-sale – the prices of certain assets could plummet because of a large number of forced sellers trying to liquidate at once. This could be exacerbated by money market funds, which are often legally prohibited from owning the types of collateral underpinning their repo trades and would be forced to sell quickly if their counterparty defaulted and the fund took possession of the collateral. The solvency of an individual bank could deteriorate much faster in this scenario because it would be forced to sell assets at a loss, thereby eroding its capital. In fact, solvency concerns could spread through the financial system.

Academic studies have described this phenomenon as a "funding and liquidity spiral". [2] Asset price shocks in a particular market create funding problems for cash borrowers who pledged the same or similar collateral. Borrowers reduce their positions by selling some of their holdings, while their ability to borrow against their remaining assets shrinks as haircuts increase and the value of these holdings falls in response to selling pressure. This exacerbates the funding problems and forces more de-leveraging and asset fire-sales – the process becomes self-reinforcing.

Lessons from the credit crisis

Concerns about repo runs are not theoretical. The failure of Lehman Brothers serves as a real world case study

Concerns about repo runs are not merely theoretical. Lehman Brothers' failure in September 2008 serves as a real world case study. Lehman's repo book accounted for 34% of total liabilities at 2Q08, a cursory measure of the firm's dependence on short-term funding. During normal times, this was an effective strategy for leveraging returns, but as the firm's crisis reached a climax, repo funding providers suddenly fled. Between September 9, 2008, and September 15, 2008 (the day of its bankruptcy filing), the number of tri-party counterparties providing Lehman Brothers with cash in exchange for securities fell from 63 to 16. Given that Lehman Brothers had used repo to fund a material volume of lower-quality, non-governmental securities – the prices of which had fallen sharply – the firm was left with assets it could no longer fund in overnight markets or sell without destroying capital, eventually contributing to the firm's bankruptcy filing.

Although the Lehman experience is an important, cautionary tale, it also delineates where the true "run risk" lies within the repo market. Interestingly, the financial crisis did not cause a waterfall of repo runs across the rest of the system. Instead, the deterioration in repo markets was more focused.

- **Higher-quality assets were still funded at modest haircuts:** Repo haircuts did rise during the crisis across many asset classes; however, this was generally concentrated in funding for lower-quality ABS structures.[3] Treasuries, agencies, and even investment grade corporate bonds showed modest – if any – increases in margin requirements over this period. For example, a Federal Reserve staff report indicated that U.S. Treasuries and agencies continued to be funded in the repo market throughout this period at haircuts of only 3% or less (ie, 97% loan to value).
- **Evaporation of repo funding was concentrated in lower-quality issuers:** Evidence from the same Federal Reserve study suggests that the repo funding flight was highly idiosyncratic to Lehman Brothers. Certain investors chose to cease providing Lehman with repo funding but nonetheless continued to fund other financial market participants.

[2] See "Market Liquidity and Funding Liquidity", M. Brunnermeier and L. Pedersen, National Bureau of Economic Research working paper, December 2008.
[3] See "Repo Runs: Evidence from the Tri-Party Market", A. Copeland, A. Martin, and M. Walker, Federal Reserve Bank of New York, July 2011.

Overall, this suggests to us that repo is less flight-prone than might be imagined. Funding terms were not markedly increased and were not in themselves the transmission mechanism for forced sales. Furthermore, the markets for higher-quality assets that typically serve as repo collateral were able to absorb the liquidation of Lehman's large Treasury and agencies books, which had been funded by repo. This can be naturally linked to the strong performance of these safe haven assets during times of turbulence, minimizing the risk of needing to take a loss as positions are closed.

However, we must be careful not to draw too much comfort from the experience of the crisis, given the unprecedented intervention in markets by the Federal Reserve and other central banks, which may have helped stem further contagion. The core issues around funding long-term, price-sensitive assets remain – entities using short-term funding (such as repo) need to mark their assets to market and obtain new funding every day. A temporary price decline has the potential to wipe out a firm's margin and force it to sell its assets. This could in turn push asset prices lower, forcing other participants to sell and perpetuating the cycle. We believe that it is this risk – of a waterfall of forced sellers destabilizing the broader system – that regulators are attempting to address via repo-targeted reform.

Regulators have responded with significant changes

Global standards for bank balance sheet size were fairly lax prior to the financial crisis. Basel I and II capital standards were largely based on risk-weighted assets, as opposed to total assets. This facilitated inflated balance sheets and more active proprietary risk taking in trading businesses. Regulators have made a series of changes to the bank regulatory framework to address perceived balance sheet structure and business model risks. These include:

- Volcker Rule
- The introduction of leverage ratios
- SIFI buffers
- Haircuts

Volcker Rule

Banks' trading operations historically served two main purposes: 1) providing liquidity to market participants wanting to buy or sell securities in exchange for a bid-ask spread; and 2) using the bank's balance sheet to generate profit from price movements. Bank regulators grew concerned that proprietary trading positions created undue risks on banks' balance sheets. In response, the Dodd-Frank Act created the Volcker Rule, which prohibits proprietary trading. Among other things, the rule limits banks' ability to take trading positions – capped at demonstrated market demand. In a market where demand from clients, customers or counterparties is expected to diminish, this limits a bank's ability to intermediate the market. Notably, regulators chose to exempt Treasury and municipal securities from these restrictions.

Leverage ratios

Pre-crisis, the most important (and binding) regulatory capital ratios banks needed to meet were based on risk-weighted assets. Safe assets, such as repo, were assigned low risk weights, and thus banks were required to allocate very limited capital to those types of positions. As a result, there were few practical limitations on the size of bank balance sheets, which expand as banks increase the size of their matched-book repo positions.

This has changed in both the US and Europe. Regulators in the US have adopted a 5% supplementary leverage ratio for the holding companies of the systemically important US banks. [4] This represents a materially stricter requirement than the old US standard, as it raises the hurdle from 4% and expands the scope to capture some off-balance sheet assets. This rule

[4] Technically, the proposed higher supplementary leverage ratio requirement would apply to all banks in the US with at least $700bn in assets and/or $10trn in assets under custody, which at present captures the eight US G-SIBs: Bank of America, Bank of New York, Citigroup, Goldman Sachs, JPMorgan, Morgan Stanley, State Street, and Wells Fargo.

complements existing risk-weighted capital measures by ensuring that even low-risk assets and certain off-balance-sheet exposures are backed by material equity capital if exposures are large enough (see *Leverage ratio: An attack on repo?*).

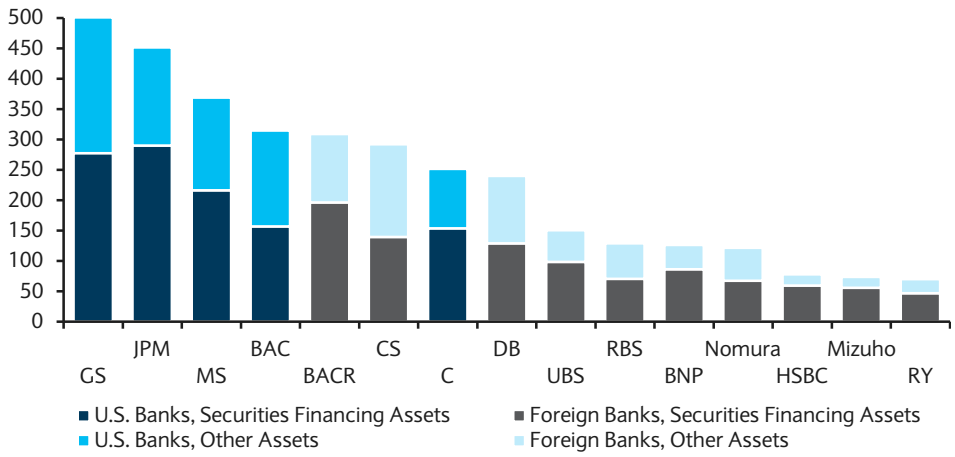
Before the crisis, European banks were not subject to any restrictions on balance sheet; thus, they naturally gravitated toward lower risk-weighted assets – this has now changed

Prior to the crisis, European banks were not subject to any restrictions on balance sheet. Thus, they naturally gravitated toward lower risk-weighted assets (eg, repo). This has now changed for two reasons. First, European regulators have adopted a 3% leverage ratio and several are moving toward an even higher standard. Second, new regulations on US subsidiaries of foreign banks will push these banks to manage the balance sheets of their US operations more conservatively. Previously, foreign banks' US intermediate holding companies were not required to meet US capital standards independently. However, beginning in July 2015, Section 165 of the Dodd-Frank Act will require foreign-domiciled banks to roll up all their US broker/dealers and bank branches into a single intermediate holding company (IHC). The IHC will then need to meet risk-based capital requirements, maintain minimum liquidity buffers, and meet the minimum leverage ratio. The challenge of establishing an IHC is particularly acute for foreign banks that mainly conduct broker-dealer business in the US, with limited lending capabilities, because their balance sheets would be naturally skewed toward lower risk-weight business (Figure 1). Based on recent data, these institutions will be under similar pressure as their US peers to reduce size and/or increase equity.

FIGURE 1

Foreign banks account for a significant share of US broker-dealer activity

Assets of US broker-dealers ($bn)



Note: Data as of YE 2013. Source: Company reports, Barclays Research

SIFI buffer for short-term wholesale funding reliance

In December 2014, the Federal Reserve released its notice of proposed rulemaking (NPR) outlining the US implementation of additional capital buffers at systemically important banks. This highly anticipated release outlined the rules for determining how much more Tier 1 common capital the largest banks will hold above the Basel III minimums.

Most elements of the rule were taken directly from the Basel/Financial Stability Board guidelines; however, the Fed also shifted critical elements. In one key change, the Federal Reserve decided to vary capital requirements based on the amount of short-term wholesale funding used by a given bank. Although we do not believe this change in itself generates higher capital requirements versus the FSB rules (based on current balance sheets), it does establish a link, for the first time, between capital requirements and wholesale funding structure. For a more detailed discussion of the proposal, see *We're Gonna Need a Bigger Buffer: Fed Proposes SIFI Capital Surcharge*, 11 December 2014.

Haircuts up next

Though somewhat less certain, we expect further rulemaking to address haircuts for repo transactions. These would likely be designed to cap leverage within the repo market to levels appropriate for the quality of the underlying collateral, see *Squeezing the leverage out*, October 24, 2014. Federal Reserve Governor Daniel Tarullo has repeatedly expressed a desire to add regulation along these lines over the past year. Most recently, in a speech at an Office of Financial Research conference (excerpted below), he highlighted his intention that such rules also apply outside the traditional banking sector to mitigate the risk of non-banks building up repo leverage as banks pull back.

Federal Reserve Governor Daniel Tarullo, January 30, 2015

"I have on past occasions described at some length my concerns with short-term wholesale funding – especially, though not exclusively, funding associated with assets thought to be cash equivalents….One policy response that the Federal Reserve has advocated and that has now been proposed by the Financial Stability Board (FSB), is for minimum margins to be required for certain forms of securities financing transactions (SFTs) that involve extensions of credit to parties that are not prudentially regulated financial institutions. This system of margins is intended to serve the macroprudential aim of moderating the build-up of leverage in the use of these securities in less regulated parts of the financial system and to mitigate the risk of pro-cyclical margin calls by preventing their decline to unsustainable levels during credit booms."

These changes have reduced repo volumes and liquidity

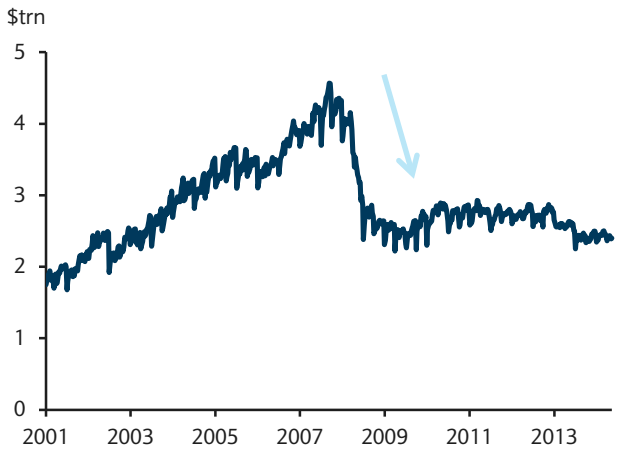
The repo market has shrunk

Repo balances have fallen from a peak of more than $5trn pre-crisis to about $2.5trn currently. We believe this market will decline by an additional ~20%, or roughly $500bn. The total amount of outstanding repo has contracted twice since 2008 (Figure 2). During the first episode (March 2008–December 2009), total repo outstanding shrank by almost 47%, driven by asset price fears and bank and investor deleveraging. Although repo against corporate bonds accounted for less than 10% of overall collateral pledged in March 2008, this market had the biggest reduction in activity, with volumes plunging by more than 63% during the financial crisis. We interpret this decline as a response to the use of non-traditional collateral.

The second repo contraction, which occurred between November 2012 and February 2014, has been focused on higher quality collateral, and in our view has been a result of new regulations. In this episode, overall repo volume fell by 22%, led by agency MBS collateral, which plunged by 43% – more than it fell during the financial crisis.

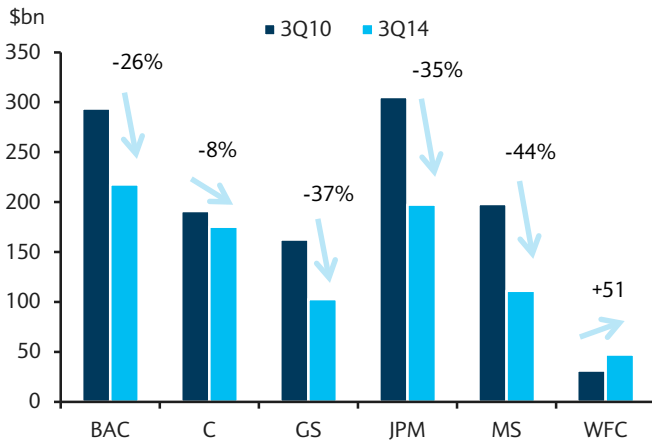
This is clearly visible in the repo balances of the large US banks, which have declined by 28% over the past four years (Figure 3). Notably, the only US global systemically important bank (G-SIB) to grow its repo balances over the past few years has been Wells Fargo, which we estimate has a significant surplus to its required supplementary leverage ratio requirement. That is because Wells Fargo predominantly focuses on traditional banking businesses of taking deposits and making loans (higher RWA), with lower exposure to repo and trading (lower RWA).

FIGURE 2
Aggregate repo volumes have contracted sharply from pre-crisis levels
Repo outstanding ($trn)



Source: Federal Reserve, Barclays Research

FIGURE 3
Most large US banks have responded to SLR requirements by reducing repo balances
Repo borrowings ($bn)



Source: Company reports, Barclays Research

Although the pace of the reaction to new rules has varied, all bank management teams that face balance sheet size pressure have taken steps to reduce their low RWA exposures. Most recently, Goldman Sachs CFO Harvey Schwartz highlighted the company's focus on reducing its balance sheet in response to increased regulatory clarity.

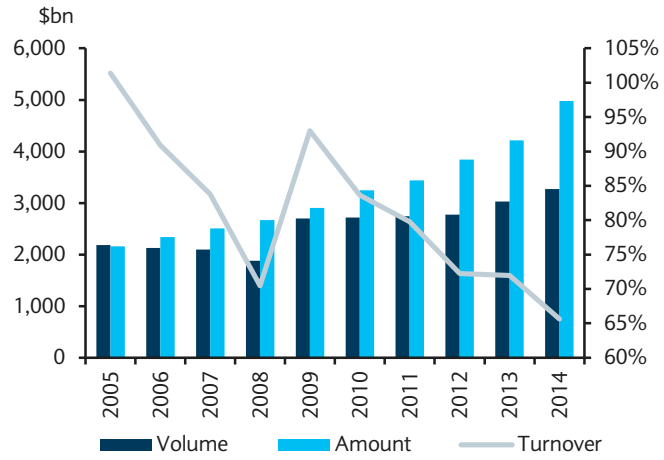
> **Goldman Sachs CFO Harvey Schwartz, July 15, 2014**
>
> "Over the past few months, we have received greater clarity on the role of the balance sheet across a variety of regulatory requirements, most notably the Comprehensive Capital Analysis and Review (CCAR) and the supplementary leverage ratio. During the quarter, we undertook a comprehensive analysis of our balance sheet. We began the process by examining the return on asset characteristics associated with different businesses. Through that analysis, we identified opportunities to reduce balance sheet with a de minimis impact to our client franchise and earnings potential. As you would expect, the quarterly reduction largely impacted lower return asset activities within our matchbook and other secured financing transactions."

Liquidity in fixed income markets has contracted

The decline in liquidity in fixed income markets is another consequence of the changes in bank regulation for financial markets. For illustrative purposes, we focus on the US credit market, for which we have accurate volume and transaction cost data, but we believe the results shown below are indicative of how trading patterns have evolved generally.

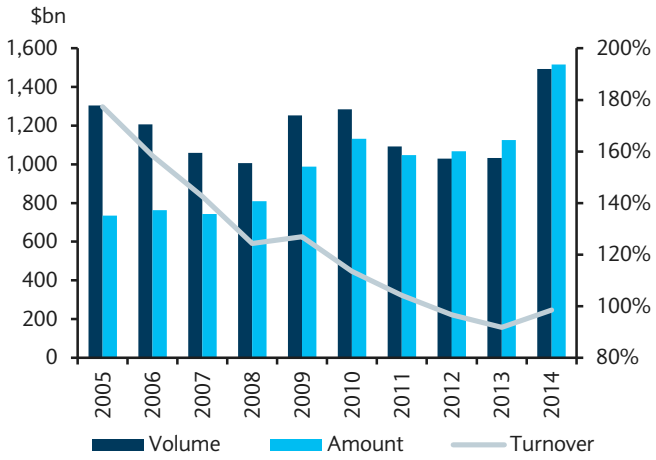
Beginning with volume data (from the TRACE reporting system, which captures all corporate bond trades in the US), we compute turnover metrics for both the US investment grade and high yield bond markets. Turnover has clearly been on a declining trend – in both markets, it is at or close to the lowest levels on record (high yield experienced a small bounce in late 2014 as a result of the volatility of energy credits). In high yield, turnover has steadily made its way down from 177% in 2005 to 98% in 2014 (Figure 5). Notwithstanding a genuine spike in investment grade corporate turnover in 2009, as the market recovered from the credit crisis, volumes in that market have also failed to keep pace with growth in par outstanding, and turnover is down from 101% to 66% over the same period (Figure 4).

FIGURE 4
Volume, market size, and turnover in high grade credit



Source: MarketAxess, Barclays Research

FIGURE 5
Volume, market size, and turnover in high yield credit



Source: MarketAxess, Barclays Research

Transaction costs have risen at the same time. Figure 6 contains pre- and post-crisis transaction costs in the IG and HY markets, estimated using our Liquidity Cost Score (LCS) methodology[5]. Transaction costs have increased in both markets. Although the change in HY is notable, at more than 20%, the change in IG is more marked. We think this is the result of the substantial strength of pre-crisis liquidity in that market. Note that the change in LCS is more severe than that in bid-offer – this is driven by an increase in the average duration of the IG market over the past several years. The same average bid-offer spread corresponds to a higher transaction cost for a longer-duration bond.

FIGURE 6
Transaction costs, today versus the pre-crisis period

	1/31/2007		1/31/2015		Change	
	LCS (%)	Bid-Offer	LCS	Bid-Offer	LCS	Bid-Offer
US Credit Corporate	0.531	8.5 bp	0.951	13.2 bp	+79%	+55%
US High Yield Corporate	1.276	1.28 pts	1.550	1.56 pts	+21%	+21%

Source: Barclays Research

Changes in the drivers of volumes and turnover at the individual bond level provide further evidence of the decline in liquidity

The changes in the drivers of volumes and turnover at the individual bond level provide further evidence of the decline in liquidity. In Figure 7, we present regressions of turnover in high yield bonds against size, age, and volatility in 2006 and 2014. In 2006, the two main determinants of turnover were the age of a bond and its volatility. We interpret the relevance of age as a halo effect around new issue – bonds tend to trade in meaningful size in the months immediately after issuance. Turnover increases with volatility because price changes force investors to re-evaluate their holdings in a particular bond. Corporate actions, earnings, upgrades and downgrades are all possible sources of volatility that could lead credit investors to reposition their portfolios.

By 2014, a few things had changed. First, the coefficients on age and volatility were both sharply lower. The "new issue effect" was much reduced, and it took much more volatility to drive the same level of turnover. More interesting, size became a much more important determinant of turnover. This suggests to us that investors "pooled" liquidity in the largest bonds, which became proxy trading vehicles for the market. This is exactly the type of reaction we would expect from investors struggling to position portfolios in a lower-liquidity environment – the little liquidity that does exist is concentrated in a smaller number of issues, rather than dispersed across the market.

[5] *Liquidity Cost Scores for US Credit Bonds*, October 2009.

FIGURE 7

Cross-sectional regressions of annual turnover on size ($bn), age (yrs), and volatility (%)

	2014 (R^2 18%)				2006 (R^2 20%)			
	Size	Age	Vol	Alpha	Size	Age	Vol	Alpha
Beta	0.15	-0.06	3.80	0.89	0.08	-0.17	11.40	1.20
Standard Error	0.03	0.01	0.11	0.02	0.04	0.01	0.34	0.04
t-statistic	*6.10*	*-9.13*	*35.62*	*38.36*	*1.82*	*-14.82*	*33.16*	*32.30*

Source: Barclays Research

The short-term safe asset conundrum

Much repo funding is intra-sector – ie, financial intermediaries lending to one another – but ultimately, a portion of this funding is indirectly provided by households and non-financial corporates through investments in money market funds. From the perspective of non-financial entities, repo is an asset and just one of a number of short-term, safe – even "cash-like" – investment alternatives. Households and corporates have a natural need for these types of funds as a cash management vehicle and store of liquidity.

This natural need for liquidity grows as financial wealth grows, which results in the share of safe, short-term assets remaining in a relatively tight range for households and corporates. To demonstrate, we create a measure of short-term assets, which includes currency, deposits, and money market fund shares. For corporates, we also include a *de minimis* amount of direct repo lending and commercial paper owned. Although the direct repo holdings of households and corporates are not significant, the funding that households and corporates provide to money market funds is then reinvested by these funds in repo. Similarly – but on a smaller scale – a proportion of individual and corporate deposits is also reinvested by the bank in repo.

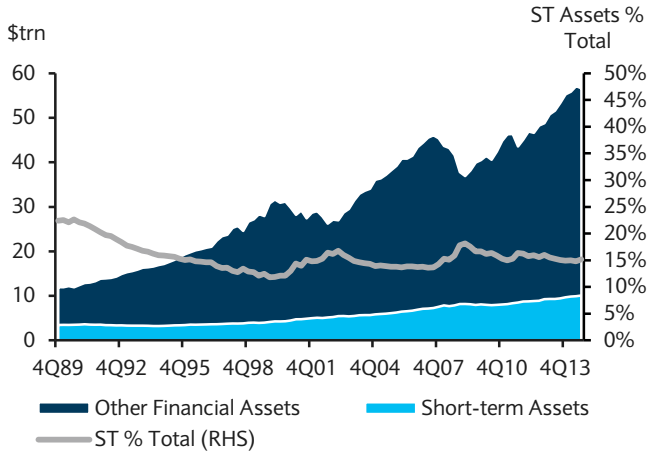
Households have consistently allocated 12-18% of financial assets into cash and short-term securities in every quarter since the early 1990s (Figure 8). Likewise, non-financial corporates' allocation has remained at 10-14% (Figure 9).

We think demand for short-term safe assets is even more stable than these ranges imply. Short-term assets as a percentage of total financial assets troughed three times: in 2000, 2007, and today – each period one of strong equity market performance inflating exposure to stocks (Figure 10). Similarly, relative exposure to short-term assets peaked in 2001 and

FIGURE 8

Short-term assets have accounted for a stable proportion of household financial assets

Household financial assets

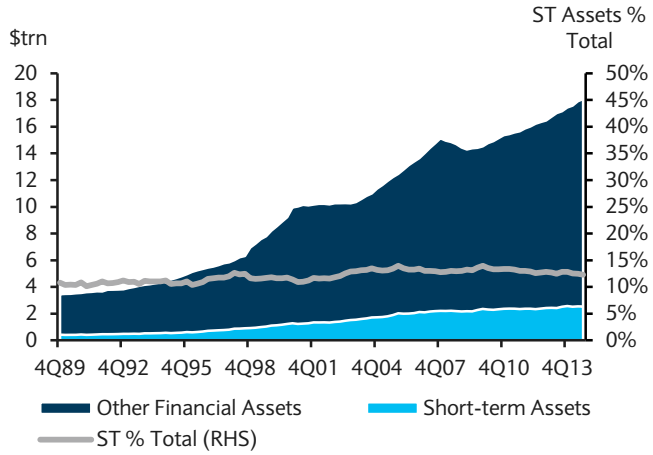


Source: Federal Reserve Flow-of-Funds data, Barclays Research

FIGURE 9

Non-financial corporates have also maintained a steady proportion of assets in short-term funds

Non-financial corporate financial assets



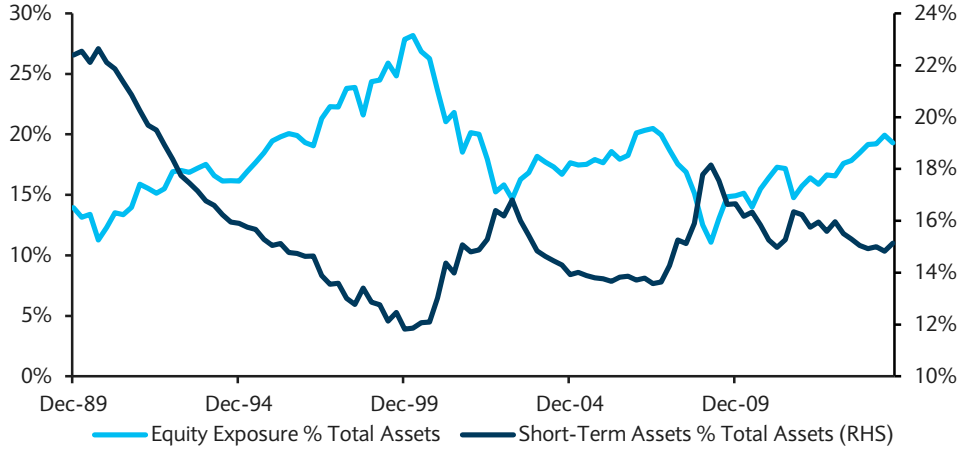
Source: Federal Reserve Flow-of-Funds data, Barclays Research

2008, when sharp equity market declines reduced the value of stocks. In fact, absolute holdings of short-term assets have increased in 19 of the past 20 years, by an average of 6.2%. In other words, the pace of growth in short-term assets has steadily tracked the long-term growth rate of household and corporate accounts. Indeed, Gorton et al report that their "safe asset" share of all US assets has remained steady at around 33% since 1952.[6]

FIGURE 10

Following periods of strong equities performance, household exposure to equities peaks and short-term assets reach a local low as a percentage of total assets

US Household Exposure to Equities and Short-term Assets



Source: Federal Reserve, Bloomberg

How will the demand for safe, short-term assets be met?

Treasury bills, bank deposits, and the Federal Reserve's new reverse repo program (RRP) all have their limitations as short-duration liquid assets

Faced with the prospect of shrinking bank-provided repo, what alternatives are available to investors seeking short-duration liquid assets? A survey of similar low-risk, short-term options suggests investors may struggle to deploy their growing allocation to this category. The main low-risk alternatives – Treasury bills, bank deposits, and the Federal Reserve's new reverse repo program (RRP) – all have their limitations.

Bills insufficient and declining

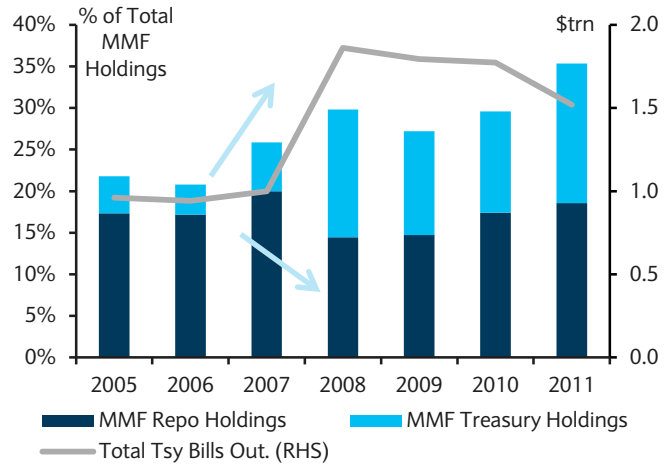
Short-dated Treasury debt is probably the closest substitute for repo – and probably the most plentiful alternative – with $1.5trn in bills and $1.5trn in coupon Treasuries under 400 days to maturity outstanding. Moreover, given the limitations on what some investors can own, short-dated Treasury debt is one of the easiest substitutes. In fact, when repo balances contracted during the financial crisis, there was a marked increase in money market funds' Treasury bill holdings, supported by the increased bill supply in 2008 (Figure 11).

However, as the budget deficit shrinks and the Treasury moves to lengthen the average maturity of the outstanding debt, it has steadily trimmed bill issuance. Since peaking in 2009, the outstanding bill supply has contracted by more than 20% (>$500bn) (Figure 12). Demand is so strong that at bill auctions – of any maturity – bids exceed the offering amount fourfold. And given the buy-and-hold nature of the investor base, once the paper is purchased into a portfolio it almost never returns to the market. Thus, even though $1.5trn in absolute terms is larger than the aggregate debt outstanding of some G7 countries, the Treasury bill market – even supplementing the supply with coupons out to 13 months – is probably too small to absorb demand diverted from the private sector repo market.

[6] See "The Safe-Asset Share", G. Gorton, S. Lewellen, A. Metrick, NBER working paper, January 2012.

FIGURE 11

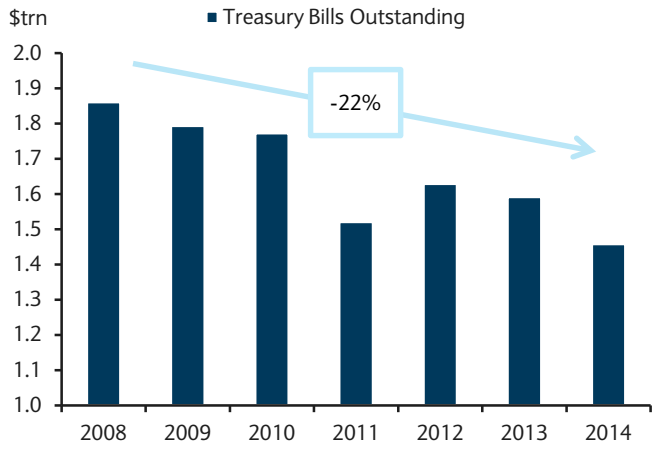
Upon the contraction of the repo market in 2008, MMFs redeployed capital into Treasury bills



Source: Federal Reserve, SIFMA, Barclays Research

FIGURE 12

However, bill volume has since declined and is unlikely to be able to absorb incremental demand from declining repo



Source: Federal Reserve Flow of Funds, Barclays Research

Deposits are a natural alternative, but rates could lag if demand increases out of step with lending opportunities

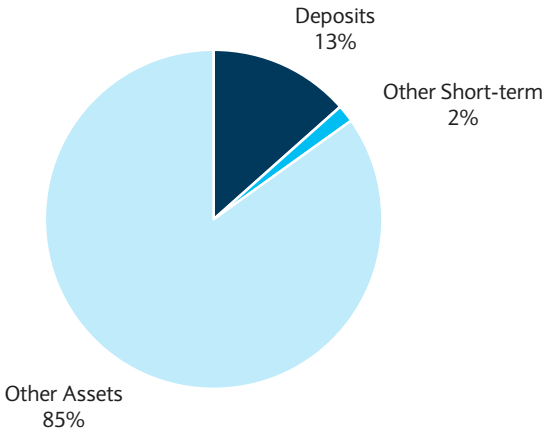
Deposits are clearly a safe, liquid asset and are one of the main areas where households and corporates deploy short-term funds. Uninsured bank deposits (above the $250k insurance maximum) do represent incremental credit risk versus government obligations; however, money market funds already deploy roughly 20% of their holdings into wholesale bank deposits, suggesting that deposits form a reasonable investment avenue for these entities.

However, we do not see much demand from banks for this incremental funding. Banks are already awash in deposits, as demonstrated by an average loan-to-deposit ratio of roughly 70%. Although banks will continue to take deposits, away from pockets of demand for retail deposits driven by the new Liquidity Coverage Rule (LCR), we believe banks' interest in further inflating their balance sheets is limited. Their appetite is constrained both by the new SLR rule and limited lending opportunities. Thus, if money market funds boost the supply of deposits to banks, banks in turn may be less inclined to raise the interest paid on deposits.

FIGURE 13

Deposits already form the core of households' safe, short-term assets and a material share of money market holdings, suggesting they are a likely alternative investment avenue

Mix of household financial assets (% of total)



Source: Federal Reserve, Barclays Research

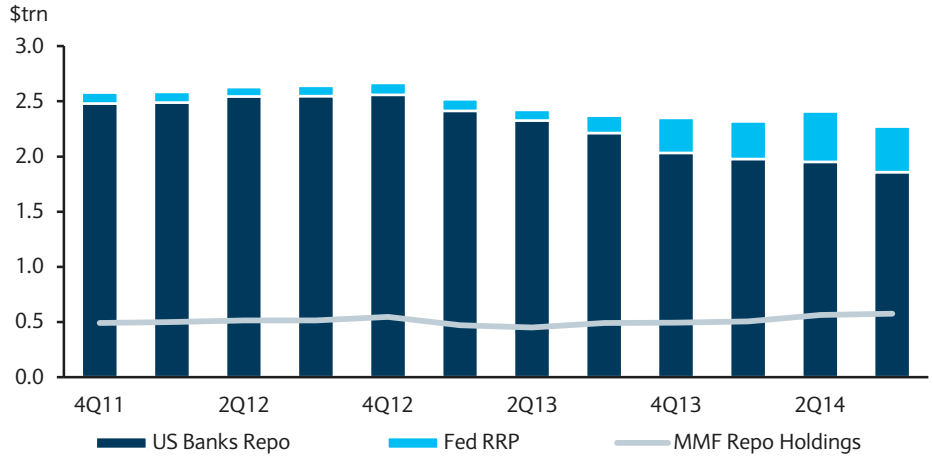
Federal Reserve's RRP capped, limiting capacity to absorb incremental demand

The RRP is a close substitute for shrinking private sector repo

The Fed's reverse repo program (RRP) is a close substitute for shrinking private sector repo and is available to a wider range of counterparties, including large money market funds and the GSEs. For these investors, Treasury repo from the Fed supplements what is available to them from the private sector. Since program testing began in September 2013, average daily balances in the RRP have been roughly $125bn (and considerably higher at quarter-ends, when bank and dealer balance sheet scarcity increases and few private sector repo assets are available for money market funds to invest in). This has largely offset the decline in private sector repo volume in recent years (Figure 14). In turn, mutual fund repo holdings have remained relatively stable in aggregate (actually increasing as a % of total holdings) as they have redeployed funds into the RRP.

FIGURE 14

Fed RRP has offset much of the fall in private-sector repo volume, helping MMFs keep total repo holdings fairly constant



Source: Federal Reserve Flow of Funds, Barclays Research

However, the Fed's stated concerns about the program have led it to put a hard cap of $300bn on the RRP; thus, we expect its capacity to replace shrinking private sector collateral supply to be limited. The Fed's concern stems from its discomfort with directly funding money market funds and the fact that even with the $300bn cap, its market presence in the repo market is nearly as large as the top three dealers *combined*. Moreover, it worries about the potential for the program to dis-intermediate bank funding during a financial crisis. Notably, in the January FOMC minutes, most participants accepted that the Fed might have to temporarily increase the cap on the overnight RRP program to strengthen its control over the fed funds rate. Officials are concerned, however, that the market might attach more significance and permanence to the RRP program if the size was increased so it is far from certain the Fed will provide money funds with extra repo.

Limited supply of alternatives could inhibit higher short-term rates

We expect deposits to exhibit a lower beta to short-term rates once the Fed begins hiking rates

In aggregate, we expect demand for safe, short-term assets to grow steadily. However, the supply of these assets from the avenues listed above will likely be constrained. When we factor in an expected decline in repo, we project an increased imbalance between supply and demand. This imbalance – more investors looking to deploy cash in the short end than safe borrowers needing that cash – should lower the relevant interest rates paid. For example, the available data suggest that bank deposits have historically had a 60-80% beta to short-term interest rate changes. We expect deposits to exhibit a lower beta once the Federal Reserve begins hiking rates, as funds that short-term investors previously allocated to repo assets flow into bank deposits. Through this indirect mechanism, forced declines in repo volumes could keep the interest earned by deposits or government-focused money market funds closer to the zero bound, even as other rates rise. In fact, it is exactly the concern about substantial demand for short-dated assets that is leading the Fed to

question whether the RRP program may need to be increased. Otherwise, the actual front-end rates used in the economy may not track Fed funds as closely, limiting Fed's control of interest rates.

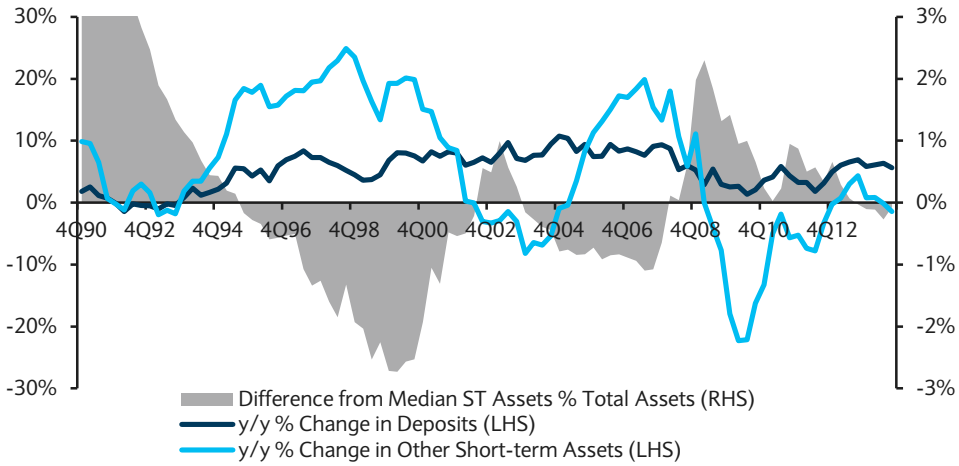
Private-sector alternatives add incremental risk

Where investment avenues backed by the government, both directly (Federal Reserve RRP, Treasuries) and indirectly (government collateral repo, FDIC), are less available, we expect private sector alternatives to become more prominent. However, their degree of substitutability with repo is lower and could introduce new risks.

FIGURE 15

When short-term assets are scarce, non-traditional alternatives step in to fill the void

Y/Y change in deposits and other short-term assets (LHS) and difference from median short-term asset holdings % total assets (RHS)



Note: Short-term assets and deposit assets for all entities. Median short-term asset rate represents aggregate of household and non-financial corporate data. Source: Federal Reserve Flow-of-Funds data, Barclays Research

History suggests less standard alternatives are likely to rise

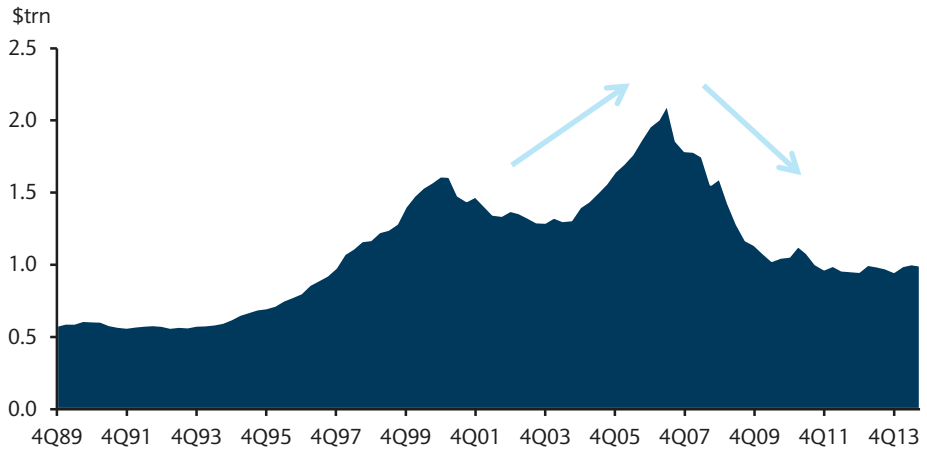
The Federal Reserve's Flow of Funds data suggest that growth in less traditional cash-like products may be particularly responsive to a shortfall in traditional safe, short-term investment opportunities. Deposits have generally grown steadily over the past two decades, with relatively limited responsiveness to economic conditions. On the other hand, other short-term assets, such as CP vehicles and money market funds, have had a more volatile growth pattern, responding to the relative demand for incremental safe assets in any given period. Figure 15 suggests that when households and corporates have a low percentage of total assets in short-term investments, the growth rate of short-term alternatives picks up sharply. In other words, when there is a shortage of traditional short-term safe assets, alternative assets have historically stepped in to fill the void.

The last trough of short-term assets as a percentage of total financial assets coincided with a large rise in the use of what were deemed to be near-safe short-term asset substitutes. CP and ABCP balances surged as investors stretched to find additional safe assets and pick up incremental yield and banks sought cheaper sources of funding (Figure 16). When market sentiment turned in 2008, these non-traditional sources of liquidity proved to be less liquid and stable than expected. The decline in bank commercial paper has not reversed due to increased regulation and lower ratings at banks, while more esoteric products such as auction rate securities and asset backed-CP proved to bear much higher liquidity and credit risk than expected and are thus unlikely to return any time soon.

FIGURE 16

Holdings of cash-like substitutes grew dramatically pre-crisis and have shrunk since

Commercial paper and bankers acceptances outstanding ($trn)



Source: Federal Reserve Flow of Funds, Barclays Research

Investors now appear to be seeking liquidity in mutual funds and ETFs

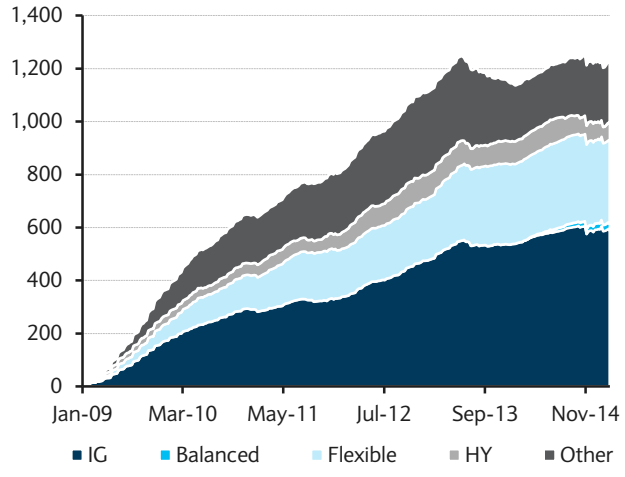
Evidence suggests that investors have settled on fixed income mutual funds and ETFs as stores of liquidity. These funds offer daily liquidity such that investors can, in principle, redeem their money as quickly as in a money market fund. The influx into these types of funds has been heavy. Since 2009, taxable bond funds have received a massive $1.2trn in inflows, excluding the effect of significant market appreciation. Investment grade corporate funds have been the biggest beneficiaries (+$588bn), followed by flexible funds that can typically roam freely across the credit spectrum (+$311bn) and high yield funds (+$70bn), according to Lipper data (Figure 17).

Similarly, ETFs are growing rapidly in fixed income. For example, although virtually non-existent before the crisis, credit ETFs have grown to account for c.2.5% of the investment grade corporate debt market and nearly 3% of the high yield corporate market (Figure 18).

Despite their passive nature and management fees, ETFs appear to be gaining traction not only for retail end users and hedge funds, but also among institutional investors. In effect, ETFs are being used not only by end investors looking for instruments with daily liquidity, but also by mutual funds seeking to mitigate the differences between the liquidity their investors

FIGURE 17

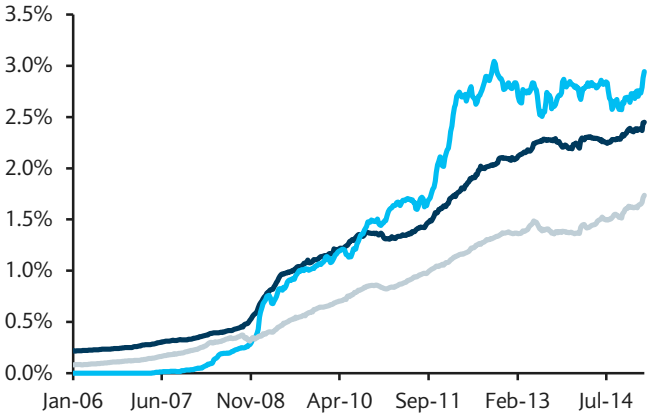
Cumulative retail flows by fixed income asset class ($bn)



Source: Lipper

FIGURE 18

ETFs have gained a significant foothold in the management of fixed income assets



Source: Lipper, Barclays Research

expect versus the (poor) liquidity available in the underlying bonds. ETFs function as a trading vehicle, aided by their increasing liquidity, such that portfolio managers can meet daily inflows and redemptions without actually needing to trade bonds[7].

Investors are increasingly using the ultra-liquid CDX indices to satisfy their daily liquidity needs

Similarly, portfolio managers have increased their trading in other related products. For example, investors are increasingly using the ultra-liquid CDX indices to satisfy their daily liquidity needs. In the high yield market, where the on-the-run CDX index trades nearly as much as all TRACE bonds combined, the correlation between large fund flow events and positioning data shows that portfolio managers use the derivatives index as a source of liquidity in periods of high fund flow volatility (Figure 19).

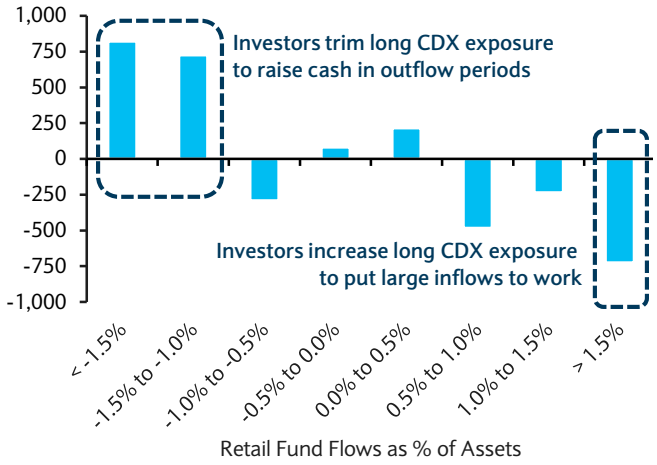
However, these alternative sources of liquidity come at a cost, even if such cost is not immediately apparent in bid-offer prices. With CDX, the price of liquidity comes in the form of basis risk, which can be very significant in times of market stress (Figure 20). This risk comes as a result of mismatches in rates exposure (CDX has virtually none) and differing credit exposure, among other potential mismatches. With the ETFs, the costs include non-trivial management fees and a market that can dislocate significantly from its underlying asset value. Holding more cash to fund potential liquidity events is an alternative whose risks are better understood, but the consequent performance drag can make this the least appealing option to managers.

The increased use of these tools to manage the disparity between the provision of daily liquidity to end-investors and poor liquidity in the underlying fixed income assets is itself evidence of the tension that the influx into mutual funds has caused. Fund managers have found that they need to use these tools already, in relatively calm markets. In the event of a market disruption, these tools may no longer be effective – if outflows exceed the extent to which fund managers have built in flexibility to meet them, they would have no choice but to turn to the underlying markets to meet their liquidity needs. This could become self-perpetuating if the corresponding price declines in the underlying led to further outflows.

Thus, regulations aimed at bolstering stability at the core of the financial system, combined with a growing demand for liquidity, may eventually lead to increased instability and fire-sale risk in the periphery (eg, the secondary markets for investment grade, high yield, leveraged loans, and emerging markets). The fragile new equilibrium comes not only from the reduced tradability of these asset classes, but also from deep liquidity mismatches between the assets themselves and the instruments being used to manage daily liquidity needs.

FIGURE 19

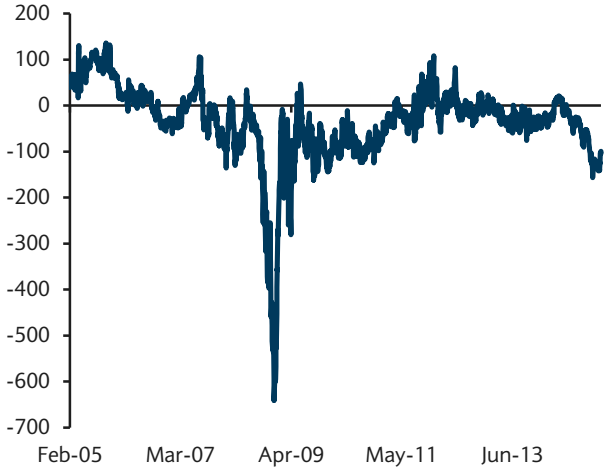
Changes in investor positioning in HYCDX (OTR) are consistent with liquidity needs ($mn)



Source: DTCC, EPFR, Barclays Research

FIGURE 20

Basis between the HYCDX index and the Barclays US High Yield Very Liquid Index (bp)



Source: Barclays Research

[7] *Institutional Investors Turning to Fixed-Income ETFs in Evolving Bond Market*, Greenwich Associates, 2014.

CHAPTER 6

India: A step change

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- **We expect India's real GDP to grow at 7-8% annually in the next 5-10 years – very strong for an economy exceeding USD 2trn and with about a 3% share of global GDP. Against a backdrop of generally subdued global growth, our forecasts imply that India could be the world's fastest-growing large economy in the years ahead.**
- **Prime Minister Modi's government is committed to pursuing an aggressive reform agenda to spur growth and development, along with a focus on boosting employment. The likelihood of a distinctly faster pace of policy reforms remains the key catalyst for the India story, in our view. Importantly, Modi's political mandate is the strongest in nearly 30 years, which offers him a markedly stronger platform to deliver growth-boosting policies than his predecessors.**
- **India's central bank is also enjoying a fresh credibility boost under Governor Rajan. Amid other tailwinds, India's twin deficits are improving quickly and inflation is softening materially. India is one of the biggest beneficiaries of lower commodity prices, oil in particular, which we believe can remain low over the medium term.**
- **We expect India to enjoy multi-notch rating upgrades to high BBB by 2017 and we remain positive on INR assets (ie, bonds, equities) over a multi-year horizon.**
- **Although the macroeconomic backdrop is favourable, the trajectory of India's economy in the years ahead will depend on the success and pace of implementation of the reform programme, especially absent a tailwind from global growth.**

Ready for takeoff, buoyed by multiple tailwinds

The recent turnaround in India's economy has been remarkable. In the wake of concerns about a potential balance-of-payments (BoP) crisis in mid-2013, there has been a sharp turnaround in sentiment and asset prices, reflecting a marked improvement in India's macroeconomic fundamentals. After years of sub-par economic performance, the Indian economy looks set to gain further strength in the coming years, buoyed by multiple cyclical and structural tailwinds.

First, the mid-2014 general election ushered in a reformist government with the strongest mandate in nearly 30 years. The new government has moved quickly to pursue an ambitious programme of macroeconomic and policy reforms.

Second, the government's policies, apart from boosting growth and development, seem poised to maintain an explicit focus on generating jobs. India enjoys a strong "demographic dividend," with a high percentage of the population of working age. Thus, an explicit focus on job creation should help India foster development and materially combat poverty.

Third, the central bank, the Reserve Bank of India (RBI), under Governor Raghuram Rajan, has further strengthened its inflation-fighting commitment recently, which could help India overcome a perennial stumbling block.

Fourth, in the near to medium term, India looks set to be among the biggest beneficiaries of softer commodity prices, which could translate into several macroeconomic pluses: falling inflation, stronger current account balance, potentially even a surplus in some years, a smaller fiscal deficit, lower interest rates, and faster growth.

A strong mandate in favour of a reformist government

In the 2014 general election, the Bharatiya Janata Party (BJP), led by Narendra Modi, won a landslide victory, giving India a single-party majority government for the first time in nearly three decades. We think this transition signals a clear break with India's history of fractured

electoral mandates, which had weighed on governments' ability to make decisions and initiate reforms. This issue was in sharp focus with the previous government, which, facing pressure from major corruption allegations and challenging alliance partners, put economic reforms on the back-burner for most of its time in office. We think the 2014 election result has significantly improved India's ability to take on difficult but necessary policy reforms.

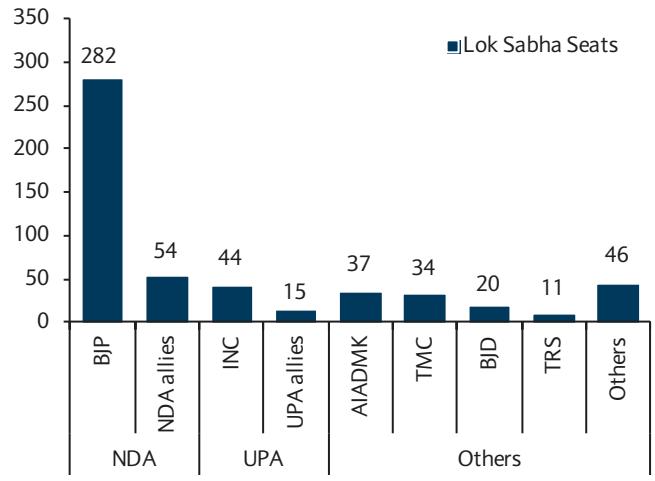
Narendra Modi also emerges as India's first prime minister to head a government that is right of centre in terms of economic policies. Identifying economic growth as the fastest path to reducing absolute poverty, the government has moved quickly to restore business and consumer confidence. Several key economic sectors were liberalised for foreign direct investment (FDI) in the early days of the government's tenure. The government is pursuing an ambitious agenda of key fiscal reforms, financial inclusion, boosting the manufacturing sector, and facilitating planned urbanisation. The government has curtailed subsidies on a medium-term basis by deregulating domestic diesel prices; undertaken fiscal reforms; and pursued initiatives to ease labour laws and land acquisition norms to facilitate manufacturing and de-clogging infrastructure bottlenecks. Overall, it has committed to improving the ease of doing business. India currently languishes at 142nd place in the World Bank's Ease of Doing Business rankings, but Prime Minister Modi has set his sights on reaching the top 50 in the next 3-5 years.

At the same time, more state governments have aligned themselves with the centre, either through political affinity or through federal programmes, which should help in terms of project implementation. The ruling BJP now directly controls eight of India's 29 states, and has formed alliances with regional parties in another three. These states are systemically important and together contribute nearly half of India's GDP. With eight state elections scheduled by 2016, the BJP's political control could strengthen. In sum, the political backdrop, which has long hobbled India's growth story, is now a clear tailwind, in our view.

Political inertia seems to have disappeared, and further reforms, targeting growth, employment and improving the ease of doing business will likely remain the focus of the government in the coming years. Key fiscal reforms such as the implementation of an integrated goods and service tax (GST) has been delayed for years, largely because of differences between state governments and the centre over revenue sharing, but we expect this initiative to move forward over the next 1-2 years. Furthermore, alongside the opening up of more sectors to larger FDI caps in the coming years, we also expect a number of critical business hurdles to be lowered, especially with regard to land acquisition, labour law reforms and the ease of doing business.

FIGURE 1

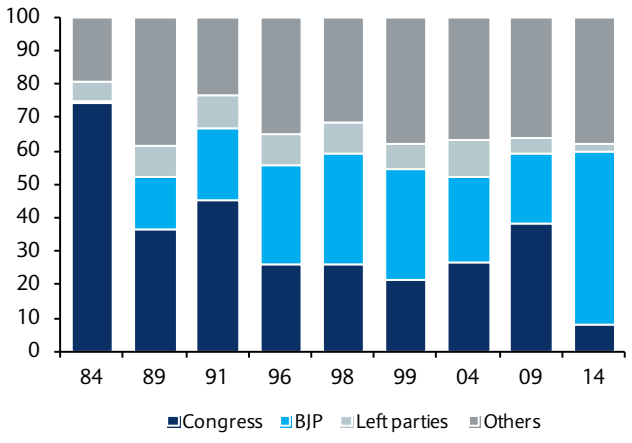
Narendra Modi's BJP won the 2014 election with a landslide…



Source: Election Commission of India, Barclays Research

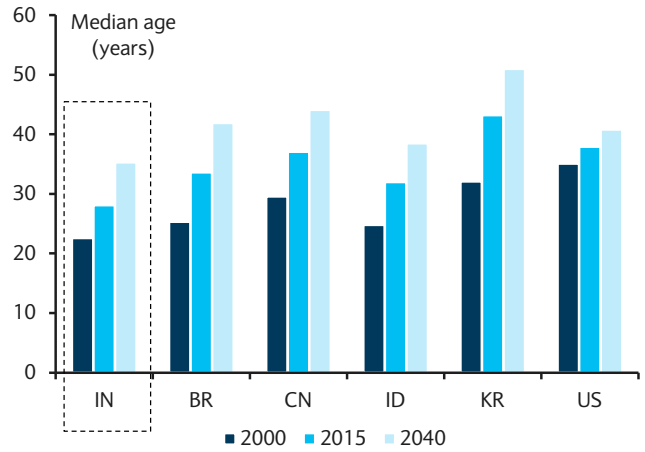
FIGURE 2

… giving India its first single-party majority gov't since 1984



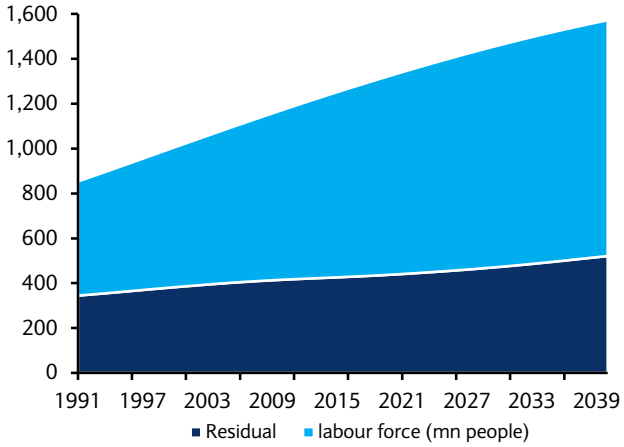
Source: Election Commission of India, Barclays Research

FIGURE 3
India is set to remain a young country for decades to come…



Source: UN, Barclays Research

FIGURE 4
… fuelling a surge in its labour force



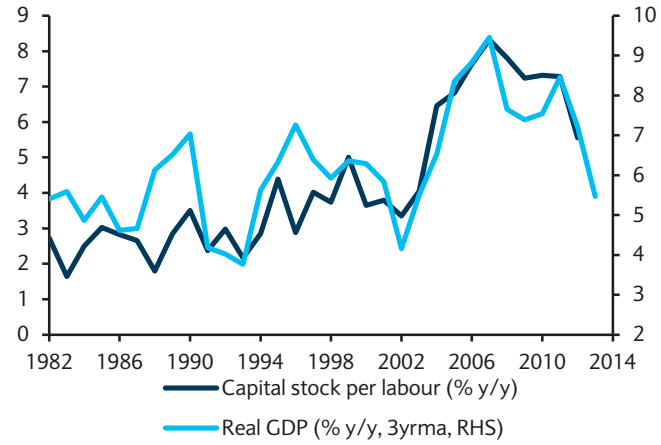
Source: UN, CEIC, Barclays Research

Revisiting India's demographic dividend

In the context of India's long-term growth potential, its demographics are a key positive. With nearly 65% of India's 1.25bn population under the age of 35, its growth trajectory is defined to a great extent by its population's consumption and savings potential. The United Nations (UN) projects India's population to rise to 1.6bn by 2040, an increase of roughly 400m from 2010 levels. More important, the working age population is expected to increase by almost 300m during this period, which could drive a significant rise in consumption and growth.

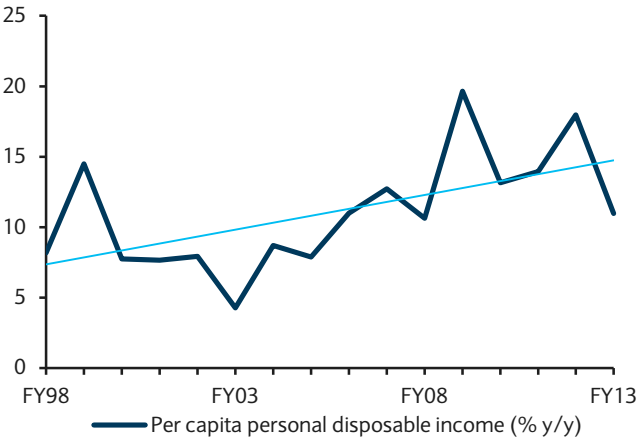
Furthermore, India's labour productivity has increased over the past 20 years on better education and capital availability. This higher productivity, coupled with the improving health and education of the Indian labour force, provides a significant opportunity, in our view, in terms of consumption demand and economic size. India's 'demographic dividend' is expected to continue for at least three decades as the median age in India is projected by the UN to remain low by global standards well into the 2040s. Against this backdrop, we think that even if the government's initiatives to boost growth and job creation are only partially successful, this will go a long way to helping India realise its potential.

FIGURE 5
Labour productivity has fallen in recent years, but is still far above the long-term average



Source: UN, CEIC, Barclays Research

FIGURE 6
Disposable income has been trending upward since the late 1990s



Source: RBI, CEIC, Barclays Research

Central bank puts renewed emphasis on combating inflation

Controlling inflation remains one of the key challenges for public policy in India – both for the central bank and the government. Against that backdrop, the RBI, under the leadership of Governor Raguram Rajan, who took charge in 2013, has attempted to reinforce the RBI's inflation-fighting credentials by moving toward a flexible inflation-targeting regime. Since coming to power in mid-2014, the new government has also put in place several initiatives to curb inflation, such as pro-actively releasing stocks of foodgrains, reining in minimum support prices (MSP) for various agricultural commodities, and curbing the hoarding of essential commodities. These efforts seem to have achieved a degree of success, albeit with the help of a wave of global disinflationary trends. Although it is premature to be confident about longer-term inflation dynamics in India, the clear focus on controlling inflation by both the monetary authority and the government remains a key potential positive for India.

Benefiting from softer commodity prices

India is a large net importer of several commodities, including oil and metals, and has thus been a key beneficiary of the recent global trend of softer commodity prices. This trend is set to improve India's current account and fiscal balances, containing inflation and inflation expectations, helping to ease interest rates, and thereby supporting growth. The recent fall in commodity prices is expected to be sustained over the medium term, allowing India to adopt more constructive policies in the near to medium term (see Chapter 2, "Adjusting to a world of lower oil").

As a result of these cyclical and structural tailwinds, the backdrop across growth, inflation, current account and fiscal scenarios are lining up favourably for India. Coupled with the size of the economy – above USD 2trn – and well developed asset markets, India's economy is likely to attract attention and flows from global investors in the coming years.

Growth: Stepping up

Despite a slowdown in recent years, India's growth in the past 10 years has averaged above 7.5% pa, with the size of the economy expanding from ~USD700bn to more than USD2trn. India continues to benefit from a large, young population, a deep savings pool to finance capital investment, and productivity growth. Although infrastructure bottlenecks persist, the government is taking steps to resolve them, setting the stage, we think, for better growth dynamics. We estimate that India can grow at an average of 7-8% pa over the next decade.

We feel that the political transition in 2014 has been the main catalyst for the revival of expectations for the Indian economy. The government looks poised to capitalise on the recent surge in confidence and optimism in the economy and seems committed to combating some of the persistent challenges it faces, including generally entrenched inflation expectations, a sub-optimal fiscal situation, a stagnating agricultural sector, corruption and poor delivery of government services. We think the government is currently prioritising three areas: 1) manufacturing, via the 'Make in India' campaign; 2) planned urbanisation; and 3) enhancing the effectiveness and efficiency of government services.

New manufacturing policy: 'Make in India' campaign

The government has launched the 'Make in India' campaign to boost India's manufacturing sector. We think the potential for a stronger manufacturing sector depends on the policy initiatives that form the campaign: the implementation of a GST, further liberalisation of FDI rules, easing bottlenecks around coal, power and environmental issues, the overhaul of outdated labour laws, and potentially making land acquisition easier. The stated goals of the new manufacturing policy are to boost the share of manufacturing to about 25% of GDP by 2022 (from the current share of about 15%) and create 100m jobs in the next decade.

Planned urbanisation

Another key focus area is urbanisation, which has been a strong driver of growth in India since the 1990s. Urban areas now generate nearly two-thirds of India's GDP – up from *c.*45% in 1990. The policy focus is to make the country's urbanisation plans more coherent

with its industrialisation needs by creating new 'smart cities' and dedicated industrial corridors, as well as upgrading existing urban infrastructure. If the government succeeds, we think this would be a major factor supporting industrial growth. Even if past trends are maintained, we estimate that urban India could make up 35% of the country's population and contribute 70-75% of GDP by 2020. According to *Urbanisation in India*, a report by the McKinsey Global Institute in 2010, India could have 68 cities with a population of more than 1m by 2030 – up from 42 in 2010.

Enhancing government services

The government of Prime Minister Modi has shown a commitment to enhancing the effectiveness and efficiency of government services. The government remains focused on the path of fiscal consolidation but is also emphasising making the delivery of public services faster and better targeted. Whether it is the policy of self attestation of documents, encouraging wider use of Unique Identification Authority of India (UIDAI) identification, direct transfer of government subsidies, focusing on its "Clean India" mission, or strengthening the financial inclusion drive, the government has made concrete progress relatively quickly. Overall, we believe that an uptick in the quality and timeliness of services from government agencies – a significant part of the economy – could increase the value addition in the economy materially, both directly and indirectly.

Savings-income, a virtuous cycle in the making

A key positive influence of India's strong demographics has been its domestic savings rate, which rose from 23% of GDP in FY91 to 37% of GDP in FY08 before moderating to 30% in FY13. Even at about 30% of GDP, this ratio is one of the highest among EMs, and is broadly keeping pace with China's. This has allowed India's investment rate to rise significantly, from 25% of GDP in FY91 to 35% in FY13, despite a soft patch during the post-crisis years. From a longer-term perspective, we think that India's already healthy savings and investment rates can improve in the coming years, buoyed by the government's efforts to boost growth, employment and financial savings against a backdrop of favourable demographics (see Chapter 1, Population dynamics and the (soon-to-be-disappearing) global 'savings glut').

We view this as encouraging, as it points to both savings and investment rates increasing along with the expected growth in per capita GDP, largely because consumption tends to moderate as a percentage of GDP, given the falling marginal propensity to consume at higher incomes. While India's investment rate and incremental capital output ratio (ICOR) worsened during the post-crisis years, we expect an improvement in the coming years given the clear policy focus on this area. Assuming India's investment rate and ICOR improve at least toward their longer-term average levels, India should be in a position to sustain annual growth rates of 7-8% in the coming years, in our view.

FIGURE 7

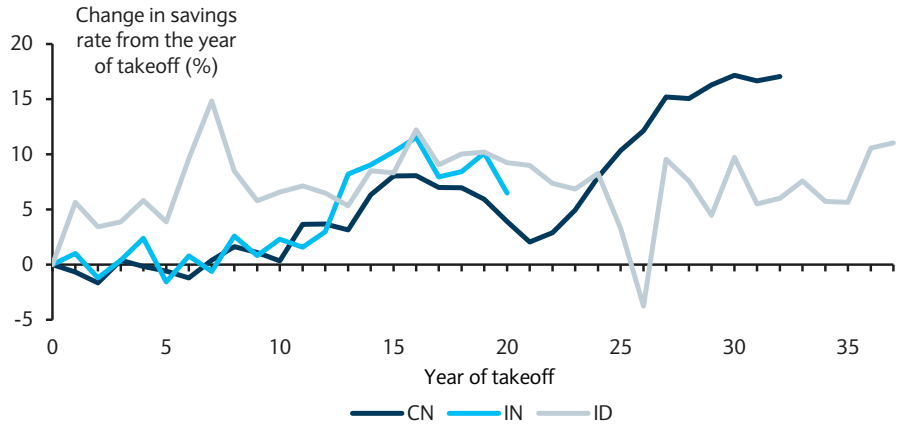
Improvements in productivity and capital formation could help India average 7-8% growth over the next 5-10 years*

		Investment rate (GFCF as a % of GDP)					
		27%	30%	33%	36%	39%	42%
ICOR	3.50	7.7%	8.6%	9.4%	10.3%	11.1%	12.0%
	3.80	7.1%	7.9%	8.7%	9.5%	10.3%	11.1%
	4.10	6.6%	7.3%	8.0%	8.8%	9.5%	10.2%
	4.40	6.1%	6.8%	7.5%	8.2%	8.9%	9.5%
	4.70	5.7%	6.4%	7.0%	7.7%	8.3%	8.9%
	5.00	5.4%	6.0%	6.6%	7.2%	7.8%	8.4%

Note: *Values indicate real GDP growth rate for a certain combination of incremental capital output ratio (ICOR) and investment rate. Source: Barclays Research

FIGURE 8

India's saving improvement is in line with China's experience post-liberalisation



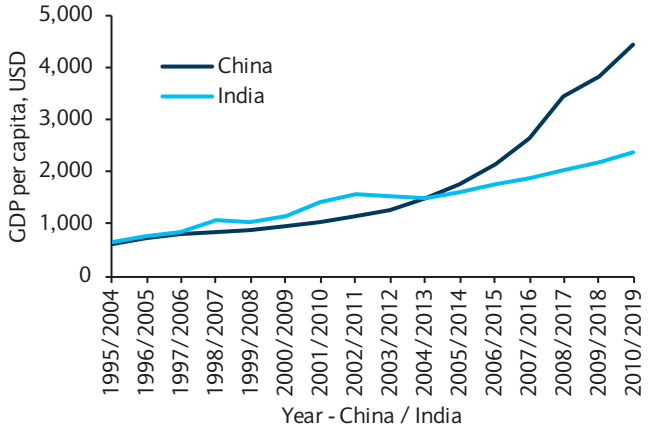
Take-off years for China, India and Indonesia are defined as 1979, 1991 and 1973, respectively.
Source: Haver Analytics, Barclays Research

A number of India's macro parameters have a degree of resemblance with those of China 1-2 decades back, when China had taken off for a spell of very high growth. For example, India's per capita GDP crossed the USD1,000 mark in 2007, a milestone that China crossed in 2001. On a purchasing power parity basis (PPP), India's per capita GDP in 2014 stood at around USD5,700; a similar level was achieved by China in 2006 (China in 2014: about USD13,000). The current differential in per capita income between the two countries remains large given China's protracted period of high growth and strong currency. However, a steady near-8% growth rate in India in the coming years – if maintained – could help India to narrow this gap in the coming years.

The manufacturing sector and an uptick in exports played a critical role in boosting China's economy during the high growth years. Recently, this particular area has been a relatively weak point for India. Nevertheless, India's current export intensity remains similar to that of China at the turn of the century. Indian policymakers are currently emphasising boosting the country's manufacturing industry with a view to eventually boosting net exports, which could be a critical part of India's growth strategy in the coming 5-10 years. A somewhat similar pattern can be observed in case of a few other important macro parameters, such as the rate of gross capital formation.

FIGURE 9

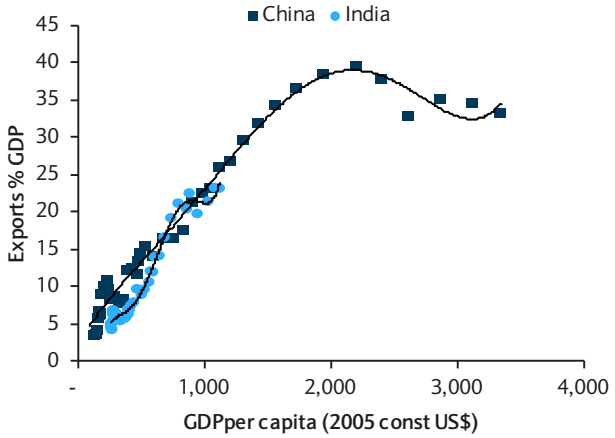
India's current per capital GDP is close to that of China about a decade back…



Source: IMF, Barclays Research

FIGURE 10

… while India's current export intensity is broadly in line with that of China at the turn of the century



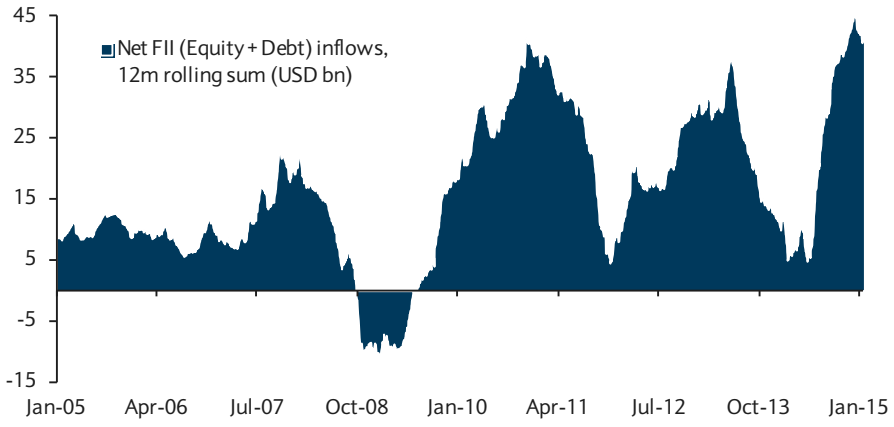
Note: The scatter plot above is based on annual data pertaining to 1970-2012.
Source: UN, World Bank, Barclays Research

External sector: From fragility to strength

The recent turnaround in the Indian economy started with a sharp swing in the external balance in late-2013. India's current account deficit contracted sharply to 1.7% of GDP in FY 13-14, down from a record high of 4.7% the year before. The recent plunge in international commodity prices is another major tailwind for India's current account, which we forecast to record a modest surplus of 0.1% of GDP in FY 15-16. Although a current account surplus would likely be temporary, we expect India's current account to remain broadly healthy, likely averaging about 1% of GDP during the next 3-5 years, below the long-term average of about 1.5% of GDP.

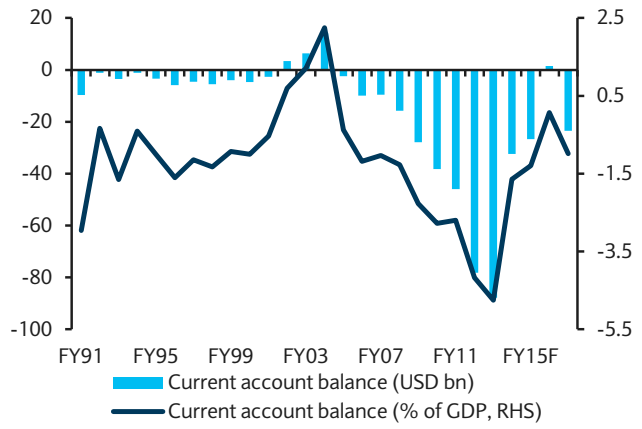
Swings in India's overall current account balance typically reflect fluctuations in the merchandise trade position. We expect a low commodity imports bill in the coming years to help keep the merchandise trade deficit low. Exports, on the other hand, should improve in the medium term as the government focuses on resolving infrastructure bottlenecks and helping to increase export capacity. India's export growth performance has been impressive in the past 15 years (CAGR: ~17%); though, admittedly, from a low base. Indeed, among the major emerging markets, India has posted the second-fastest average export growth, trailing only China. During this period, India's exports have risen by more than 8x in USD terms. The government's new "Make in India" campaign should also boost India's export performance.

FIGURE 11
FII inflows remain strong



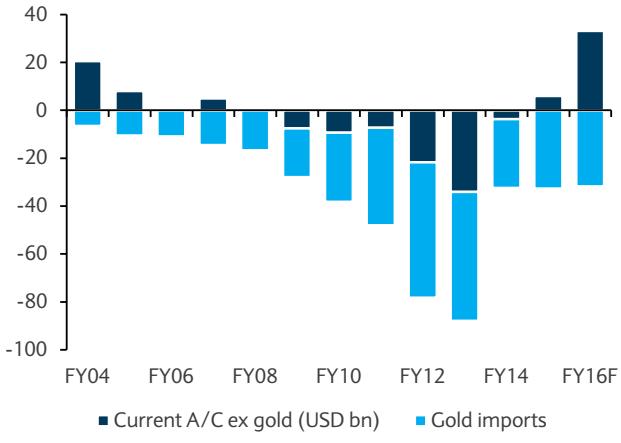
Source: Bloomberg, Barclays Research

FIGURE 12
Current account balance – eyeing a surplus



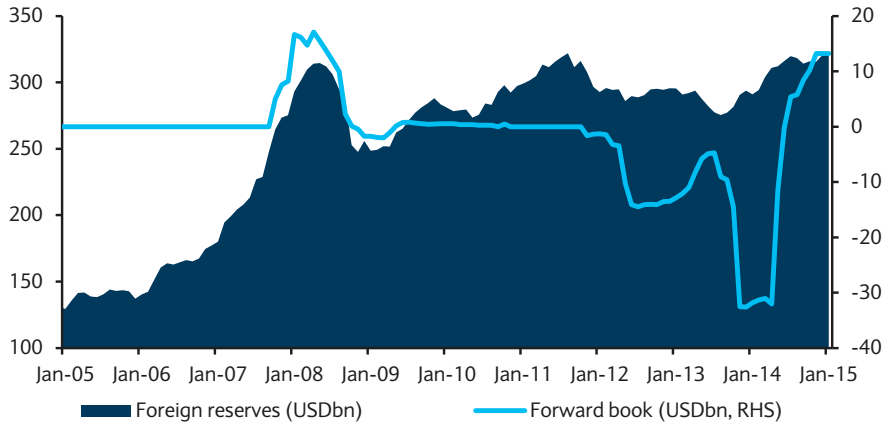
Source: RBI, CEIC, Barclays Research

FIGURE 13
Current account ex-gold gives a much stronger picture



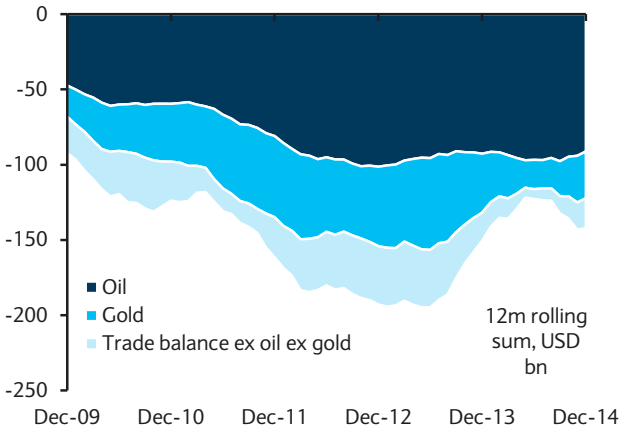
Source: RBI, CEIC, Barclays Research

FIGURE 14
Foreign reserves – back on a rising track



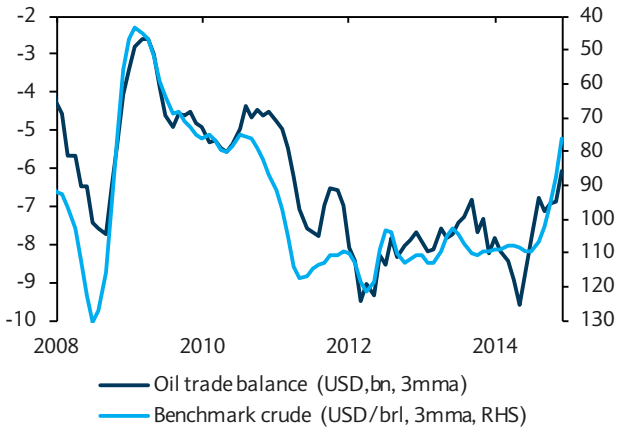
Source: RBI, CEIC, Barclays Research

FIGURE 15
Oil bill accounts for almost two thirds of total trade deficit



Source: Haver Analytics, Barclays Research

FIGURE 16
Fall in crude oil price – a major tailwind for India's BoP



Source: RBI, CEIC, Barclays Research

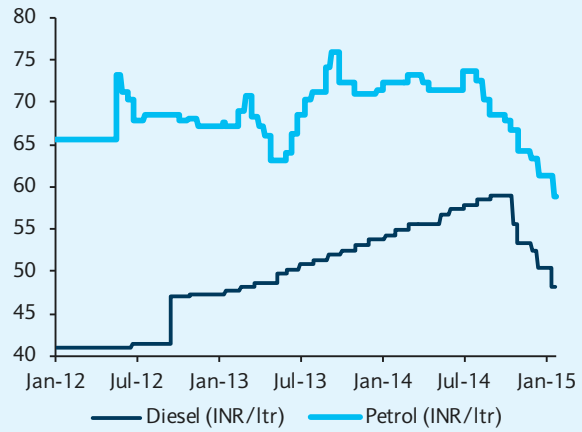
Lower oil price – A multi-pronged positive for India

The fall in oil prices is a boon for India. Our commodities team forecasts oil prices to average USD44/bl in 2015, rising to USD60/bl in 2016 (see Chapter 2, "Adjusting to a world of lower oil"). For India, oil prices directly affect its current account, fiscal balances, and inflation. The most direct and immediate beneficiary of lower crude oil prices is the current account. As a result of the current account balance turning positive in FY15-16, foreign reserve accumulation should increase sharply; we now forecast India's foreign reserves to rise from USD304bn in March 2014 to around USD330bn by March 2015 and to around USD380bn by March 2016.

The energy price plunge should also help ease inflation, which we now expect to stay relatively benign for longer. Given that the pass-through of lower global oil prices into domestic retail prices in India has been less than complete and slower than in several other countries, we see more modest declines in CPI than has been the case elsewhere. Even so, CPI looks set to undershoot the RBI's January 2016 'target' of 6%, on our estimates, which should lead to further rate cuts. We expect the RBI to cut the repo rate cumulatively by 75bp during 2015 (25bp already delivered). The fall in crude oil prices, coupled with deregulation of domestic fuel pricing, on the other hand, should accelerate fiscal consolidation. The government has used the fall in crude oil to cut subsidies and enhance revenue collection via higher excise duties on petrol and diesel. We estimate that this could create fiscal headroom of over INR1.2trn (USD19bn, or nearly 1% of GDP) in FY15-16, which could either be saved or spent on infrastructure. We expect the government to stick to its fiscal deficit target of 4.1% of GDP in FY14-15, and 3.6% in FY15-16 remains attainable, in our view.

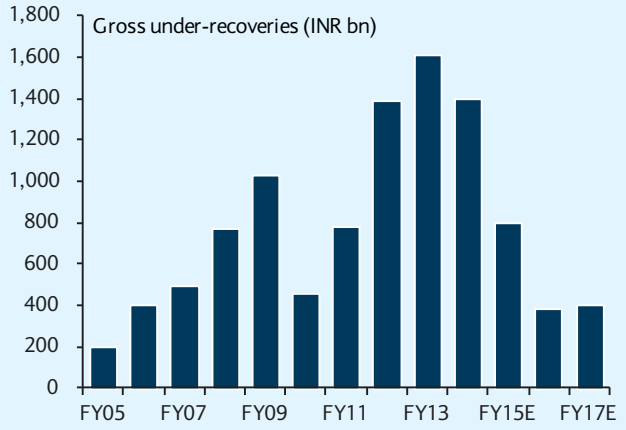
In terms of economic growth, the pass-through from oil is likely to take longer and depend on government spending. Much of the benefit from lower oil has been 'fiscalised', either through lower subsidies or higher indirect tax revenues (as discussed above). This will likely have a positive impact on government spending in FY15-16 and should complement investment and private consumption spending and, thereby, boosting growth (we forecast FY15-16 GDP growth at 7.8%). This can potentially have a negative impact on the current account, though it would positively affect the fiscal balance, given strong pro-cyclicality.

Domestic fuel price falls less than international prices, leaving a meaningful buffer in case of a fresh uptick



Source: Bloomberg, Barclays Research

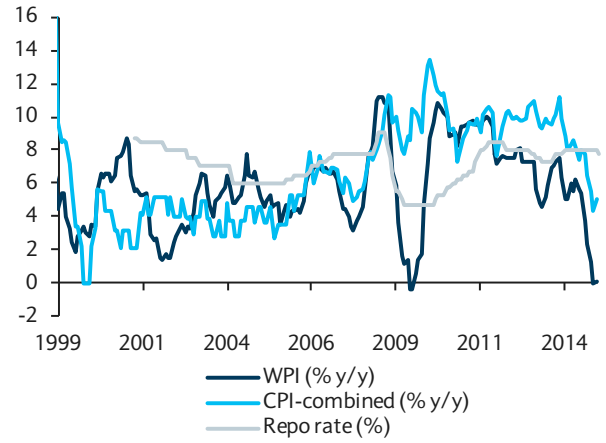
Decline in fuel subsidies will help cut fiscal deficit and boost capital expenditure



Source: PPAC, Barclays Equity Research

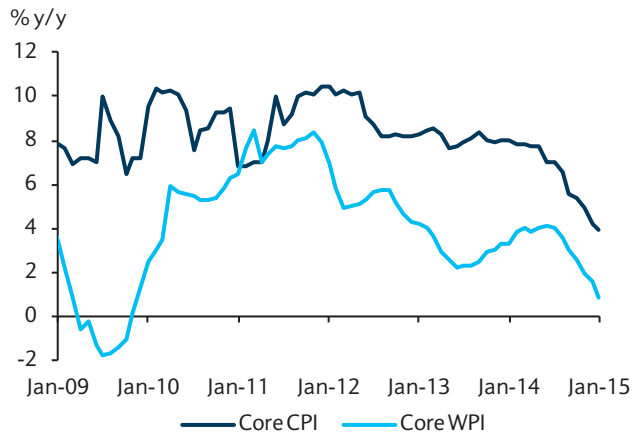
Liberalising FDI rules remains a key government focus. We expect policy initiatives to keep capital inflows into India strong, resulting in a persistent balance of payments (BoP) surplus. We think India's economy can sustain FDI levels of USD40-50bn (about 2.0% of GDP), which would play a key role in financing the current account gap. We believe the proposed opening of strategic sectors, including defence, insurance, railways and aviation, to foreign investment signals the government's willingness to attract more foreign investment to improve India's industrial capacity and benefit consumers. We expect other policy initiatives to boost foreign inflows, including raising the limits on foreign investment in the domestic debt market, and the potential issuance of (quasi-) government bonds in foreign currencies and/or offshore INR bonds.

FIGURE 17
Inflation continues to surprise to the downside…



Source: GoI, RBI, CEIC, Barclays Research

FIGURE 18
…on the back of a broad-based softening



Source: GoI, CEIC, Barclays Research

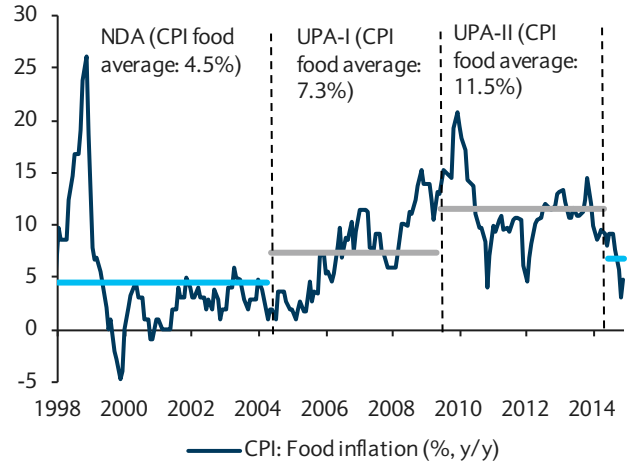
We expect the overall BoP dynamics to lead to a healthy accumulation of foreign exchange reserves at the Reserve Bank of India (RBI). Moreover, following the 2013 experience of uncertain BoP dynamics and rapid depreciation of the INR, the new leadership of the RBI seems determined to build foreign reserves to defend the currency, if need be. We think the RBI's forex reserves will likely reach USD450bn by FY 2018-19, even on what we consider to be a conservative assessment. India's import cover has averaged close to 11 months over the past two decades and around nine months over the past five years, above the IMF's recommended safe level of six months.

Inflation: Lower for longer

Inflation has historically been a key obstacle to sustained higher growth in India. High inflation in the past 6-7 years has largely been the result of public policy, in our view. Reining in inflation remains a key challenge for both the government and the RBI.

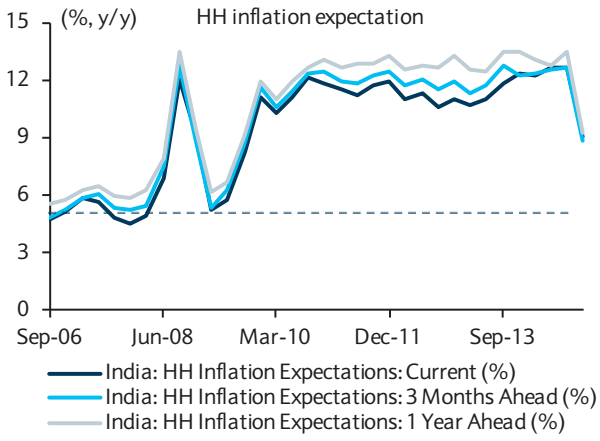
Although the longer-term issues of persistent inflation and generally entrenched inflation expectations have not faded, near- to medium-term inflation dynamics look more favourable. Disinflation in 2014 was significant and we expect inflation momentum to remain in check through 2015 and 2016. Core inflation remains manageable, given considerable idle capacity and weak pricing power in the manufacturing sector, and a stable INR. Food inflation in India

FIGURE 19
New government manages to drive food inflation lower…



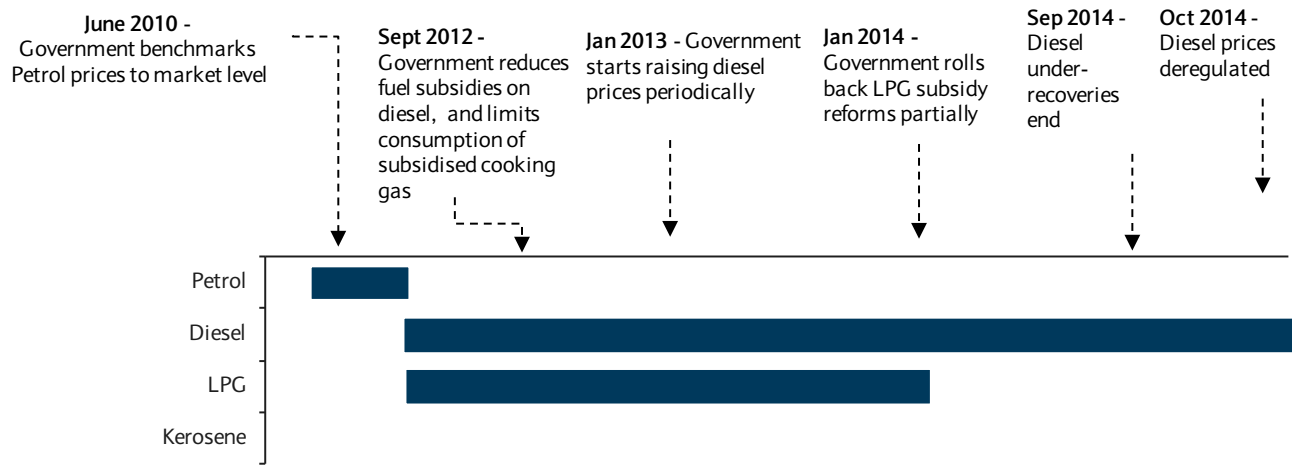
Source: GoI, CEIC, Barclays Research

FIGURE 20
…leading to a major drop in inflation expectations recently



Source: RBI, Barclays Research

FIGURE 21
India has delivered significant deregulation of fuel prices since 2010



Note: The horizontal bars in the chart above denote the indicative time period during which (since 2010) fuel price reforms took place. Source: PIB, Barclays Research

tends to be more volatile, but the new government has enjoyed some early success in tackling rising food prices. The ongoing weakness in commodity prices, which seems unlikely to be temporary, is also playing an important role in this context. The recent softening in inflation momentum thus appears quite broad-based. The central bank has also recently flagged downside risks to its early 2016 CPI inflation forecast of 6%. The material softening in inflation momentum triggered the start of rate cuts by the RBI in early 2015. We expect the RBI to cut the repo rate by a cumulative 75bp during H1 2015.

RBI appears keen to move on to an inflation-targeting framework

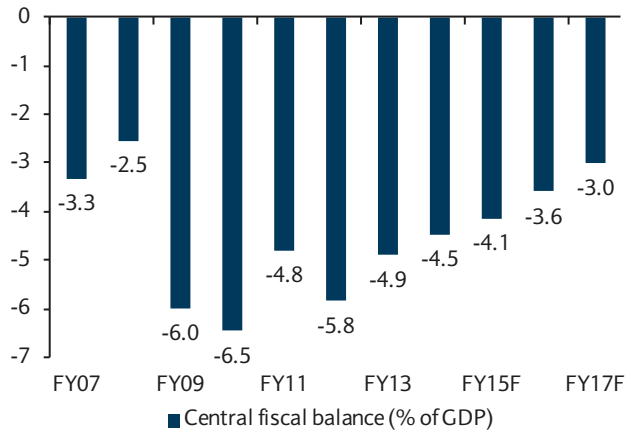
Our expectation of RBI rate cuts remains limited by the RBI's stated preference for maintaining a positive real (policy) interest rate spread of, say, 150bp or more. The RBI, under its new leadership, feels that a positive real interest rate will be effective in reining in inflation and boosting financial savings in the medium to longer term.

In January 2014, the RBI published a report by a committee (led by Deputy Governor Urjit Patel) on India's monetary policy framework. It proposed an overhaul of the conduct of monetary policy and management of the financial system in India. Since then, the RBI has appeared keen to implement several of the proposals, including adopting a 'glide path' for CPI inflation and a formal inflation-targeting regime (the committee's main recommendation). This inflation-targeting framework was proposed with the aim of anchoring inflation expectations, which have long been an issue in India. Under the proposed new framework, the RBI would follow a CPI inflation target of 6% by early 2016, and an eventual target of 4%, with a $\pm$ 2pp band from 2017 onward. The feasibility of formally adopting an inflation-targeting framework would need to be supported by the government. We think clarity on this issue is likely to emerge once the RBI and government reach agreement on restructuring of India's monetary policy framework, potentially in 2015.

Fiscal health: Consolidation gathers pace

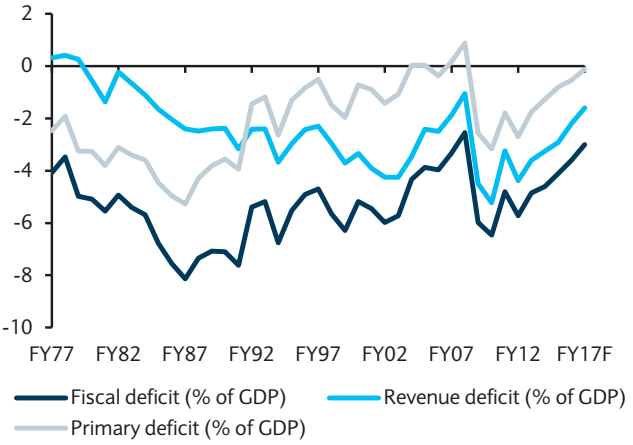
India's fiscal health has weakened materially in the post-crisis years but started recovering in 2012, despite a markedly weak growth backdrop. With fiscal policy now correcting course, we believe public finances are likely to continue improving. The government aims to reduce the fiscal deficit to 3.0% by FY16-17, from the recent peak of 5.7% in FY 11-12. We think the announced path of fiscal consolidation will be sufficient to improve the government's underlying fiscal position significantly. We think that the present fiscal deficit roadmap is by and large achievable, though it will likely require the government to undertake efforts to increase both tax and non-tax revenue as further cuts in expenditure would be challenging and counter-productive in the longer run.

FIGURE 22
India's fiscal deficit on a gradual consolidation path



Source: GoI, CEIC, Barclays Research

FIGURE 23
Primary deficit set to be close to zero by FY17



Source: GoI, CEIC, Barclays Research

The recent fall in global commodity prices, particularly oil prices, and the government's initiatives to gradually rationalise domestic energy prices, will likely be a material benefit for the fiscal balance over the coming years. A materially lower subsidy bill is likely not only to help reduce the fiscal deficit, but also to improve the quality of government expenditure by shifting it toward capital spending.

On the revenue side, the central government's level of tax collection has been stagnant for the past eight years. Tax cuts introduced to stimulate growth in 2009-11 had a long-lasting impact on the fiscal balance as the government's reliance on non-tax revenue rose, while 'fixed' expenditure (eg, subsidies, interest payments, defence) kept rising along with spending under various welfare schemes between 2008 and 2012. The government is also looking to boost revenues. A key initiative in this regard is the implementation of an integrated GST, potentially from 2016. Apart from broadening the tax base, we think a GST would trigger significant productivity gains, given the move to a single tax platform.

Indian assets on a strong footing

A constructive story for the rupee

Thanks to the improvement in investor sentiment and strong capital inflows after the elections, the INR was among the best-performing EM currencies in 2014 and has continued its relatively solid performance into 2015. Further out in the medium to longer term, we believe the macroeconomic and political backdrop has turned structurally more favourable for the INR. While there remains the risk that the RBI continues to limit nominal appreciation of the INR to support India's manufacturing sector and to rebuild FX reserves, we believe INR exchange rate volatility should be much lower compared with previous years. The increased stability of the INR, along with the relatively high carry and undervaluation of the currency, offers a much stronger proposition for owning the rupee from a medium- to long-term perspective, in our view.

Indeed, there are indications that the INR is undervalued based on FX valuation models. Our Behavioural Equilibrium Exchange Rate (BEER) model estimates real effective exchange rates (REERs) that are consistent with a global equilibrium between currencies and wealth, incomes, external assets, and fiscal policies. The INR is about 10% undervalued according to this estimate, suggesting that the currency is currently the cheapest in Asia. Moreover, compared with its 10-year average REER, we estimate that the INR is still about 6% undervalued. Separately the World Bank's estimate of the PPP-implied USDINR exchange rate stood at 16.76 at end-2013, compared with the spot rate of 61.90 at that time. Interestingly, the INR is currently the third most undervalued currency globally according to The Economist's Big Mac Index (after the UKH and the RUB). The INR's cheapness suggests that it may be less susceptible to downside pressure during the upcoming Fed tightening cycle and as the USD strengthens on multi-year basis as we forecast.

We believe the undervaluation of the INR is likely associated with two factors. First, the INR was previously under pressure from the widening current account deficit, which in turn was associated with the failure of domestic production capacity to keep up with the rapid growth in domestic demand. Factors such as higher CPI and wage inflation in India relative to trading partners, infrastructure bottlenecks and rigid land and labour laws limited the improvement in competitiveness of the manufacturing and export sectors. Consequently, import growth outpaced export growth during the boom years. Second, the RBI has tended to limit INR appreciation during times of strong capital inflows. According to our estimates, FX reserve accumulation in India's amounted to around 4% of GDP during 2001-14. Although this is a comparatively slower pace than in other countries in the region, such as Singapore (8.3%) and China (5.8%), over the same period, it was higher than in Malaysia (3.2%) and Indonesia (0.5%).

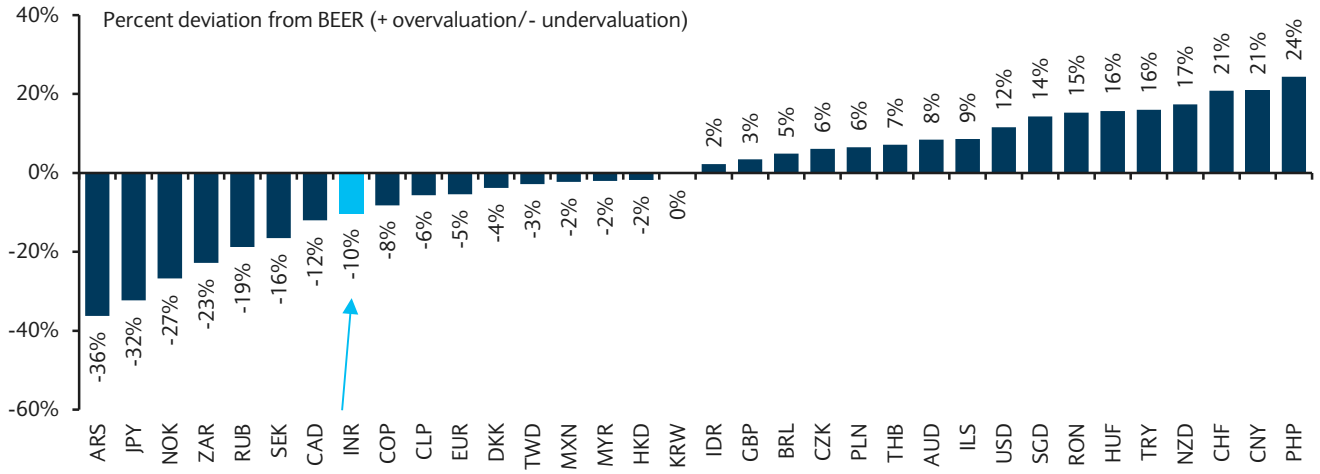
However, macroeconomic fundamentals in India are improving and should help to lessen the pressure on the INR. Importantly for the rupee, India's current account deficit should narrow significantly on lower oil prices and an improvement in savings/investments ratio. Lower inflation, as a result of cheaper fuel, should also enable the RBI to cut interest rates further to boost growth and investment. Structurally lower consumer price and wage inflation, along with reforms to regulations on infrastructure development, land acquisition and labour, should also help strengthen the competitiveness of the manufacturing and export sectors. Above all, India is embarking on a higher growth trajectory, which in turn should raise the attraction of and demand for the rupee among foreign investors.

Even if the current account balance eventually weakens on stronger domestic demand, we do not expect India to face difficulties funding the deficit, given the likelihood that the country will continue to attract both short- and long-term inflows as Prime Minister Modi's government implements its reform agenda. The government also may gradually lift the limits on foreign investors' investments in local debt, and FDI regulations are being relaxed gradually. Indeed, the prospects of long-term structural investment inflows should reduce the reliance on short-term, "hot money" flows, leaving the currency less susceptible to capital flow gyrations.

Despite improving fundamentals and strong capital inflows, USD buying by the RBI to rebuild FX reserves allowed limited INR appreciation in the recent past. However, we think the healthy increase in FX reserves has strengthened RBI's capacity to defend the INR in times of market stress and currency weakness. Although we expect a likely continued increase in foreign exchange reserves over coming years to limit INR appreciation as the RBI absorbs dollars, this will in turn provide a higher degree of confidence and stability in the rupee over the long term.

FIGURE 24

The INR is among the most undervalued currencies



Source: Barclays Research

Overall, we expect the INR to come under less pressure than in previous years, even though the currency could still depreciate against the USD in a strong-USD environment. Since the 1990s, much of the appreciation of the INR effective exchange rate has occurred in real terms due to relatively faster inflation in India; the INR NEER has been on a downward path. However, we see scope for the currency to appreciate in NEER terms, given the improvement in macro fundamentals, with NEER appreciation helping to play a bigger role in correcting some of its undervaluation over the medium term. We also think the INR will likely remain an attractive proposition to yield-seeking investors in a world of depressed interest rates.

Additionally, India's currency framework will undergo further structural reforms over the coming years, and this should help to strengthen confidence in the rupee. India is set to continue to gradually move towards capital account convertibility after making the current account convertible in 1994. Currently, a limited amount of capital account transactions are permitted. The RBI has taken more steps in recent years to relax regulations around foreign exchange transactions. However, we expect foreign investors to be allowed increased access to India's capital markets, especially India's bond markets where there is a cap on such inflows. Importantly, India is also likely to allow its huge pool of domestic savings to increasingly access foreign markets. However, caution over possible disruptions to the domestic financial sector means that this process will likely continue to be gradual.

Bonds on a secular bull run; overweight duration

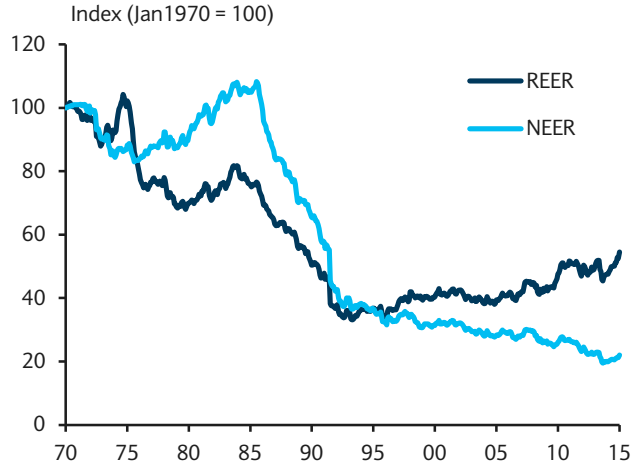
A sustained decline in inflation, a rise in household financial savings and current account rebalancing should provide a favourable backdrop for a decline in government bond yields, in our view. We expect a secular bull market in bonds over the next 2-3 years and see room for 10y benchmark government bond to return ~25-30% by end-2017. We expect India's benchmark 10y local-currency government bond yield to fall to ~7.25%, from 7.75% currently, by the end of calendar year 2015, and possibly below 7% in the next couple of years.

Government efforts to tackle food inflation, which had pushed inflation expectations up, will be critical for sustained positive real rates and in driving our expected decline in yields. We expect positive real rates to result in higher financial savings. Given fiscal consolidation, we expect demand/supply dynamics to turn favourable. Key developments over the next three years that should support lower yields:

- Fiscal consolidation, lowering the central government deficit to 3% of GDP.

FIGURE 25

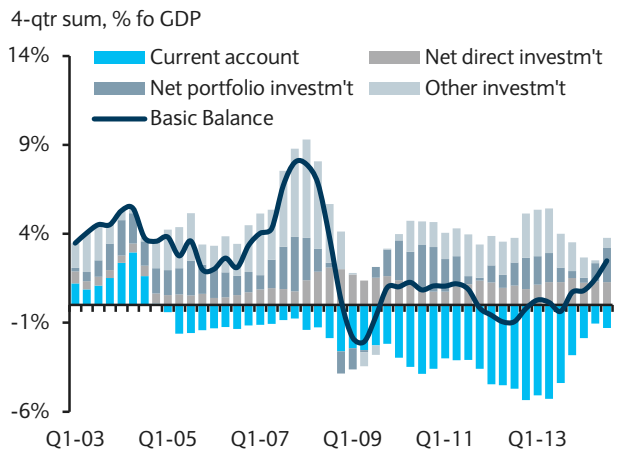
Much of appreciation of the INR since 1990 has occurred in real terms, due to faster inflation In India, not due to nominal appreciation



Source: Bruegel, Barclays Research (Click *here* to view the INR REER in Barclays Live)

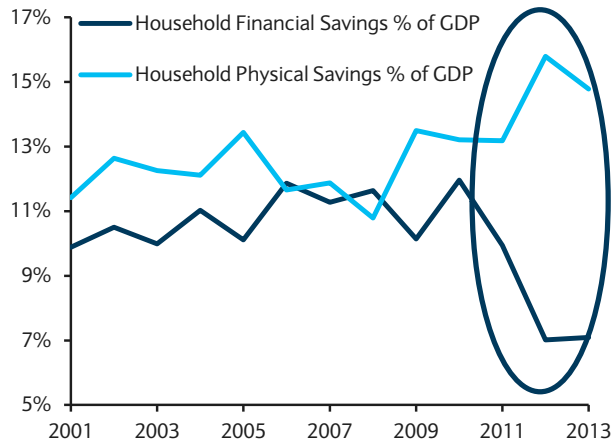
FIGURE 26

India's external balance is improving, with capital inflows picking up while the current account deficit is narrowing



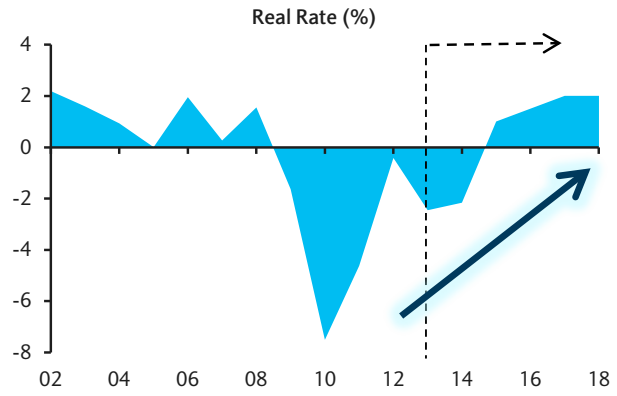
Source: Haver Analytics, Barclays Research

FIGURE 27
Household financial savings have declined since 2010…



Source: RBI, Barclays Research

FIGURE 28
… however, with a sharp rise in real rates, we expect the 2010-13 trend in household financial savings to reverse



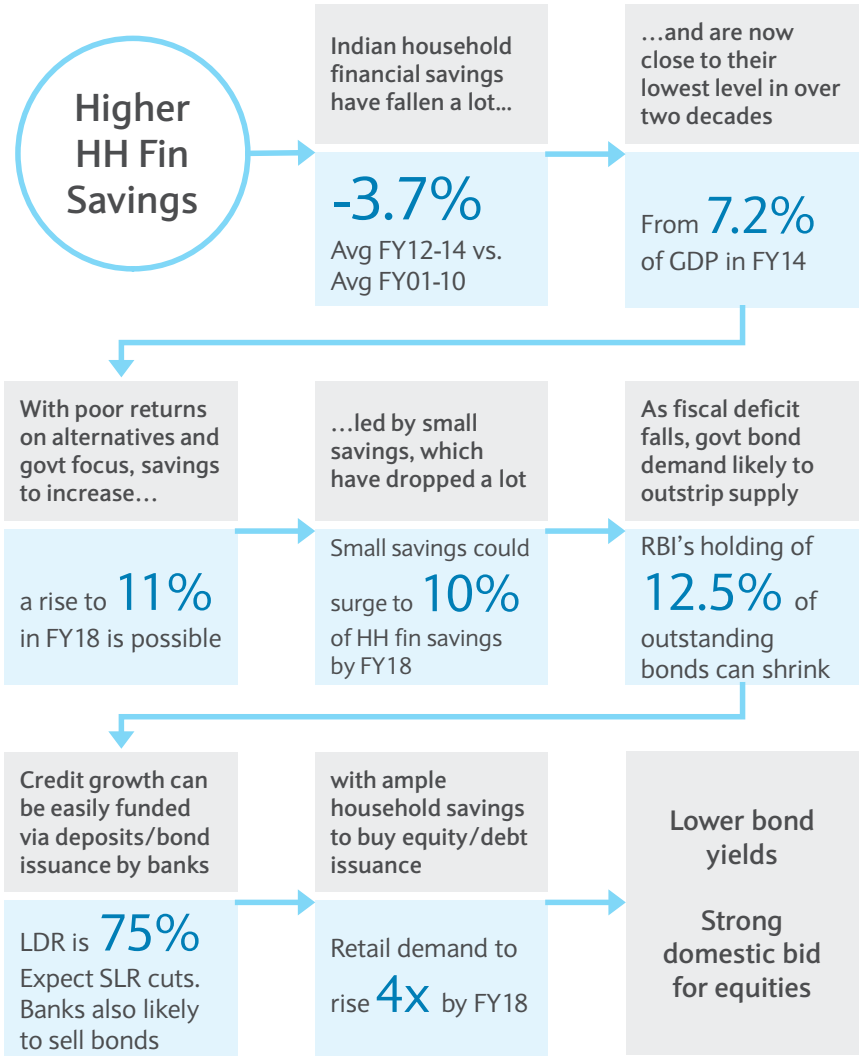
Source: CEIC, Barclays Research

- Sustained positive real rates, resulting in a rise in household financial savings to 11% of GDP by FY18 from 7.1% of GDP in FY13. This should boost demand for bonds from insurance companies and pension funds.
- A rise in financial savings, coupled with an increased government focus on small savings, should reduce net state and central government borrowing from the market to 65% of the fiscal deficit in FY18 from ~85% in FY 14.
- Regulators gradually opening up the bond markets to foreign investors.

A paradigm shift in demand/supply dynamics for financial savings

- Indian households' financial savings rate has declined over the past four years as a result of high inflation (negative real rates) and very high returns on physical assets, including real estate and valuables. Household financial savings have declined from a stable 11-12% of GDP in the 2000s to close to 7% of GDP.
- However, given falling inflation, the government's renewed focus on small savings and the RBI's anti-inflation stance, we think positive real rates are here to stay and that the trend in household financial savings is set to reverse (see Chapter 1, " Population Dynamics and the (soon-to-be-disappearing) global 'savings glut'"). Moreover, given poor returns on valuables and real estate, the backdrop looks favourable for a rotation from physical savings to financial savings. Finally, a broader choice of financial savings products and a savings boost from wider pension access and revitalization of small savings programs should help speed the process (see *Asia Macro Themes: India: A step change* for details.)
- In our view, pension funds, insurance and equity/debt instruments are set to attract substantially larger flows given increased product penetration and focus. We expect this flow increase to outpace the issuance of bonds; hence, pension and insurance demand for equities and corporate debt should increase. Although deposits are likely to attract a smaller portion of the expected rapid expansion of the household savings pool, we expect them to still grow in line with nominal GDP. Banks can fund strong credit growth through bond issuance and by reducing their government bond holdings.

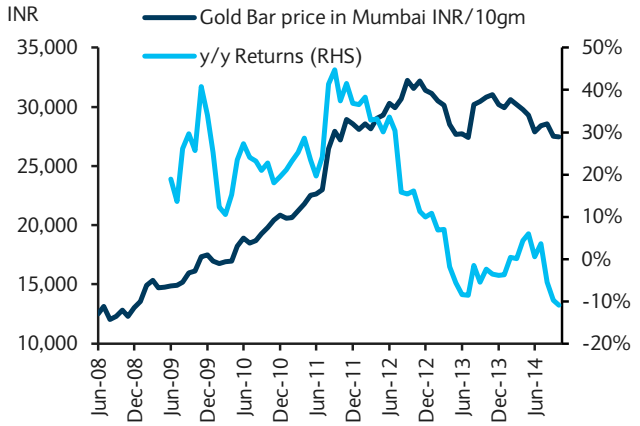
FIGURE 29
Higher savings can kick-start virtuous cycle for asset markets



Source: Barclays Research

FIGURE 30

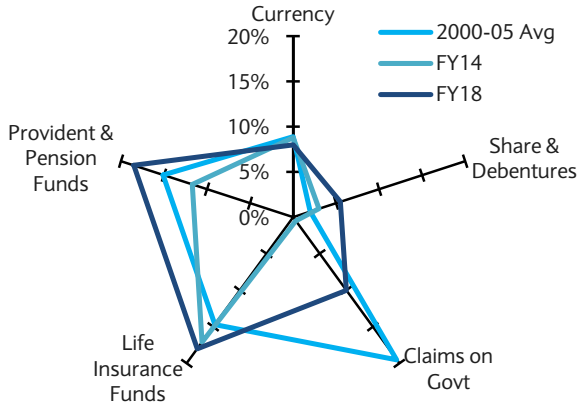
Gold is less attractive as an investment/inflation hedge



Source: Bloomberg, Barclays Research

FIGURE 31

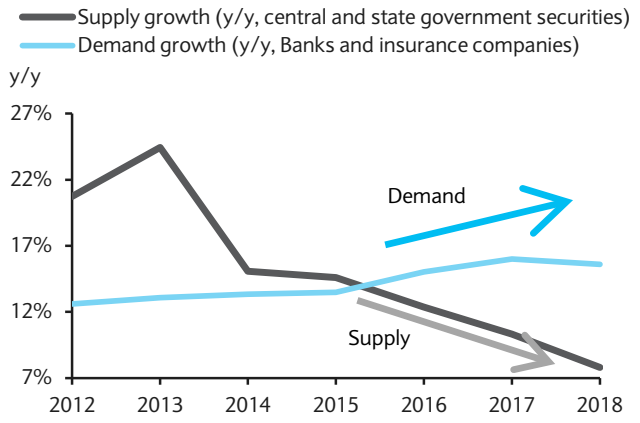
Mix likely to change with more small savings



Source: RBI, Barclays Research

FIGURE 32

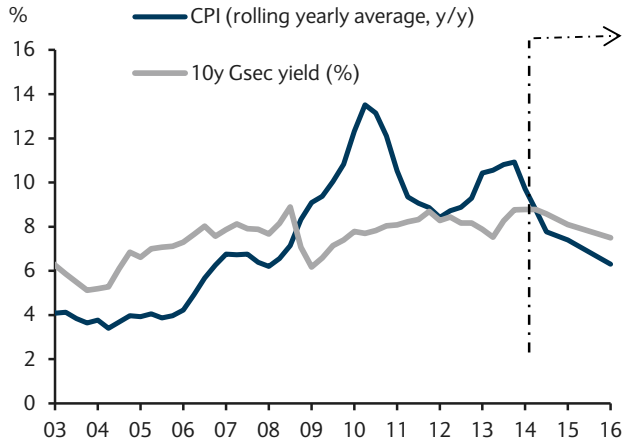
Demand/supply divergence



Source: CEIC, Barclays Research

FIGURE 33

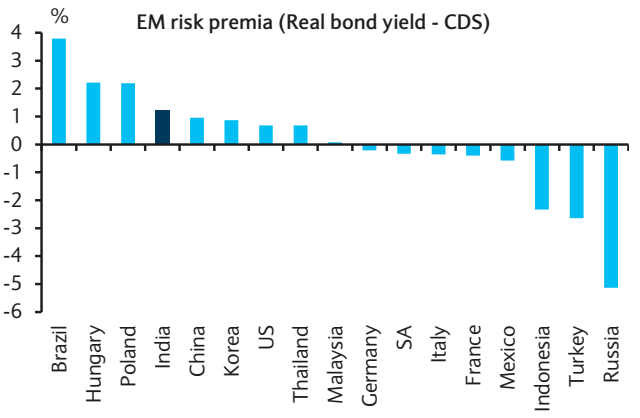
Bond yields set to decline gradually against a backdrop of sustained disinflation



Source: CEIC, Bloomberg, Barclays Research

FIGURE 34

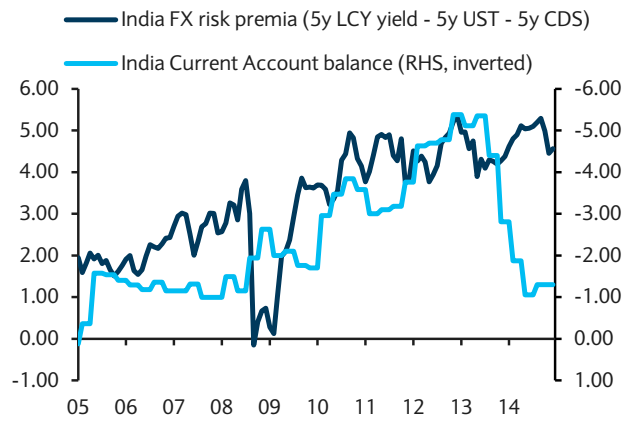
India has one of the highest EM risk premia



Note: For India, we use 5y SBI CDS. Source: Barclays Research, Bloomberg

FIGURE 35

Significant current account adjustment would accelerate a sharp decline in FX risk premia

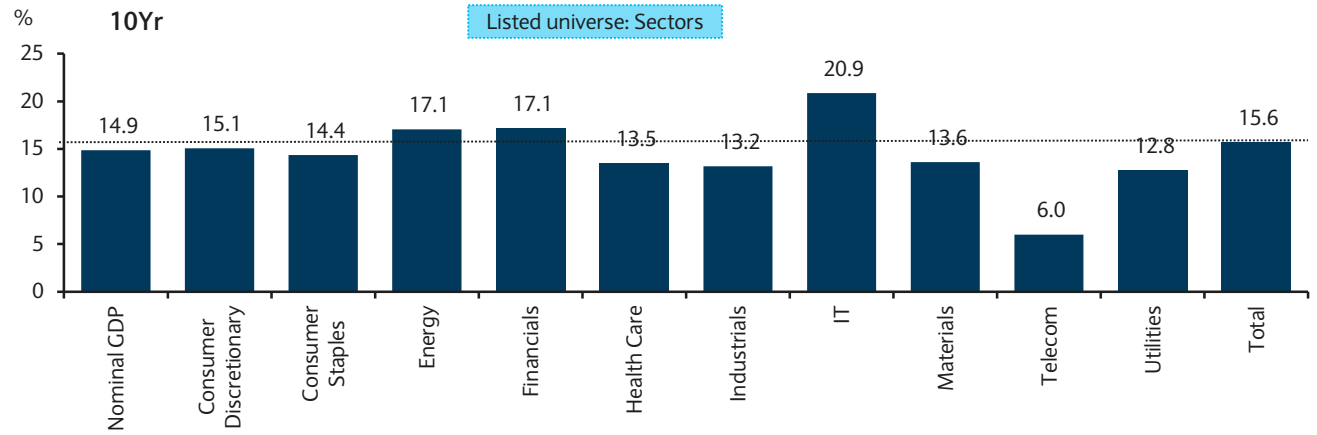


Source: Bloomberg, Barclays Research

Equities: Indian stock market could have multiple years of growth in the mid to high teens[80]

- Strength in India's GDP growth should also be reflected in a higher growth trajectory for the corporate sector. Even if the sector's top line moves only in line with nominal GDP growth rates, we would expect top-line growth in the low teens for Indian corporates.
- Looking at the bottom-up estimates of our research analysts, we think sectors including financials, healthcare, consumer, autos and infrastructure could exhibit strong double-digit growth over the next decade. New sectors could also emerge, with e-commerce and alternative energy (largely solar) two areas that we believe could return 20%+ annual growth over the next 10 years.
- On various metrics, including market cap to GDP and market-implied growth rates, we find Indian valuations reasonable. Furthermore, during periods of strong growth, market multiples usually increase. We thus believe that the Indian market could have multiple years of returns in the mid to high teens.

FIGURE 36
Sectoral growth trends in India over the past decade



Note: Listed companies' sector growth rates are based on an analysis of 640 standalone companies' financials.
Source: Planning Commission, Reserve Bank of India, Prowess, Barclays Research

FIGURE 37
Barclays analysts' expectations of growth in sectoral market size over the next decade

	Now	2025E	CAGR
Consumer	US$37bn	US$160-220bn	14-18%
- Organized Retail (Penetration)	6%	20%	
Healthcare	US$100bn	US$350-380bn	13-15%
- Diagnostics	Rs230bn	Rs834bn	27%
- Domestic Pharma	US$15bn	US$55-65bn	14-16%
- Health Insurance	Rs192bn	Rs464bn	16%
Internet			
E-commerce	US$13bn	US$150bn	28%
Internet Penetration	21%	46%	
Financial Services			
- Credit growth			16-17%

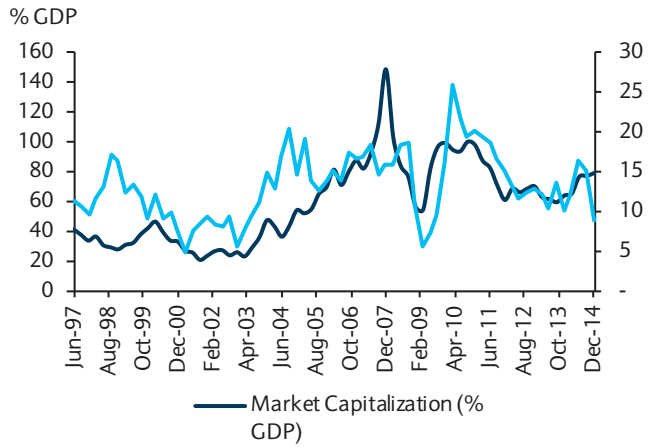
[80] This section summarises the views of our equity analysts published in *Asia Themes: India in the next decade*, 19 January 2015.

	Now	2025E	CAGR
- Credit penetration	55%	71-76%	150-180bp/year
- Retail Mortgage Penetration	7.50%	12-15%	18-22%
- Corporate Lending Penetration	43%	51%	15%
Materials			
-Cement	220mt	465mt	7.0%
- Steel	82mt	175mt	6.5%
Infrastructure			
- Road Passenger Traffic	7,000BPkm	20,000BPkm	11.0%
- Road Freight Traffic	1,400BTKm	3,400BTKm	8.3%
- Solar Infrastructure	2,800MW	20,000MW	22%
Autos			12-14%
- Cars	2.5mn	11.3mn	15%
- Two-wheelers	14mn	40mn	10%
Oil & Gas			
- Oil Demand	3.7mbd	5.4mbd	3-4%
- Natural Gas demand	51bcm	107bcm	7-8%

Note: mbd is million barrels per day; bcm: billion cubic metres BPkm: Billion person kilometres, mt: million tones.
Source: Reserve Bank of India, Government of India, BP Statistical Review, Barclays Research estimates

FIGURE 38

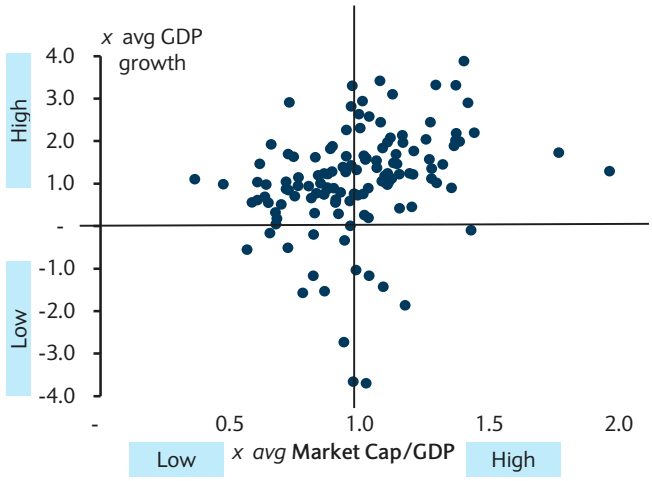
India's market capitalization as % of GDP still below historical highs



Source: World Bank, RBI, Barclays Research.

FIGURE 39

Across major nations, stock market capitalization as % GDP tends to rise in periods of high growth



Note: We used 10 major stock exchanges and countries to construct the above chart. The market capitalization as a % GDP and GDP growth rate of each country for the past four years are represented as x times avg over the past decade. "Low" market cap/GDP thus implies a value lower than that country's last 10 year avg.
Source: World Bank, United Nations, Bloomberg, Barclays Research.

India looks set for multi-notch upgrade to high BBB by 2017

We expect India's sovereign foreign currency ratings to move to high BBB (from current low BBB levels) by 2017. Upgrades are likely to occur against a backdrop of sustained higher growth, relatively stable inflation and continued fiscal consolidation. A sustained decline in crude oil prices provides significant support for these trends.

Addressing asset-quality issues and improving the capitalisation of public sector banks will be pivotal to achieving a two-notch upgrade in three years, and we think the government and regulators are making progress on both fronts.

Key developments that should serve as milestones over the next three years include:

- Fiscal consolidation driving the central government deficit toward 3% of GDP. Improved quality of spending through subsidy reforms and progress on implementing a GST to strengthen long-term fiscal health.
- Improvement in the strength and effectiveness of institutions, reflected in better governance indicators, such as ease of doing business, rule of law and control of corruption, thereby improving the business climate
- Banking sector reform is set to increase the capitalisation levels of public-sector banks, in line with Basel III guidelines, improve corporate governance and reduce the level of non-performing assets.

Key risks to our view

- Reduced political willingness to push for reforms in the face of any electoral setbacks.
- Domestic social tensions and local security risks that could have a destabilising effect on investment and growth prospects.

FIGURE 40
Key rating factors

	Key rating factors				
	Fiscal and government debt dynamics	**Growth dynamics**	**Institutional effectiveness/ governance**	**Monetary policy effectiveness/ credibility**	**Banking system**
Rating positive trends needed between now and 2017	Central government fiscal deficit moves towards 3% by FY17 Debt/GDP decreases by over 4% in FY17 vs. FY14 levels	Growth continues to accelerate and reaches near 7% by FY17 Growth is not funded by a surge in credit	Improvement in governance indicators and competitiveness indicators to 2003 levels. General agreement on policy direction with predictability	CPI Inflation settles around the mid-single digit zone by FY17 with lower volatility Higher degree of perceived independence for the central bank	Capitalisation levels increase across the system with a buffer to Basel III ratios Stressed assets decrease to 2011 levels
Sensitivity of our rating view to downside risks	Slippage in deficit by 20-30bp or in debt/GDP by 2% can be absorbed	Low 6% growth unlikely to change trajectory	Significant slippage could have an effect on ratings	CPI inflation in the mid-single digit zone would not be a headwind if volatility is limited	Critical to upgrades and any slippage can constrain ratings

Source: Moody's, S&P, Barclays Research

CHAPTER 7

FX risk in a multi-asset portfolio

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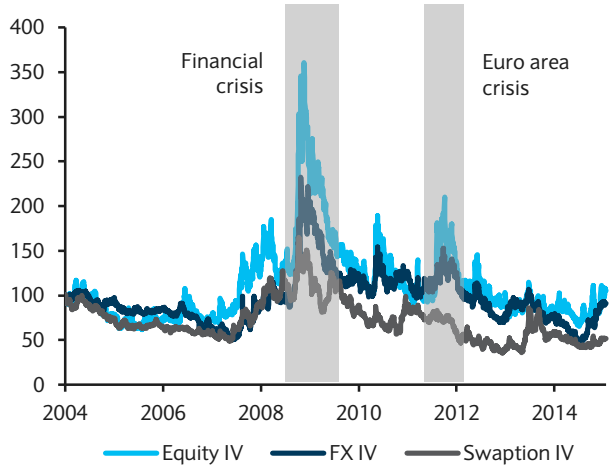
- **After falling to historically low levels between mid-2012 and mid-2014, cross-asset volatility has risen recently. We think a trend rise in volatility may be forthcoming in a highly asynchronous global economic recovery with elevated macroeconomic uncertainty related to demographic and structural changes across major economies.**
- **An increase in foreign exchange market volatility has the potential to erode returns and raise portfolio-level volatility in international multi-asset portfolios.**
- **We construct a standard 60%/40% (equities/bonds) international portfolio and find that higher Sharpe ratios – ie, risk-adjusted returns – are achieved, both ex ante and ex post, through FX hedging of the bond portfolio.**
- **Our results appear to be driven mainly by an increase in the negative correlation between bonds and equities, particularly during periods of heightened volatility, when bonds are FX hedged.**
- **However, by analyzing a set of subsamples, we find that FX hedging can generate superior risk-adjusted portfolio returns during market stress and in "normal" periods.**

Whether or not to hedge foreign currency investment exposure is an important decision for international investors. Heightened or rising FX market volatility can erode returns and introduce portfolio volatility. Hedging can reduce this volatility and give portfolio managers and investors a degree of certainty, but there are also costs. In the case of a passive FX hedging strategy (in which the foreign currency component of a portfolio is sold forward on a rolling basis) direct costs include transaction costs or the price of the hedging instrument (eg, FX options premiums), and large, unanticipated cash flows as hedges mature. Indirect costs might be the degree to which the existence of the hedge reduces overall portfolio returns.

FX volatility is likely to rise in trend from the low levels of recent years

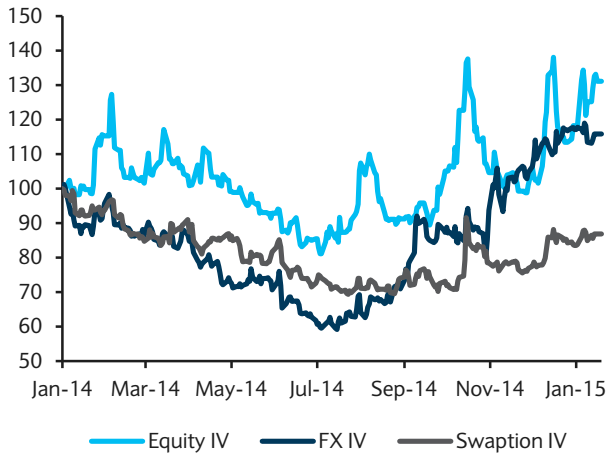
We think FX volatility is likely to rise in trend from the low levels of recent years. In this chapter, we examine how high FX volatility affects an international portfolio and whether or not FX hedging helps to improve the risk-adjusted portfolio performance of a balanced international portfolio. We also examine the impact on an international portfolio, hedged and unhedged, of a trend rise in the USD, which we expect in coming years. Specifically, we

FIGURE 1
Financial market volatility has picked up recently…



Note: IV = Implied Volatility, indexed to 100 in January 2004. Source: Bloomberg, Barclays Research. A version of this chart can be found on Barclays Live, *here*.

FIGURE 2
… particularly in FX markets



Note: IV = Implied Volatility, indexed to 100 in January 2004. Source: Bloomberg, Barclays Research. A version of this chart can be found on Barclays Live, *here*.

examine the historical performance of risk-adjusted returns to a standard 60%/40% (equity/bond) international portfolio with and without FX hedging of the bond portion of the portfolio under differing volatility conditions and trends in the USD. We explore only bond portfolio hedges for ease of calculation and because equity portfolios are usually unhedged because of the greater volatility of the underlying asset.

FX hedging the bond portfolio raises the negative correlation between equity and bond returns, driving the volatility of the overall portfolio lower and improving risk-adjusted returns

Our results show that FX hedging the bond portfolio raises the negative correlation between equity and bond returns, driving the volatility of the overall portfolio lower and improving risk-adjusted returns. Our analysis suggests that this feature is particularly pronounced during periods of heightened market volatility (eg, the 2008-09 global financial crisis and the euro area debt crisis of 2011-12). Our results also hold more generally and suggest significant benefits from hedging the FX exposure of the bond portfolio even in "normal" periods.

Return to volatility

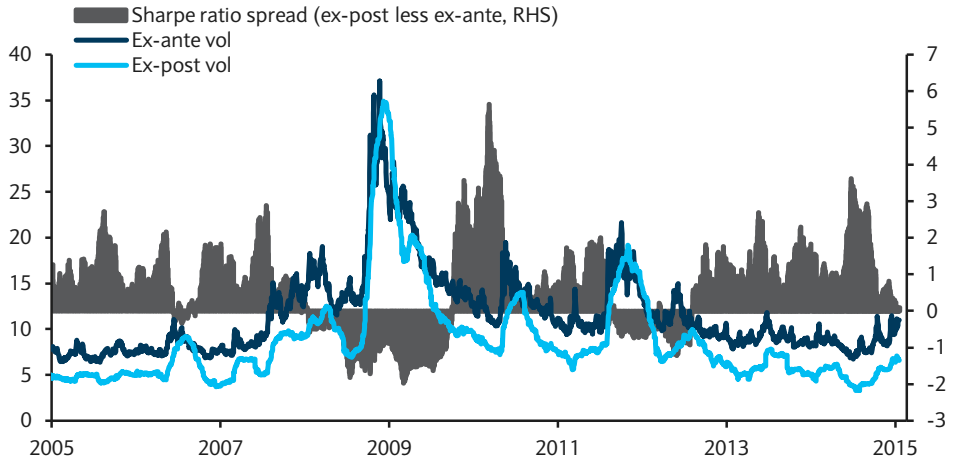
Between mid-2012 and mid-2014, volatility across asset classes declined to historically low levels (Figure 1). Extremely accommodative global monetary policy, increased financial regulation, a decline in macroeconomic volatility, greater synchronicity of global economic cycles and, perhaps, auto-correlation of volatility, all appear to have dampened volatility in recent years (see *Three Questions: Gone fishin'*, 4 August 2014, for a detailed discussion of some of the factors behind low realized volatility during this period).

China is likely to remain a source of uncertainty as it attempts to rebalance its economy toward consumption while managing a structural slowdown

We expect the highly unsynchronised global economic recovery, broad demographic trends (see Chapter 4, "The great destruction") and structural economic change in major economies, including China and India, to lead to a sustained rise in macroeconomic uncertainty, creating an environment of higher financial market volatility. We forecast the euro area economy to grow at less than half the pace of the US over the next two years. Strong growth and an improving labour market should support a multi-year process of Fed policy normalisation, which is likely to begin in June, in our view. In contrast, we expect several small, open-economy central banks to introduce further stimulus this year in response to weak inflation outlooks and unwanted exchange rate appreciation. In some cases, this could include the introduction, or expansion, of extraordinary measures, such as negative deposit rates and quantitative easing (see *Three Questions: Quantum Evolution*, 27 January 2015). Elsewhere, China is likely to remain a source of uncertainty as it attempts to engineer a rebalancing of its economy away from investment and exports toward consumption while managing a structural slowdown stemming from an ageing population and declining labour force. Moreover, significant structural change in India is also likely to take place over the coming years under the Modi government (see Chapter 6, "India: A step change"). Additionally, continued political uncertainty in Europe is a reminder of the unsettled risks *around European* Monetary Union.

FIGURE 3

Our hedged portfolio results are consistent with existence of positive volatility risk premium



Source: Barclays Research

The recent pick-up in financial market volatility has been most pronounced in FX

One of the most interesting features of the recent pick-up in financial market volatility is that it has been most pronounced in FX markets (Figure 2). One possible explanation is that currencies are the most liquid and accessible assets through which to express a view on market risks or to hedge exposure. Indeed, history suggests that higher FX volatility rarely occurs in isolation and the prospect of higher volatility in other asset classes adds further risk to multi-asset portfolio returns. Furthermore, there is a strong theoretical basis for a relationship between volatility across asset classes. In equities, volatility in FX affects the earnings of companies with international exposure in either their product or supply chains. However, causality can also be argued in the opposite direction as changes in the price of domestic assets, both equities and bonds, will tend to result in changes in demand for local currency by foreign investors. Indeed, statistical analysis over our sample period proves inconclusive in this respect, showing two-way causality between FX volatility and that of bonds and equities.

Data analysis and methodology

We use a modified version of the Sharpe ratio because of its tractability

To examine the impact of rising volatility on portfolio returns, we focus on the response of risk-adjusted returns. We choose to think about risk and reward via the commonly used Sharpe ratio. The Sharpe ratio, also known as the reward-to-variability ratio, is a mathematical construct formally defined by William Sharpe in 1966. It measures a portfolio's predicted performance as the ratio of its expected rate of return per unit of variability or risk.[1] Although it is an imperfect measure of risk-adjusted performance when returns are not normally distributed, we choose to use (a modified version of) the Sharpe ratio because of its tractability and ease in *ex ante* portfolio choice given a particular risk tolerance and in *ex post* performance evaluations.

Given a portfolio, the Sharpe ratio is defined as:

$$S = \frac{E(r_p) - r_f}{\sigma(r_p)}$$

where $E(r_p)$ denotes the expected portfolio return, r_f is the risk-free rate and $\sigma(r_p)$ is the relevant measure of portfolio volatility. For *ex post* volatility we use the historical standard deviation of returns; for the *ex ante* measure we integrate implied volatilities of underlying portfolio components using historical co-variation. Realized volatility represents a statistical measure of variability of the actual return distribution over a specific time horizon. In contrast, implied volatility represents the market's best estimate of future volatility, given today's information. It is usually implied from prices of liquidly traded options and will on average be higher than realized volatility. This stylized fact, often referred to as the *volatility risk premium*, discussed below, ensures sufficient compensation to risk-averse sellers of options for their asymmetric payoffs.

Because we are interested in assessing the impact of FX hedging the bond component of our market portfolio, we use the following modified version of the Sharpe ratio:

$$S = \frac{E(r_p) - r_f - \alpha h}{\sigma(r_p)}$$

where h represents the cost of FX hedging and $\alpha \in (0,1)$ is the share of the bond portfolio that is hedged. We consider three values for α: 1, 0.5 and 0; ie, full hedging, 50% hedging and no hedging.

In our analysis, we use daily data from 1 January 2004 to 14 January 2015. For the equity component of our portfolio, we use the MSCI ACWI index, which covers approximately 85% of the global investable equity opportunity set and includes 23 developed and 23 emerging

[1] See Sharpe, William F. "*Mutual Fund Performance*," The Journal of Business, Vol. XXXIX, No. 1, Part II, January 1966. A Sharpe ratio is a sufficient measure of risk-adjusted performance if returns are normally distributed, but may not fully describe the risk-return tradeoff if returns are not derived from a distribution fully characterized by its mean and variance.

market indices.[2] *Ex ante* equity returns are calculated as the inverse of the forward-looking price-to-earnings ratio (inverse P/E, or earnings yield) of the MSCI ACWI index, whereas *ex post* returns are computed as the rolling annual return. Because MSCI ACWI options are not regularly traded in the market, the *ex ante* volatility of the MSCI ACWI is approximated by the implied volatility from options on the SPX, SX5e, UKX, NKY, and HIS. To calculate this measure, we first construct a replicating portfolio consisting of fixed weights in those five indices with the aim of minimizing a tracking error against the MXWD ACWI index. Using the estimated weights, we combine the at-the-money-forward volatilities for each index. We use the three-month point on the volatility curve. It should be noted that our weighted volatility measure may somewhat overstate the true underlying volatility because correlation between the five indices is disregarded in our construction.

For the fixed income component of our portfolio, we create a simplified variation of the Barclays Global Aggregate Bond Index using its USD, EUR, JPY and GBP subindices. Our G4 fixed income portfolio represents approximately 92% of the Barclays Global Aggregate Bond Index. Using only four currencies greatly simplifies the calculations, particularly in capturing co-variation between the components, and the high proportion of the Barclays Agg invested in these four currencies suggests that our proxy is a representative measure of a realistic global fixed income portfolio. We use the weighted sum of yield to maturity of each corresponding sub-index as the *ex ante* return of the bond component of the portfolio and the weighted sum of annual returns as *ex post* bond returns. For an *ex ante* measure of volatility, we use G4 3-month into five-year at-the-money normal swaption volatilities, and in contrast to our equity measure we do account for co-variation across currencies as it is important to our analysis of hedging decisions. We chose 3m5y swaptions since our Barclays Global Agg index has roughly a five-year average duration over the sample period.

Using the above and three-month USD LIBOR for the risk-free rate, we calculate *ex ante* and *ex post* rolling Sharpe ratios for a fairly typical market portfolio consisting of 60% equities and 40% bonds. *Ex ante* Sharpe ratios represent the expected excess return of a market portfolio per unit of predicted portfolio standard deviation, ie, the portfolio's implied volatility. In calculating this, we create a measure of implied portfolio volatility that considers not just the variability of each individual portfolio component, equities, bonds and FX, but also how the three components co-vary. The *ex post* Sharpe ratio is simply the realized excess return of the 60/40 portfolio divided by the standard deviation of returns.

Theoretically, we expect increases in the FX hedging ratio to improve portfolio Sharpe ratios by reducing overall portfolio volatility

We assume a passive FX hedging strategy for a USD-based investor: FX forward contracts are sold on a rolling basis in proportion to the foreign currency component of the bond portfolio. Hedging costs, given by h in the formula above, are calculated using 12-month forward exchange rates. In the *ex ante* case we assume that the "cost" of the hedge reflects the 12-month forward rate relative to current spot. In the *ex post* calculations, we incorporate the cash flows resulting from rolling maturing contracts. We assume three different passive FX hedging strategies: i) no hedging; ii) 50% hedging; and iii) 100% hedging. We assume the equity component remains unhedged in all cases. International equities often are not hedged due to the greater volatility of the underlying asset relative to currencies. Additionally, FX returns and equity returns on average are positively correlated, in contrast to bond and FX returns. We discuss this point in more detail below. Theoretically, we expect increases in the FX hedging ratio to improve portfolio Sharpe ratios by reducing overall portfolio volatility.

Results

Figure 4 presents results for the entire sample. Average portfolio return, volatility and Sharpe ratios are reported for each of the three hedging cases outlined above both in *ex ante* and *ex post* terms. One of the more notable features of Figure 4 is the large improvement in *ex post* risk-adjusted performance relative to *ex ante* expectations. For all three hedge ratios, the *ex post* Sharpe ratio is roughly three times the *ex ante* ratio. The *ex*

[2] See *http://www.msci.com/products/indexes/tools/index.html#ACWI*

post improvement is apparent in both the numerator (returns) and the denominator (volatility) as Figures 3, 5 and 6 show. This divergence also reflects four widely observed factors: one persistent and three specific to our sample period.

FIGURE 4
Relative portfolio performance: 2004-15

Hedge ratio	Performance measure	Ex-ante	Ex-post	Ex-post less ex-ante
0%	Return	3.73	4.91	1.18
	Volatility	11.76	9.07	-2.69
	Sharpe ratio	0.33	0.93	0.60
50%	Return	3.86	4.97	1.10
	Volatility	11.52	8.79	-2.73
	Sharpe ratio	0.35	0.98	0.63
100%	Return	4.00	5.03	1.03
	Volatility	11.44	8.49	-2.94
	Sharpe ratio	0.37	1.05	0.68

Source: Barclays Research

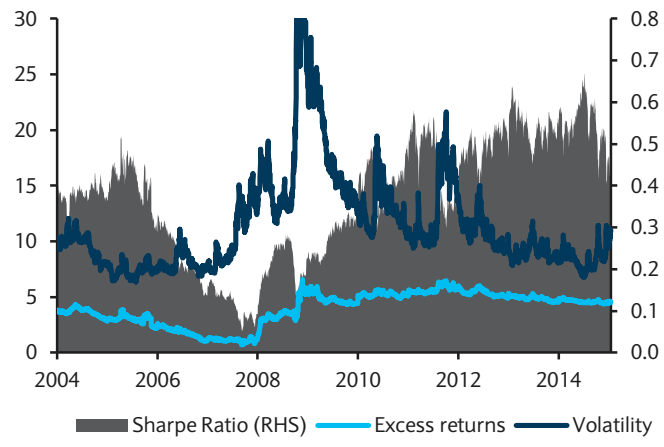
The persistent factor is the existence of a volatility risk premium that compensates risk-averse sellers of options for bearing asymmetric payoffs. For this reason, there are few natural sellers of volatility, but a wide range of buyers. The asymmetric nature of the risk taken by option sellers is difficult to diversify and operationally intensive to manage. As a result, realized volatility is, on average, lower than implied volatility (see *The FX volatility risk premium: Identifying drivers and investigating returns*, 16 June 2014 and *The Lesser Known Risk Premium - Investing in volatility across asset classes*, 19 November 2013).

Three other factors in our sample likely contributed to the ex post improvement in risk-adjusted returns. First, there was a persistent trend rally in fixed income as real interest rates declined almost monotonically through the sample. Second, the negative correlation between bonds and equities was unusually strong and persistent through the sample, particularly in times of market stress, as we discuss below.

Our results show a positive contribution to risk-adjusted returns from FX hedging, a decision most managers can make

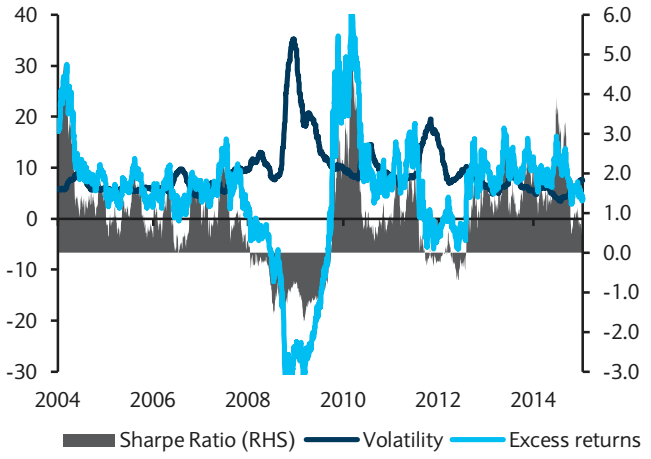
Third, US interest rates were generally higher than other G4 interest rates during the period, making hedging into USD via FX forwards profitable, on average, contrary to theoretical expectations. Although accommodative monetary policy in the euro area and Japan may cause this feature to persist in coming years, it is unlikely to be sustained in the long run.

FIGURE 5
Ex-ante portfolio Sharpe ratio for 100% hedging



Source: Barclays Research

FIGURE 6
Ex-post portfolio Sharpe ratio for 100% hedging



Source: Barclays Research

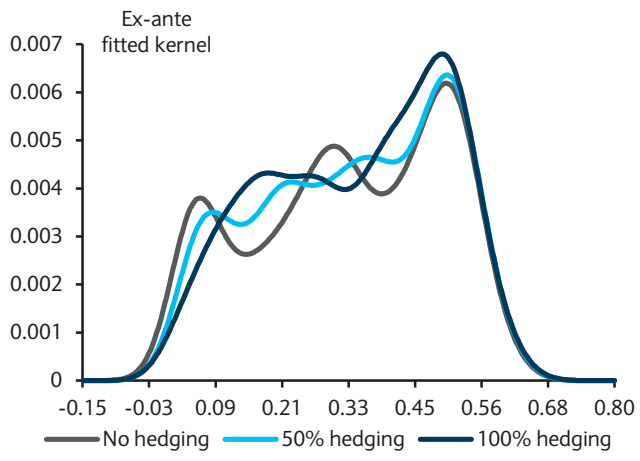
The size of the ex ante/ex post difference is remarkable, but it has little bearing on the portfolio decisions of most international asset managers. But our results also show a positive contribution to risk-adjusted returns from FX hedging, a decision most international managers can make. As we hypothesized, FX hedging generates higher Sharpe ratios by reducing portfolio volatility, both *ex ante* and *ex post* on average. The average *ex ante* Sharpe ratio increases from 0.33 in the case of no FX-hedging to 0.37 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* increases in Sharpe ratios are more impressive, from 0.93 in the case of no hedging to 1.05 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex ante* portfolio volatility drops from 11.76% in the case of no FX hedging to 11.44% in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* reductions in portfolio volatility fall from 9.07% in the case of no hedging to 8.49% with 100% hedging of the foreign bond portfolio. Additionally, using rolling Sharpe ratios, we are able to obtain empirical distributions[3] of both *ex ante* and *ex post* Sharpe ratio (Figures 7 and 8). In both distributions there is a clear rightward shift in the distribution for the 100% FX hedged portfolio, and for the *ex post* distribution a notable skew to higher Sharpe ratios.

A greater degree of FX hedging can boost the negative correlation between equity and bond returns, thereby reducing portfolio volatility

A key driver of this result is the way in which a greater degree of FX hedging can boost the negative correlation between equity and bond returns, thereby reducing portfolio volatility as high returns in one offset low returns in the other. This phenomenon is particularly apparent during periods of elevated volatility, as in the 2008-11 global financial crisis. That increased correlation also is noticeable in the period of increasing FX volatility and USD strength since mid-2014. Figure 10 plots rolling conditional correlations of the residuals on equity, bond and FX daily returns[4]. FX hedging the bond component of the portfolio leads to a pronounced increase in the negative correlation between equity and bond residuals, particularly during periods of heightened market volatility. Because currencies tend to be negatively correlated with local bond returns – higher interest rates lower bond prices but boost the currency – unhedged bond portfolios' returns become less negatively correlated with equity returns.

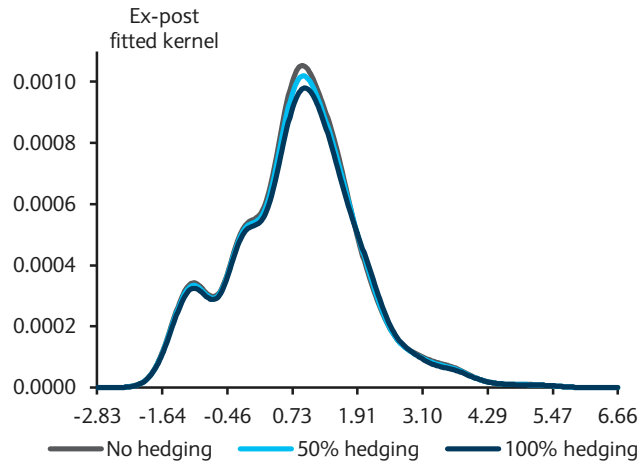
A strengthening USD also boosted the negative bond/equity correlation. Between October 2007 and March 2009, the MSCI ACWI index fell by almost 60% in USD terms and had recovered only about half of these losses by end-2011. At the same time, safe-haven demand for the USD was hurting the returns of foreign bond holdings. Indeed, the USD appreciated by about 15% against a weighted basket of EUR, JPY and GBP between March 2008 and March 2009 (Figure 11). Balanced portfolios with foreign bond holdings hedged back into USDs did not suffer a drag on bond returns from USD appreciation, increasing the negative correlation with equity returns and reducing portfolio volatility.

FIGURE 7
Empirical ex-ante Sharpe ratio distribution



Source: Barclays Research

FIGURE 8
Empirical ex-post Sharpe ratio distribution



Source: Barclays Research

[3] To obtain the empirical densities we perform non-parametric kernel estimation using a Gaussian kernel.
[4] By conditional correlation we mean the correlation between two variables conditional on fixing the value of another variable. In our example we compute the conditional correlation of equity and bond innovations by fixing the FX innovations and similarly for equity and FX and bond and FX.

To establish this more formally we isolate periods of higher market volatility and USD strength in our sample. We use 2008-11 as our high FX volatility environment and periods of material USD Index appreciation (Jan 05-Dec 05; Apr 08-Feb 09; Dec 09-Jun 10; and Jun 14-present) as our strengthening USD environment. Figures 9 and 12 show that in both cases lower portfolio volatility and higher *ex ante* and *ex post* Sharpe ratios are achieved as FX hedging is increased:

i) **During periods of higher volatility:** The average *ex ante* Sharpe ratio increases from 0.33 in the case of no FX-hedging to 0.34 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* Sharpe ratios increase from 0.38 in the case of no hedging to 0.44 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex ante* portfolio volatility drops from 15.90% in the case of no FX-hedging to 15.51% in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* portfolio volatility falls from 13.22% in the case of no hedging to 12.68% in the case of 100% FX hedging of the foreign bond portfolio.

ii) **During periods of a stronger USD:** The average *ex ante* Sharpe ratio increases from 0.33 in the case of no FX-hedging to 0.38 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* Sharpe ratios increase from 0.91 in the case of no hedging to 1.10 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex ante* portfolio volatility drops from 12.62% in the case of no FX hedging to 12.28% in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* portfolio volatility falls from 10.06% in the case of no hedging to 9.42% in the case of 100% FX hedging of the foreign bond portfolio.

FIGURE 9

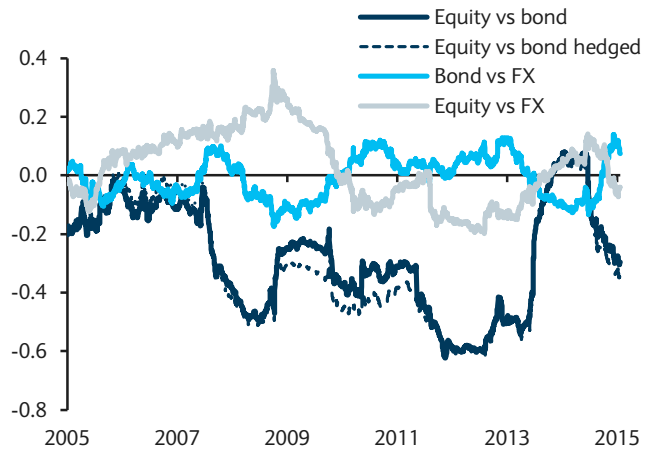
Relative portfolio performance: Period of high FX volatility*

Hedge ratio	Performance measure	Ex-ante	Ex-post	Ex-post less ex-ante
0%	Return	4.86	0.32	-4.54
	Volatility	15.90	13.22	-2.68
	Sharpe ratio	0.33	0.38	0.05
50%	Return	4.86	0.46	-4.40
	Volatility	15.61	12.95	-2.65
	Sharpe ratio	0.34	0.41	0.07
100%	Return	4.85	0.60	-4.25
	Volatility	15.51	12.68	-2.83
	Sharpe ratio	0.34	0.44	0.10

We define this period as 2008-11, inclusive. Source: Barclays Research

FIGURE 10

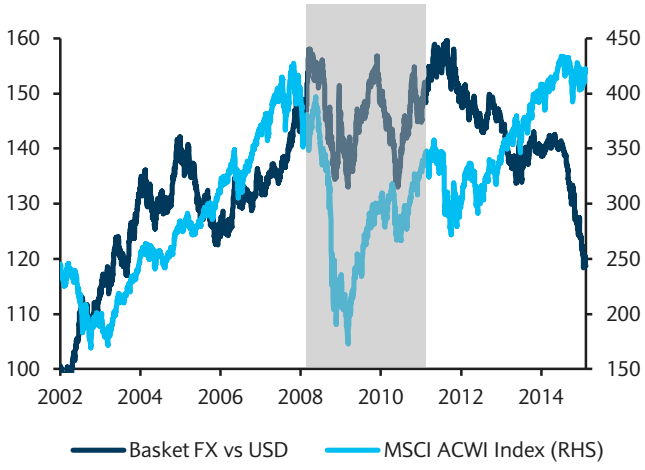
The negative correlation between equity and bond returns increases with hedging…



Source: Barclays Research

FIGURE 11

… and was particularly apparent during the crisis



Source: Bloomberg, Barclays Research

FIGURE 12

Relative portfolio performance: Periods of USD strength*

Hedge ratio	Performance measure	Ex-ante	Ex-post	Ex-post less ex-ante
0%	Return	3.78	3.11	-0.67
	Volatility	12.62	10.06	-2.56
	Sharpe ratio	0.33	0.91	0.58
50%	Return	3.93	3.35	-0.58
	Volatility	12.36	9.75	-2.62
	Sharpe ratio	0.36	0.99	0.64
100%	Return	4.07	3.59	-0.48
	Volatility	12.28	9.42	-2.86
	Sharpe ratio	0.38	1.10	0.71

Note: * We define these periods as: Jan 05-Dec 05; Apr 08-Feb 09; Dec 09–Jun 10; Jun 14-present.
Source: Barclays Research

FX hedging is able to lower portfolio volatility and generate superior risk-adjusted returns in "normal" times as well as during pronounced market stress

The analysis so far suggests that FX hedging is most beneficial in periods of market stress. To see if this result holds in a more general sense, we examine sub-periods in our sample that exclude higher volatility or a strengthening USD. These results are presented in Figure 13 and indicate that FX hedging is able to lower portfolio volatility and generate superior risk-adjusted returns in "normal" times as well as periods of pronounced market stress. Through these periods we find that the average *ex ante* Sharpe ratio increases from 0.31 in the case of no FX-hedging to 0.36 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* Sharpe ratios increase from 1.16 in the case of no hedging to 1.30 in the case of 100% FX hedging of the foreign bond portfolio. Average *ex ante* portfolio volatility drops from 10.09% in the case of no FX hedging to 9.82% in the case of 100% FX hedging of the foreign bond portfolio. Average *ex post* portfolio volatility falls from 7.24% in the case of no hedging to 6.70% in the case of 100% FX hedging of the foreign bond portfolio.

FIGURE 13

Relative portfolio performance: Periods excluding high FX volatility and USD strength*

Hedge ratio	Performance measure	Ex-ante	Ex-post	Ex-post less ex-ante
0%	Return	3.10	7.35	-4.54
	Volatility	10.09	7.24	-2.68
	Sharpe ratio	0.31	1.16	0.05
50%	Return	3.28	7.36	-4.40
	Volatility	9.89	6.98	-2.65
	Sharpe ratio	0.34	1.22	0.07
100%	Return	3.45	7.37	-4.25
	Volatility	9.82	6.70	-2.83
	Sharpe ratio	0.36	1.30	0.10

Note; *We define these periods as follows, Jan 04 – Dec 04, Jan 06 – Dec 07 and Jan 12 – May 14.
Source: Barclays Research.

Beyond hedging: FX as an asset

We have assumed a direct FX hedging strategy using FX forwards, though using FX options would be similarly direct. Implicit in this approach is the treatment of FX as a medium of exchange, rather than as an asset class. An alternative approach is to implement a dynamic hedging strategy, such as a currency overlay, where FX is treated as an asset and hedging is actively managed relative to a benchmark. For example, an investor may think the USD is likely to depreciate against the JPY and thus reduce the hedge ratio on the JPY-asset proportion of your portfolio. Because active currency management can generate correlations very different from the "natural" correlations shown in our analysis, it has the

potential to further dampen (or accentuate) volatility in an international equity and bond portfolio. The implications of active currency management are beyond the scope of this analysis but should be noted.

Our results show a clear benefit to FX hedging of international bond portfolios in a global portfolio. While one should not expect a continuation of the sample-specific factors that boosted the absolute returns in our results (eg, a persistent global bond rally, higher US interest rates), FX hedging of bonds in a balanced international portfolio should persistently raise risk-adjusted returns by increasing the negative correlation between bonds and equities. Furthermore, we show that this effect appears to be amplified during heightened volatility and periods of USD strength, both of which we expect in coming years.

CHAPTER 8

UK asset returns since 1899

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We analyse returns on equities, gilts and cash from end-1899 to end-2014. Index-linked gilt returns are available from 1982, while corporate bonds begin in 1999. To deflate the nominal returns, a cost-of-living index is computed using Bank of England inflation data from 1899 to 1914 and the Retail Price Index, calculated by the Office of National Statistics, thereafter.

FIGURE 1
Real investment returns by asset class (% pa)

Last	2014	10 years	20years	50years	115 years*
Equities	-0.4	4.1	4.6	5.7	5.0
Gilts	16.4	3.7	5.1	2.9	1.3
Corporate Bonds	10.7	2.5			
Index-Linked	14.0	3.5	4.4		
Cash	-1.2	-0.7	1.1	1.5	0.8

Note: * Entire sample. Source: Barclays Research

Figure 1 summarises the real investment returns of each asset class over various time horizons. The first column provides the real returns over one year, the second column real annualised returns over 10 years, and so on. UK equities had a lacklustre year and underperformed other developed market indices in 2014. UK nominal total returns were just 1.2%, compared to 2.65% for the German DAX and 10.5% for US equities. The underperformance occurred despite a reasonable growth backdrop. The UK was one of the few economies where the consensus growth forecast was actually revised higher last year; US, European and Global real GDP estimates had all been downgraded over the course of the year. The Scottish Referendum contributed to some temporary underperformance in the FTSE All-Share index, but the key drag came from the disinflationary impact of the commodity price fall and, in particular, the 50% decline in the oil price during the second half of the year. Much of the performance drag on UK equities was driven by exposure to the oil- and mining-related sectors which accounted for more than 20% of the FTSE All-Share market cap. In comparison, the worst-performing sectors in the STOXX Europe 600 included oil and gas, and basic resources, the combined weight of which stood at just 8.5%.

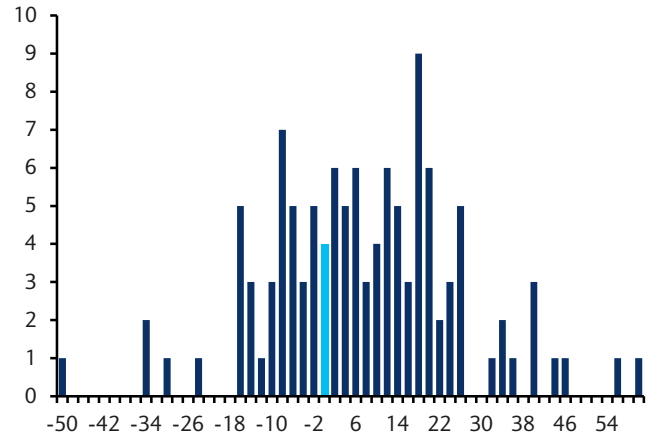
Fixed income and credit had a very strong performance in 2014 as a result of the deflationary fears fuelled by the oil price decline. Nominal and inflation-linked gilts posted their best returns since the Euro sovereign debt crisis in 2011. The long end outperformed in both gilts and treasuries as the curves bull-flattened. Credit returns were the strongest since 2012. Monetary policy divergence was a key theme driving bond markets in 2014. The prospect of QE from the ECB caused European government bonds to outperform the US and the UK in the 10-15 year sector. Cash returns remained weak in the low yield environment.

FIGURE 2
Real investment returns (% pa)

	Equities	Gilts	Index-linked	Cash
1904-1914	2.1	-0.1		1.5
1914-24	0.4	-3.1		-1.7
1924-34	9.2	11.7		5.6
1934-44	3.0	-1.4		-2.4
1944-54	5.3	-2.6		-2.8
1954-64	7.1	-2.6		1.4
1964-74	-6.0	-6.3		0.0
1974-84	17.4	5.6		-0.3
1984-94	9.4	5.8		5.5
1994-2004	5.0	6.5	5.3	3.0
2004-2014	4.1	3.7	3.5	-0.7

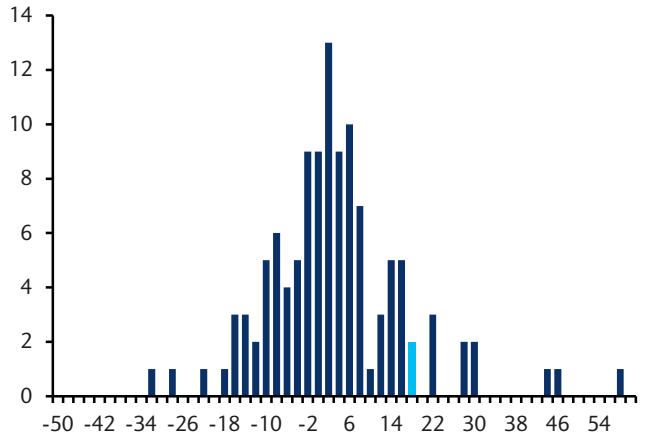
Source: Barclays Research

FIGURE 3
Distribution of real annual equity returns since 1899



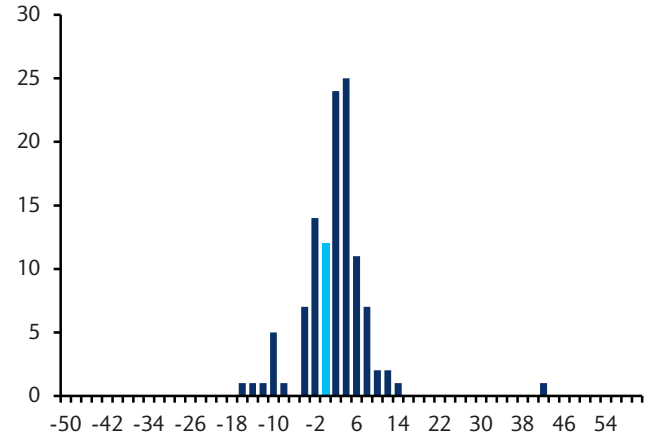
Source: Barclays Research

FIGURE 4
Distribution of real annual gilt returns since 1899



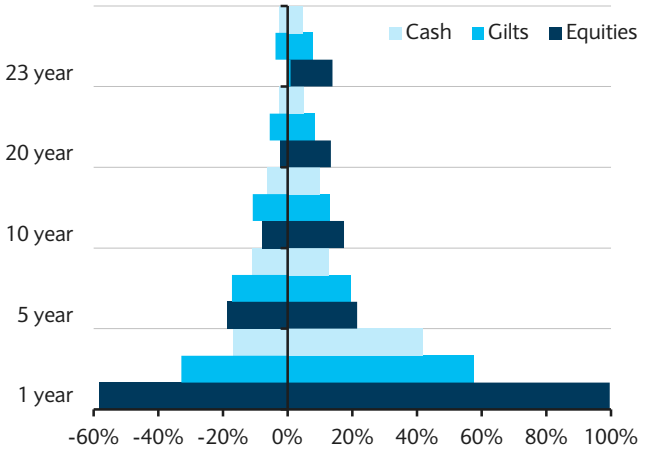
Source: Barclays Research

FIGURE 5
Distribution of real annual cash returns since 1899



Source: Barclays Research

FIGURE 6
Maximum and minimum real returns over various periods



Source: Barclays Research

Figure 2 breaks down real asset returns for consecutive 10-year intervals. Equities have outperformed cash and bonds over the past decade, with an average annualised return of 4.1% since 2004. Cash, on the other hand, has delivered the worst returns since the stagflationary 1970s. Ranking the annual returns and placing them into deciles provides a clearer illustration of their historical significance. The results for 2014 are shown in Figure 7. The equity portfolio is ranked in the seventh best decile since 1899, down from the third decile in 2013, as a result of the poor performance in the second half of the year. Gilts and linkers are ranked in the first and second deciles, a striking jump from the ninth decile in 2013, as deflationary fears appear to have wiped out the memory of the 2013 taper tantrum. Cash remained weak as yields were held near zero.

FIGURE 7
2014 performance ranked by decile (1899-2014)

	Decile
Equities	7
Gilts	1
Index-Linked	2
Cash	8

Note: Deciles ranking: 1 signifies the best 10% of the history, 10 the worst 10%. Source: Barclays Research

Figures 3-5 illustrate the distribution of returns over the past 115 years, 2014 is highlighted within each distribution. They show that equity returns have the widest dispersion, followed by gilts and then cash. The observed distributions are in accordance with financial theory; from an ex-ante perspective, we would apply the highest risk premium to equities, given their perpetual nature and our uncertainty over future growth in corporate profits and changes in the rate of inflation. For gilts, the uncertainty with respect to inflation remains, but the risk from the perspective of coupon and principal is reduced, given their government guarantee. Over the past 30 years, the dispersion of annual gilt returns has widened significantly; in the 1970s and 1980s, an unexpected increase in the inflation rate led to significant negative real returns, while in the 1990s, an unanticipated fall in inflation, in conjunction with lower government deficits, facilitated above-average real returns. The cash return index has the lowest dispersion. In recent years, the real returns to cash have been relatively stable, with the move toward inflation-targeting by the Bank of England stabilising the short-term real interest rate.

Performance over time

Having analysed annual real returns since 1899, we now examine returns over various holding periods. Figure 6 compares annualised returns when the holding period is extended to 5, 10, 20 years, or beyond.

The most striking feature of the chart is the change in the volatility of returns as the investments are held for longer periods. The variance of equity returns falls significantly relative to the other assets as the holding period is extended. When equities are held for as long as 20 years, the minimum return is actually greater than for either gilts or cash. However, as discussed in past issues of this study, we do not believe that this fall in volatility should be interpreted as an indication of mean reversion in the returns. The series used comprises rolling returns; hence, there is an overlap in the data. For example, in the 10-year holding period, nine of the annual returns will be the same in any consecutive period; thus, the observations cannot be considered to be independently drawn.

Figure 8 illustrates the performance of equities against gilts and cash for various holding periods. The first column shows that over a holding period of two years, equities have outperformed cash in 77 of 114 years; thus, the sample-based probability of equity outperformance is 68%. Extending the holding period out to 10 years, this rises to 91%.

FIGURE 8
Equity performance

	Number of consecutive years					
	2	3	4	5	10	18
Outperform cash	77	79	81	83	96	97
Underperform cash	37	34	31	28	10	1
Total number of years	114	113	112	111	106	98
Probability of equity outperformance	68%	70%	72%	75%	91%	99%
Outperform gilts	78	84	84	81	84	85
Underperform gilts	36	29	28	30	22	13
Total number of years	114	113	112	111	106	98
Probability of equity outperformance	68%	74%	75%	73%	79%	87%

Source: Barclays Research

The importance of reinvestment

Figures 9 and 10 show how reinvestment of income affects the performance of the various asset classes. The first table shows £100 invested at the end of 1899 without reinvesting income; the second is with reinvestment. One hundred pounds invested in equities at the end of 1899 would be worth just £184 in real terms without the reinvestment of dividend income, but with reinvestment the portfolio would have grown to £28,261. The effect upon the gilt portfolio is less in absolute terms, but the ratio of the reinvested to non-reinvested portfolio is more than 600 in real terms.

FIGURE 9

Today's value of £100 invested at the end of 1899 without reinvesting income

	Nominal	Real
Equities	£14,597	£184
Gilts	£59	£0.75

Source: Barclays Research

FIGURE 10

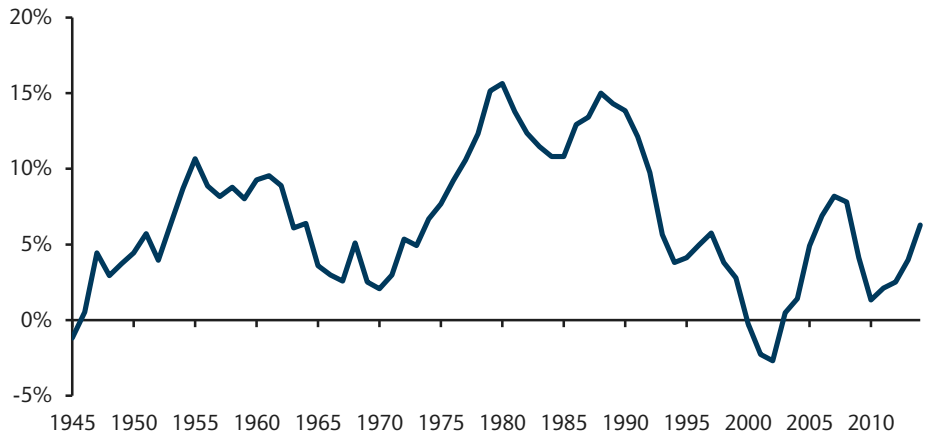
Today's value of £100 invested at the end of 1899, income reinvested gross

	Nominal	Real
Equities	£2,240,727	£28,261
Gilts	£36,197	£457
Cash	£20,444	£258

Source: Barclays Research

FIGURE 11

Five-year average dividend growth rates

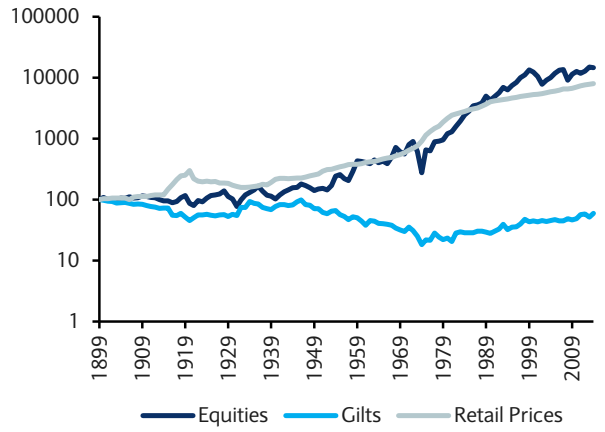


Source: Barclays Research

Turning to the dividend growth ratio, the FTSE All-Share dividend rose just 0.6% in 2014, the slowest pace of growth in four years. Figure 11 shows that the five-year average growth rate had picked up following the steady declines of recent years after corporates began cutting dividends in 2008. In 1997-2001, dividend income had fallen by a cumulative 15% as companies cut dividends on the basis that funds would be put to better use by corporates than by shareholders. In the wake of the dotcom crash, investors actively sought income-yielding stocks as a way to lower risk.

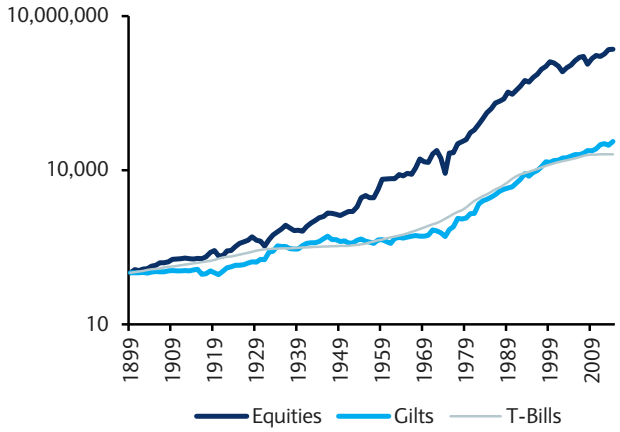
Figures 12 and 13 illustrate the time series of price indices and total return indices for equities, gilts and cash over the entire series. These returns are in nominal terms and are shown with the use of a logarithmic scale.

FIGURE 12
Barclays price indices – Nominal terms



Source: Barclays Research

FIGURE 13
Barclays total return indices – Nominal terms, gross income reinvested



Source: Barclays Research

FIGURE 14
Today's value of £100 invested at the end of 1945 without reinvesting income

	Nominal	Real
Equities	£9,148	£261
Gilts	£65	£2

Source: Barclays Research

FIGURE 15
Today's value of £100 invested at the end of 1945, gross income reinvested

	Nominal	Real
Equities	£179,695	£5,118
Gilts	£7,773	£221
Cash	£6,261	£178

Source: Barclays Research

FIGURE 16
Today's value of £100 invested at the end of 1990, gross income reinvested

	Nominal	Real
Equities	£750	£379
Gilts	£764	£386
Index-Linked Gilts	£577	£291
Treasury Bills	£300	£151

Source: Barclays Research

CHAPTER 9

US asset returns since 1925

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We have analysed returns on US equities, government bonds and cash using 89 annual return observations. The construction of the series is explained in more detail in the indices in Chapter 10 ("Barclays Indices"). Corporate bond performance is captured using the Barclays Investment Grade Corporate Long Index, which incorporates bonds with a maturity of 10 years or more. The Barclays US Inflation Linked 15-year Plus Index is used to represent the performance of TIPS. The nominal return series are deflated by the change in the consumer price index, which is calculated by the Bureau of Labor Statistics. The first holding period covered in this analysis is the calendar year 1926, representing money invested at the end of 1925 and its value at the end of 1926.

FIGURE 1
Real investment returns (% pa)

Last	2014	10 years	20 years	50 years	89 years*
Equities	9.7	5.5	7.4	5.6	6.7
Government bond	23.0	5.1	6.0	3.4	2.6
TIPS	18.3	4.0			
Corporate bond	14.9	4.8	5.9		
Cash	-0.7	-0.7	0.3	0.9	0.5

*Note: Entire sample. Source: Centre for Research into Security Prices (CRSP) provided US asset return data for the past 14 years, Barclays Research

Figure 1 provides real annualised returns over various time horizons. US equity returns in 2014 outperformed both developed and emerging markets by a wide margin as domestic growth remained robust. Despite periodic drags from global growth concerns and deflationary fears, the upward momentum was maintained throughout the year. Strong earnings growth, with US corporate profits reaching record highs, helped fuel the outperformance. M&A activity also accelerated in the US as corporates took advantage of strong balance sheets and the low rate environment. This, in turn, provided further support for equity performance.

Fixed income markets followed the trends in the UK: nominal bonds were the best-performing asset of 2014, producing a 23% real total return, in sharp contrast to the -13% of the previous year, when investors first digested the prospect of monetary policy normalisation by the Fed. Treasuries, TIPS and credit produced the best returns since the Euro sovereign debt crisis in 2011. As mentioned in Chapter 8, monetary policy divergence was a key theme of 2014, yet, despite the prospect of Fed policy normalisation, US bonds still managed a strong performance.

FIGURE 2
Real investment returns (% pa)

	Equities	Government bond	Corporate bond	Cash
1934-44	6.4	1.0		-2.6
1944-54	11.5	-1.6		-3.0
1954-64	10.7	0.1		1.0
1964-74	-4.1	-2.6		0.2
1974-84	8.2	-0.2		1.5
1984-94	9.6	7.8	7.6	2.0
1994-2004	9.3	7.0	7.0	1.4
2004-2014	5.5	5.1	4.8	-0.7

Source: CRSP, Barclays Research

Equities only marginally outperformed Treasuries and corporate bonds in the most recent decade. A total real return of 5.5% is in line with the average returns of the past 50 years, but below the average performance since 1925 of 6.7%. Treasuries and corporate bond returns were also in the region of 5% over the past decade, so the gap between equity and bond performance has closed substantially relative to prior decades. Equities' best decades were in the 1950s and the 1980s. Bonds have enjoyed strong performance over the past three decades relative to preceding decades, largely as a result of continued disinflation since the late 1970s. The strong bond performance of 2014 has pulled the average returns for the past decade up from 3.4% last year to 5.1%, comfortably higher than the long-run average of 2.6%.

Figure 3 ranks the relative performance of 2014 returns by deciles to get a clearer indication of their historical significance. The US equity ranking has fallen from the second decile in 2013 to the sixth in 2014 as returns failed to match 2013's near-30% total return. Bonds moved from the worst decile in 2013 to the best in 2014 as investors switched from fears of Fed policy normalisation in 2013 to global deflationary concerns in 2014. Cash returns remained weak, with negative real returns placing them in the seventh decile.

FIGURE 3

Comparison of 2014 real returns with historical performance ranked by decile

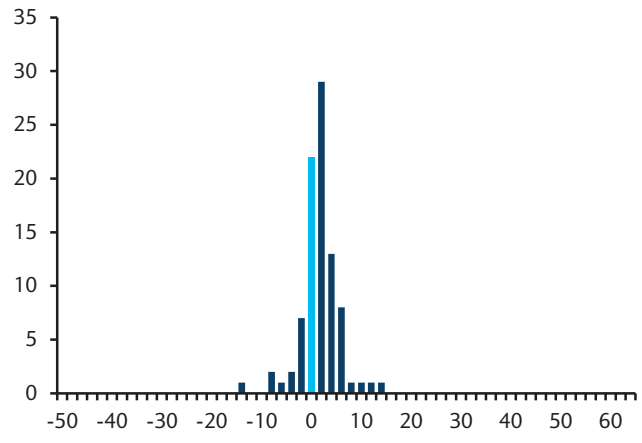
	Decile
Equities	6
Government bonds	1
Cash	7

Note: Deciles ranking - 1 signifies the best 10% of the history, 10 the worst 10%. Source: CRSP, Barclays Research

Figures 4-6 plot the sample distributions over the past 89 years; 2014 is highlighted within each distribution. These charts allow readers to appreciate the volatility of each asset class while gaining an understanding of the distribution of the annual return observations. Clearly, cash has exhibited the lowest volatility of each asset class, with bonds next and equities having the highest dispersion of returns.

FIGURE 4

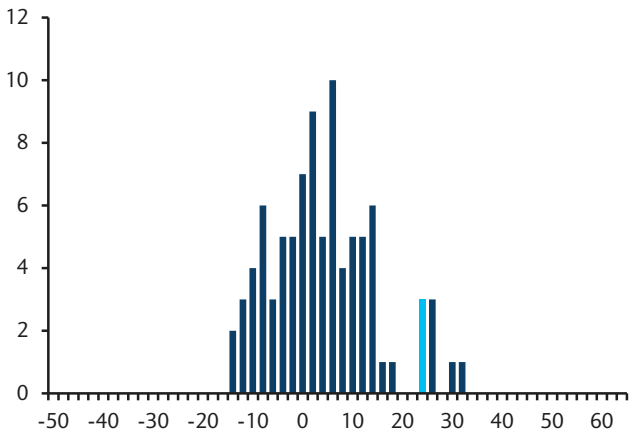
Distribution of real annual cash returns since 1925



Source: CRSP, Barclays Research

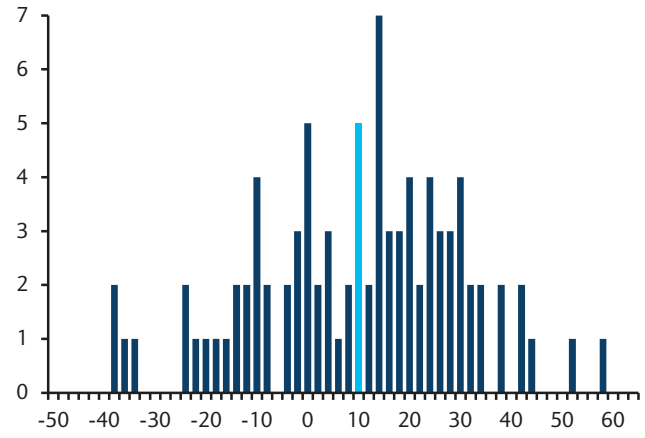
FIGURE 5

Distribution of real annual bond returns since 1925



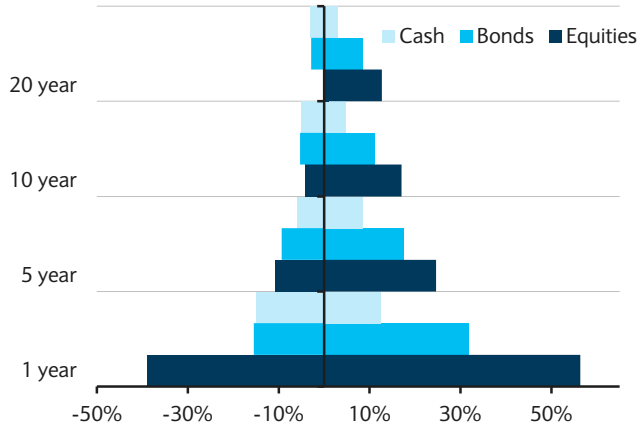
Source: CRSP, Barclays Research

FIGURE 6
Distribution of real annual equity returns since 1925



Source: CRSP, Barclays Research

FIGURE 7
Maximum and minimum real returns over different periods



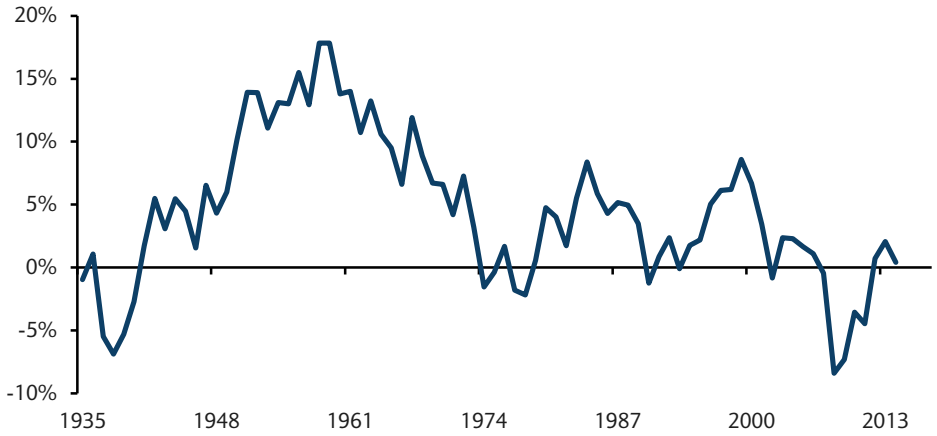
Source: CRSP, Barclays Research

Figure 7 shows the extremes of the return distribution for various holding periods. The volatility of equities over very short horizons is clearly demonstrated in the maximum and minimum distributions of one-year returns. As we extend the holding period, the distribution begins to narrow. Over the past 89 years, the worst average annualised 20-year return for equities was 0.9%, while the best was 13%. However, this is not to say that it is impossible to lose money by holding equities over a 20-year period, as the analysis is conducted on an *ex-post* basis. The figure simply highlights that such an occurrence seems unlikely, given equities' performance over the past 89 years.

In addition, we would expect the *ex-ante* equity risk premium to act as a cushion against uncertainty in the long term. Bonds and cash have had negative returns on a 20-year investment horizon, reflecting unexpected inflation surges at various times in the past century.

Figure 8 plots the US equity risk premium and shows that the 10-year annualised excess return of equities over bonds has recovered from the lows of 2008 and remains in positive territory.

FIGURE 8
Equity-risk premium – Excess return of equities relative to bonds (10y annualised)



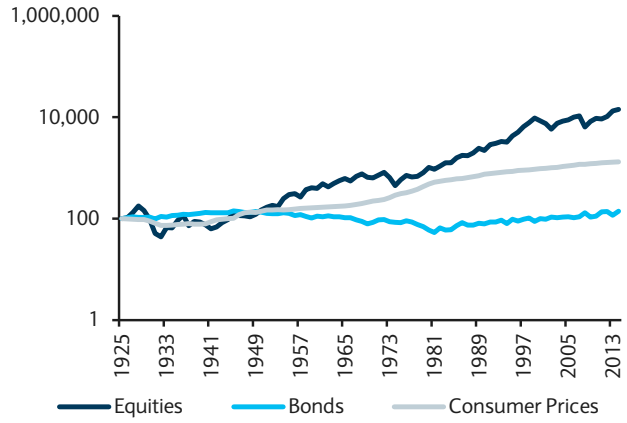
Source: CRSP, Barclays Research

The importance of reinvestment

Figures 9 and 10 show the importance of reinvestment of income in the form of dividends on equity investments and coupons on government bonds.

FIGURE 9

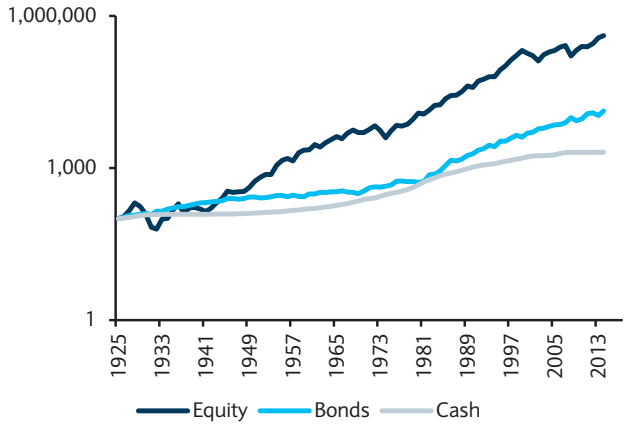
Barclays US price indices in nominal terms



Source: CRSP, Barclays Research

FIGURE 10

Barclays US total return indices in nominal terms with gross income reinvested



Source: CRSP, Barclays Research

FIGURE 11

Value of $100 invested at the end of 1925 without reinvesting income

	Nominal	Real
Equities	$14,328	$1,092
Bonds	$140	$11

Source: CRSP, Barclays Research

FIGURE 12

Value of $100 invested at the end of 1925 with income reinvested gross

	Nominal	Real
Equities	$408,413	$31,134
Bonds	$13,327	$1,016
Cash	$2,043	$156

Source: CRSP, Barclays Research

CHAPTER 10

Barclays indices

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We have calculated three indices showing: 1) changes in the capital value of each asset class; 2) changes to income from these investments; and 3) a combined measure of the overall return, on the assumption that all income is reinvested.

Additional series allow for the effects of inflation. The data for cash include building society deposit rates and Treasury bills. The series on index-linked securities is based at December 1982 and the corporate bond index starts at the end of 1990.

Barclays Equity Index

The Barclays Equity Index is designed to give as accurate a measure as possible of the performance of a representative portfolio of equities. Three main types of index can be used. The FT Index, which for years was the most widely used in the UK, is geometric, meaning that the price changes of the 30 shares it comprises are multiplied together to produce the change in the index. We believe that this is a fair basis for indicating short-term market behaviour, but that over long periods it imparts a downward bias. The second type of index uses the Dow formula, in which the prices of a number of shares are added together. This does not have the distorting effect of a geometric index, but the weighting of the various shares is arbitrary and varies with changes in capitalisation.

We think the most accurate and representative indices are arithmetic and weighted by the number of shares in issue by each company. These indices include virtually all of the large quoted companies, and, thus, we believe they accurately reflect the behaviour of an equity market. The Standard & Poor's Indices are of this type, and they date back to the 1920s. The FT Actuaries Indices, introduced in the 1960s, were the first of this type in the UK. Subsequently, a number of weighted arithmetic international indices, such as those calculated by Morgan Stanley Capital International and Datastream, have been introduced. More recently, the FTSE 100 Index, which uses the same construction but incorporates only the 100 leading shares, has been introduced and, generally, is now used as the main market indicator because it is calculated on a real-time basis throughout the day.

The Barclays Equity Index, which is used in this study, is a weighted arithmetic index, and is available for the period since 1899, with a dividend yield and an income index. The original Barclays Equity Index, used in editions of this study until 1999, was first calculated retrospectively in 1956 and included 30 shares chosen because of their similarities to the FT 30 Index, which covers the 1935 to 1962 period. For the 2000 edition of this study, we compiled a new index for 1899-1935, based on the 30 largest shares by market capitalisation in each year. From 1962, the Barclays Equity Index is based on the FTSE Actuaries All-Share Index because, with its broader coverage, it gives a more accurate picture of market movements. The indices are calculated only annually, at year-end.

The equity returns between 1899 and 1935 are, therefore, calculated from a new Equity Index, consisting of the 30 largest shares by market capitalisation in each year; between 1935 and 1962 they are calculated from the FT 30 Index and from 1962 onward they are derived from the FTSE Actuaries All-Share Index.

FIGURE 1
Equity Index constituents

Constituents at December 1899	Constituents at December 1934	Constituents at December 1962
De Beers Consolidated Mines	Woolworth Ltd	Associated Portland Cement
Rio Tinto Ltd	Imperial Chemical Industries	Bass Mitchells & Butlers
Armstrong Whitworth	Shell Transport & Trading Ltd	British Motor
Consolidated Gold Fields	Courtaulds Ltd	Coats Patons
London and County Bank	Royal Insurance Co	Cory (William)
London City & Midland Bank Ltd	Barclay & Company	Courtaulds
Lloyds Bank Ltd	Lloyds Bank	Distillers
London & Westminster Bank Ltd	Prudential Assurance Co Ltd	Dunlop
Vickers, Sons & Maxim Ltd	Westminster Bank Ltd	EMI
Imperial Ottoman Bank	Midland Bank Ltd	Fine Spinners & Doublers
Parrs Bank Ltd	London & Lancashire Fire Ins. Co	General Electric
Royal Insurance Co	North British & Mercantile In. Co Ltd	Guest Keen
Tharsis Sulphur & Copper Ltd	Reckitt & Sons Ltd	Hawker Siddeley
Great Northern of Copenhagen	County of London Electric Supply Co	House of Fraser
Simmer & Jack Propietary Mines Ltd	Unilever Ltd	ICI
North British & Mercantile Insurance	Tate & Lyle Ltd	Imperial Tobacco
Consett Iron Ltd	Alliance Assurance Company	International Stores
Eastern Extension Australasia * China Ltd	Boots Pure Drug Co Ltd	Leyland Motors
Nobel Dynamite Tst Ltd	Pearl Assurance Co	London Brick
Mysore Gold Mining Ltd	Marks & Spencer Ltd	Murex
Exploration Co	Cory (WM.) & Son	P&O Steam Navigation
Alliance Assurance Co	National Bank Of Egypt	Rolls-Royce
Aerated Bread Ltd	Consolidated Gold Fields Of South Africa	Swan Hunter
Howard & Bullough Ltd	Bass, Ratcliff & Gretton Ltd	Tate & Lyle
Sun Insurance Office	GeduldProp Mines Ltd	Tube Investments
New Jagersfontein Mining & Expl Ltd	Sun Insurance Office	Turner & Newall
Champion Reef Gold Mining	Bank Of Australasia	United Steel
National Telephone Ltd	British South Africa Co	Vickers
Northern Assurance	Chartered Bank Of India, Australia & China	WatneyMann
Phoenix Assurance Co	North Eastern Elec Supply Co	Woolworth

Source: Barclays Research

The Equity Index is a weighted arithmetic average. In the Equity Index, the weights of the 30 constituent companies for each year are proportional to their market capitalisation at the beginning of the year. Each year a fund was constructed. The number of shares in the fund for each company was calculated so that its market value at the beginning of the year was equal to the company's index weighting. The value of the fund was calculated annually at the end of the year.

For 1899-1962, the Equity Income Index is based on the Barclays Equity Fund. The Income Index relates to the dividend income actually received in the 12 months prior to the date of the index. It is calculated by totalling the dividends paid on the shares in the fund. We believe that it is the only published index based on actual income receipts.

From 1963 the Income Index is derived from the yield on the FTSE All-Share Index. Despite a minimal discontinuity in the yield, in our view, this is the most representative method of evaluating equity performance over the period. The dividend yield is quoted net from 1998, with non-taxpayers no longer able to reclaim ACT.

Barclays Gilt Index

The Gilt Index measures the performance of long-dated gilts. From 1899 to 1962 the index is based on the prices of undated British funds. During this period, the undated stocks were a major part of the gilt market, but over the years, the effect of high interest rates on their prices, together with the growing number of conventional long-dated issues, meant that undated stocks became less and less representative of the market as a whole.

Since 1962, the Barclays Gilt Index has been based on a portfolio of long-dated stocks, selected on 1 January each year. The portfolio was chosen to represent as closely as possible a 20-year security on a par yield, and contains a weighted combination of four long-dated stocks with a mean life of 20½ years (so that the average life of the stocks for the year in which they are in the portfolio was 20 years). The combination and weightings of the four stocks are chosen to have the minimum possible deviation from a par yield. Small issues (less than £1bn) are excluded and in any year none of the four stocks has been allocated a weight of more than 40%, or less than 5% of the index.

During the late 1980s, there was a steady contraction in the number of issues that satisfied the criteria for inclusion in the Gilt Index. As a result of the lack of issues of new long-dated stocks and the fall in the remaining life of existing stocks, the universe of eligible stocks narrowed sharply. By the end of 1989, there were four stocks with a life of more than 20 years, and only two of these were over £1bn nominal.

Thus, from the beginning of 1990, the index has been constructed to represent a portfolio of 15-year par yielding gilts.

Barclays Inflation-linked Index

The index-linked market has now been established for almost three decades and is capitalised at £477bn (compared with the £1.3trn capitalisation of the conventional market). The index has been constructed to mirror as closely as possible the rules of the conventional gilt index. An average life of 20 years was used up until 1990, and 15 years thereafter. Again, stocks have been chosen to be as close to par as possible, although, of course in this case, par means “indexed par”.

Barclays Corporate Bond Index

The UK corporate bond market has expanded markedly since the beginning of 1999. The index and returns are based on the Barclays Sterling Aggregate Corporate Index. Clearly, we are unable to select individual stocks for this index in the way we do for the gilt indices because such a small sample of stocks cannot be representative of the market.

Barclays Building Society Fund

In previous editions of this study, we have included indices of the value of £100 invested in a building society at the end of 1945. We originally used the average interest rate on an ordinary share account. In the mid-1980s, many building societies introduced new tiered interest rate accounts, which provided a higher rate of interest while still allowing instant access. In response to this, we have been tracking both types of account, but as time progressed, the old style “ordinary share accounts” became less and less representative and by the mid-1990s had been completely superseded by the new accounts. From 1986, the Barclays Index follows the Halifax Liquid Gold Account (formerly called the Halifax Instant Xtra) as a representative of the newer tiered interest rate-style accounts. The Halifax is no longer a building society, having converted to a bank, so from 1998, we follow the Nationwide Invest Direct Account. This is the closest equivalent account offered by the Nationwide Building Society (which is now the largest remaining building society in the UK); the difference is that it is operated by post. We consider this type of postal account to be more representative of building society returns than the branch operated passbook accounts, which are more in the nature of a cash-based transaction account.

US asset returns

The US indices used in this study were provided by the Center for Research in Security Prices (CRSP) at the Graduate School of Business of the University of Chicago. The value-weighted equity index covers all common stocks trading on the New York, Nasdaq, and Arca Stock Exchanges, excluding ADRs. For the bond index, the CRSP has used software which selects the bond that is closest to a 20-year bond in each month. The same methodology has been employed for the 30-day T-Bill.

Total returns

In this study, we have shown the performance of representative investments in UK equities and long gilts, with additional analysis of equivalent US returns in both monetary and real (inflation adjusted) terms. The total returns to the investor, however, also include the income on the investment. This is important throughout the study for comparability between asset classes. For example, when constructing an index for a cash investment such as the UK Treasury Bill Index, the £100 invested at the end of 1899 grew to approximately £104 by the end of the following year. This full amount is reinvested and by the end of 1920 the value of this investment had grown to about £190. In contrast, equity and bond market returns can be split into two components: capital appreciation; and dividend income. The most commonly quoted stock market indices usually include only the capital component of the return. In order to calculate returns on a comparable basis, we need to include the returns obtained by reinvesting this income. This is particularly important in looking at bonds where the scope for capital appreciation is small, so almost all of the return will be from income. In this study, total returns are calculated assuming income is reinvested at the end of the year.

Taxation

The total return to an investor depends crucially on the tax regime. The largest long-term investors in the British equity and gilt markets are pension funds and similar institutions that (until the abolition of the advance corporation tax (ACT) credit) have not suffered tax on their income or capital; our main tables therefore make no allowance for tax until 1998, which was the first full year that non-taxpayers were unable to reclaim the ACT credit. This effectively reduced the dividend yield to non-taxpayers, and is reflected in our main tables and gross total return series.

The personal investor must suffer tax. The net return to a building society account is straightforward to compute. However, changes in the tax regime in recent years make the net return to equity and gilt investment less straightforward to calculate on a consistent basis. For example, the change to total return taxation for gilts means that it is inappropriate to calculate a net total return on the basis of taxing income alone. Thus, returns are quoted gross throughout, but for reference we also quote basic tax rates.

Arithmetic and geometric averages

Our analysis of past data usually relies on calculations of the geometric mean for each series. Arithmetic averages can provide a misleading picture. For example, suppose equities rose from a base of 100 to 200 over one year and then fell back to 100 over the next year. The return for year one would have been 100% and for year two minus 50%. The arithmetic average return would be 25%, even though equities are actually unchanged in value over the two years.

The geometric average return in this example would be zero. This method of calculation is, therefore, preferable. Over long periods, the geometric average for total returns is the rate at which a sum invested at the beginning of the period will grow to by the end of the period, assuming all income is reinvested. The calculation of geometric averages depends only on the initial and final values for the investment, not particular values at any other point in time.

For periods of one year, arithmetic and geometric averages will be the same. But over longer periods, the geometric average is always less than the arithmetic average, except when all the individual yearly returns are the same. For the mathematically minded, the geometric return is approximately equal to the arithmetic return minus one-half the variance of the arithmetic return.

Although geometric returns are appropriate to analyse the past, arithmetic returns should be used to provide forecasts. Arithmetic averages provide the better unbiased estimator of returns (for a statistical proof of this see Ian Cooper's paper *Arithmetic vs Geometric Premium: setting discount rates for capital budgeting calculations*, IFA Working Paper 174-93, April 1993).

Capital value indices

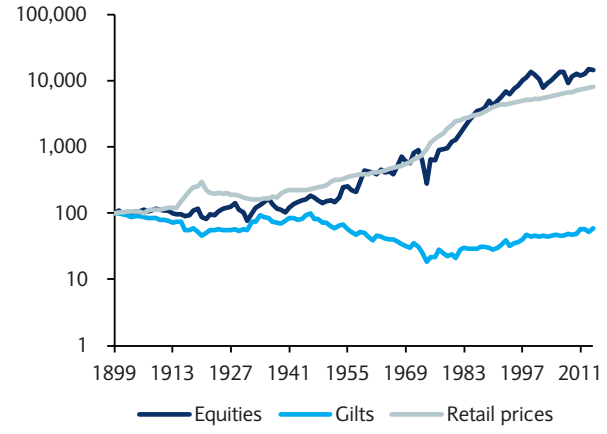
The indices in Figure 2 show the nominal capital value of £100 invested in equities and gilts at the end of 1899. The chart also plots the Barclays Cost of Living Index. Note how the equity index has correlated with increases in the cost of living versus a similar investment in gilts. The index values at the end of 2014 were 14,597 for equities, 59.27 for gilts, and 7929 for the cost of living.

We then show the same capital indices adjusted for the increase in the cost of living since 1899. Figure 3 shows the end-2014 real equity price index at 184 with the real gilt price index at 0.75.

Total return indices

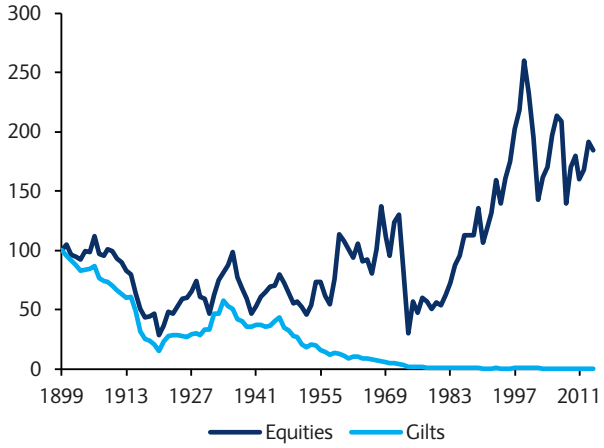
The next two charts show the nominal and real value of the equity, gilt and cash funds with gross income received reinvested at the end of each year since 1899. Figure 4 shows that the nominal worth of £100 invested in equities at the end of 1899 was £2,240,727. The same investment in gilts was worth £36,197 and in T-Bills £20,444. When adjusted for inflation, the equity fund is worth £28,261, the gilt £457 and the cash fund £258.

FIGURE 2
Barclays price indices in nominal terms



Source: Barclays Research

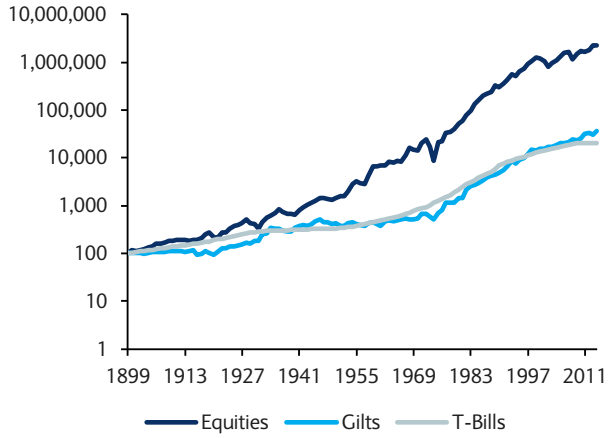
FIGURE 3
Barclays price indices in real terms



Source: Barclays Research

FIGURE 4

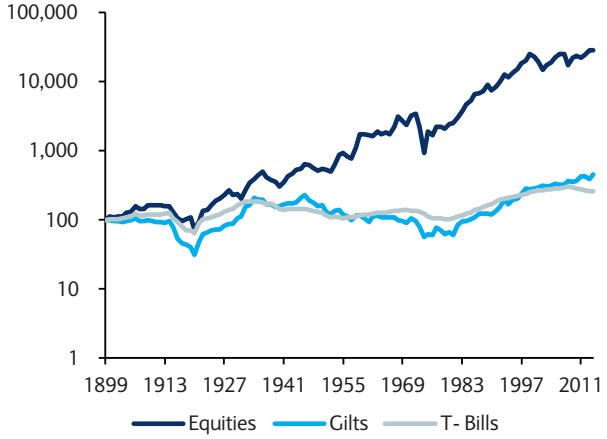
Barclays total return indices in nominal terms with gross income reinvested



Source: Barclays Research

FIGURE 5

Barclays total return indices in real terms with gross income reinvested



Source: Barclays Research

FIGURE 6
Barclays UK Cost of Living Index

Year	December (1899=100)	Change % In year	Change % 5y average	Year	December	Change % In year	Change % 5y average
1900	103.3	3.3		1958	381.8	1.8	3.9
1901	103.3	0.0		1959	381.8	0.0	3.1
1902	106.7	3.2		1960	388.7	1.8	2.3
1903	106.7	0.0		1961	405.7	4.4	2.5
1904	106.7	0.0	1.3	1962	416.5	2.6	2.1
1905	106.7	0.0	0.6	1963	424.2	1.9	2.1
1906	100.0	-6.2	-0.7	1964	444.6	4.8	3.1
1907	110.0	10.0	0.6	1965	464.5	4.5	3.6
1908	113.3	3.0	1.2	1966	481.6	3.7	3.5
1909	113.3	0.0	1.2	1967	493.4	2.5	3.4
1910	113.3	0.0	1.2	1968	522.7	5.9	4.3
1911	116.7	2.9	3.1	1969	547.1	4.7	4.2
1912	120.0	2.9	1.8	1970	590.3	7.9	4.9
1913	120.0	0.0	1.1	1971	643.6	9.0	6.0
1914	120.0	0.0	1.1	1972	692.9	7.7	7.0
1915	148.3	23.6	5.5	1973	766.2	10.6	7.9
1916	175.8	18.5	8.6	1974	912.8	19.1	10.8
1917	212.5	20.9	12.1	1975	1140.0	24.9	14.1
1918	244.7	15.2	15.3	1976	1311.8	15.1	15.3
1919	250.3	2.3	15.8	1977	1471.1	12.1	16.3
1920	299.2	19.6	15.1	1978	1594.4	8.4	15.8
1921	221.4	-26.0	4.7	1979	1869.3	17.2	15.4
1922	200.2	-9.5	-1.2	1980	2151.9	15.1	13.5
1923	196.9	-1.7	-4.3	1981	2411.2	12.0	12.9
1924	201.3	2.3	-4.3	1982	2541.6	5.4	11.6
1925	196.9	-2.2	-8.0	1983	2676.7	5.3	10.9
1926	199.1	1.1	-2.1	1984	2799.3	4.6	8.4
1927	188.0	-5.6	-1.3	1985	2958.5	5.7	6.6
1928	186.9	-0.6	-1.0	1986	3068.6	3.7	4.9
1929	185.8	-0.6	-1.6	1987	3182.0	3.7	4.6
1930	172.4	-7.2	-2.6	1988	3397.6	6.8	4.9
1931	164.6	-4.5	-3.7	1989	3659.5	7.7	5.5
1932	159.1	-3.4	-3.3	1990	4001.4	9.3	6.2
1933	159.1	0.0	-3.2	1991	4180.0	4.5	6.4
1934	160.2	0.7	-2.9	1992	4287.8	2.6	6.1
1935	163.5	2.1	-1.1	1993	4369.3	1.9	5.2
1936	168.0	2.7	0.4	1994	4495.6	2.9	4.2
1937	178.0	6.0	2.3	1995	4640.3	3.2	3.0
1938	173.5	-2.5	1.8	1996	4754.2	2.5	2.6
1939	192.4	10.9	3.7	1997	4926.6	3.6	2.8
1940	216.9	12.7	5.8	1998	5062.1	2.8	3.0
1941	223.6	3.1	5.9	1999	5151.4	1.8	2.8
1942	222.5	-0.5	4.6	2000	5302.3	2.9	2.7
1943	221.4	-0.5	5.0	2001	5339.2	0.7	2.3
1944	223.6	1.0	3.0	2002	5496.3	2.9	2.2
1945	225.8	1.0	0.8	2003	5650.2	2.8	2.2
1946	226.9	0.5	0.3	2004	5847.3	3.5	2.6
1947	234.2	3.2	1.0	2005	5976.6	2.2	2.4
1948	245.7	4.9	2.1	2006	6241.4	4.4	3.2
1949	254.3	3.5	2.6	2007	6493.9	4.0	3.4
1950	262.4	3.2	3.0	2008	6555.5	0.9	3.0
1951	294.0	12.0	5.3	2009	6712.5	2.4	2.8
1952	312.7	6.3	6.0	2010	7032.8	4.8	3.3
1953	316.0	1.1	5.2	2011	7371.5	4.8	3.4
1954	328.5	4.0	5.3	2012	7599.3	3.1	3.2
1955	347.7	5.8	5.8	2013	7802.6	2.7	3.5
1956	358.3	3.0	4.0	2014	7928.8	1.6	3.4
1957	374.9	4.6	3.7				

FIGURE 7

Barclays UK Equity Index

Year	Equity Price Index December		Equity Income Index December		Income yield %	Equity Price Index adjusted for Cost of Living		Equity Income Index adjusted for Cost of Living	
1899	100					100			
1900	108	+8.3%	100		6.3	105	+4.8%	100	
1901	100	-7.9%	69	-30.6%	4.8	97	-7.9%	69	-30.6%
1902	101	+1.3%	80	+15.6%	5.4	95	-1.9%	78	+11.9%
1903	98	-2.7%	66	-17.3%	4.6	92	-2.7%	64	-17.3%
1904	106	+8.0%	62	-6.1%	4.0	100	+8.0%	60	-6.1%
1905	105	-0.7%	71	+13.7%	4.6	99	-0.7%	69	+13.7%
1906	112	+6.1%	77	+8.5%	4.7	112	+13.2%	79	+15.7%
1907	107	-4.7%	79	+2.9%	5.1	97	-13.3%	74	-6.4%
1908	108	+1.3%	57	-27.4%	3.6	95	-1.7%	52	-29.5%
1909	115	+6.3%	73	+26.5%	4.3	101	+6.3%	66	+26.5%
1910	112	-2.1%	69	-4.5%	4.2	99	-2.1%	63	-4.5%
1911	109	-2.9%	71	+2.1%	4.4	94	-5.7%	63	-0.8%
1912	108	-1.4%	69	-3.2%	4.4	90	-4.2%	59	-5.8%
1913	100	-7.1%	57	-16.5%	3.9	83	-7.1%	49	-16.5%
1914	96	-4.4%	57	+0.1%	4.1	80	-4.4%	49	+0.1%
1915	96	0.0%	36	-37.8%	2.6	64	-19.1%	25	-49.7%
1916	89	-6.8%	67	+88.2%	5.2	51	-21.4%	39	+58.8%
1917	93	+4.2%	66	-2.2%	4.8	44	-13.8%	32	-19.1%
1918	108	+16.3%	63	-3.6%	4.0	44	+1.0%	27	-16.3%
1919	116	+7.7%	34	-47.0%	2.0	46	+5.3%	14	-48.2%
1920	86	-25.6%	77	+128.9%	6.1	29	-37.8%	26	+91.4%
1921	80	-7.1%	79	+2.7%	6.7	36	+25.5%	37	+38.8%
1922	96	+19.8%	73	-7.9%	5.2	48	+32.5%	37	+1.8%
1923	92	-4.0%	72	-0.8%	5.3	47	-2.4%	38	+0.9%
1924	106	+15.3%	67	-7.5%	4.3	53	+12.8%	34	-9.5%
1925	117	+9.9%	73	+10.3%	4.3	59	+12.4%	39	+12.7%
1926	119	+1.8%	83	+12.5%	4.8	60	+0.7%	43	+11.2%
1927	124	+4.0%	76	-8.2%	4.2	66	+10.1%	42	-2.8%
1928	139	+12.2%	79	+3.9%	3.9	74	+12.9%	44	+4.5%
1929	113	-19.1%	90	+14.9%	5.5	61	-18.6%	50	+15.6%
1930	102	-9.2%	80	-11.0%	5.4	59	-2.1%	48	-4.2%
1931	77	-24.3%	65	-18.7%	5.8	47	-20.8%	41	-14.8%
1932	99	+27.9%	64	-2.4%	4.4	62	+32.4%	41	+1.0%
1933	119	+20.6%	60	-5.6%	3.5	75	+20.6%	39	-5.6%
1934	131	+9.8%	70	+15.7%	3.6	82	+9.0%	45	+14.9%
1935	144	+9.9%	78	+11.5%	3.7	88	+7.7%	49	+9.2%
1936	166	+15.1%	82	+5.8%	3.4	99	+12.1%	51	+3.0%
1937	138	-16.7%	93	+12.7%	4.6	78	-21.4%	54	+6.4%
1938	118	-14.9%	94	+1.8%	5.5	68	-12.7%	56	+4.4%
1939	114	-3.1%	90	-4.8%	5.4	59	-12.6%	48	-14.2%
1940	102	-10.2%	94	+4.8%	6.3	47	-20.3%	45	-7.1%
1941	119	+16.8%	91	-3.6%	5.2	53	+13.3%	42	-6.5%
1942	135	+12.9%	86	-4.5%	4.4	61	+13.4%	40	-4.0%
1943	144	+7.1%	86	-0.2%	4.1	65	+7.7%	40	+0.3%
1944	156	+8.3%	87	+0.4%	3.8	70	+7.3%	40	-0.6%
1945	160	+2.0%	88	+2.0%	3.8	71	+1.0%	40	+1.0%
1946	182	+13.9%	93	+4.9%	3.5	80	+13.3%	42	+4.4%
1947	170	-6.3%	107	+15.1%	4.3	73	-9.2%	47	+11.6%
1948	157	-7.7%	98	-7.7%	4.3	64	-12.1%	41	-12.1%
1949	141	-10.3%	103	+4.4%	5.0	55	-13.3%	42	+0.8%
1950	149	+5.6%	109	+5.6%	5.0	57	+2.3%	43	+2.3%
1951	153	+3.0%	121	+11.2%	5.4	52	-8.1%	42	-0.7%
1952	144	-5.9%	128	+6.3%	6.1	46	-11.5%	42	-0.0%
1953	170	+17.8%	134	+4.3%	5.4	54	+16.6%	44	+3.2%
1954	242	+42.4%	155	+16.0%	4.4	74	+36.9%	49	+11.6%
1955	256	+5.8%	179	+15.4%	4.8	74	-0.0%	53	+9.1%
1956	220	-13.9%	183	+2.2%	5.7	62	-16.5%	53	-0.8%
1957	205	-7.0%	188	+2.8%	6.3	55	-11.1%	52	-1.7%

Year	Equity Price Index December		Equity Income Index December		Income yield %	Equity Price Index adjusted for Cost of Living		Equity Income Index adjusted for Cost of Living	
1958	289	+41.1%	202	+7.5%	4.8	76	+38.5%	55	+5.5%
1959	432	+49.5%	227	+12.1%	3.6	113	+49.5%	61	+12.1%
1960	421	-2.6%	276	+21.7%	4.5	108	-4.4%	73	+19.5%
1961	409	-3.0%	286	+3.5%	4.8	101	-7.0%	73	-0.8%
1962	391	-4.4%	285	-0.4%	5.0	94	-6.9%	71	-3.0%
1963	450	+15.2%	266	-6.5%	4.1	106	+13.1%	65	-8.2%
1964	405	-10.0%	303	+13.7%	5.1	91	-14.2%	70	+8.5%
1965	428	+5.9%	326	+7.7%	5.2	92	+1.3%	73	+3.1%
1966	389	-9.3%	328	+0.5%	5.8	81	-12.5%	70	-3.1%
1967	500	+28.7%	319	-2.5%	4.4	101	+25.6%	67	-4.8%
1968	718	+43.5%	339	+6.1%	3.2	137	+35.4%	67	+0.2%
1969	609	-15.2%	342	+0.8%	3.9	111	-19.0%	65	-3.7%
1970	563	-7.5%	360	+5.5%	4.4	95	-14.3%	63	-2.3%
1971	799	+41.9%	379	+5.1%	3.3	124	+30.2%	61	-3.6%
1972	901	+12.8%	414	+9.3%	3.2	130	+4.8%	62	+1.6%
1973	619	-31.4%	430	+3.9%	4.8	81	-37.9%	58	-6.0%
1974	276	-55.3%	472	+9.6%	11.7	30	-62.5%	53	-8.0%
1975	653	+136.3%	521	+10.4%	5.5	57	+89.2%	47	-11.6%
1976	628	-3.9%	588	+12.8%	6.4	48	-16.5%	46	-2.0%
1977	886	+41.2%	682	+16.1%	5.3	60	+25.9%	48	+3.5%
1978	910	+2.7%	768	+12.6%	5.8	57	-5.3%	50	+3.9%
1979	949	+4.3%	951	+23.8%	6.9	51	-11.0%	53	+5.6%
1980	1206	+27.1%	1073	+12.8%	6.1	56	+10.4%	52	-2.0%
1981	1294	+7.2%	1111	+3.5%	5.9	54	-4.3%	48	-7.6%
1982	1579	+22.1%	1211	+9.0%	5.3	62	+15.8%	49	+3.4%
1983	1944	+23.1%	1309	+8.1%	4.6	73	+16.9%	51	+2.7%
1984	2450	+26.0%	1578	+20.6%	4.4	88	+20.5%	58	+15.3%
1985	2822	+15.2%	1781	+12.8%	4.3	95	+9.0%	62	+6.8%
1986	3452	+22.3%	2033	+14.1%	4.0	112	+17.9%	68	+10.0%
1987	3596	+4.2%	2264	+11.4%	4.3	113	+0.4%	74	+7.4%
1988	3829	+6.5%	2628	+16.1%	4.7	113	-0.3%	80	+8.7%
1989	4978	+30.0%	3076	+17.0%	4.2	136	+20.7%	87	+8.7%
1990	4265	-14.3%	3401	+10.5%	5.5	107	-21.6%	88	+1.1%
1991	4907	+15.1%	3591	+5.6%	5.0	117	+10.1%	89	+1.1%
1992	5635	+14.8%	3573	-0.5%	4.4	131	+11.9%	86	-3.0%
1993	6951	+23.3%	3414	-4.4%	3.4	159	+21.0%	81	-6.2%
1994	6286	-9.6%	3684	+7.9%	4.0	140	-12.1%	85	+4.9%
1995	7450	+18.5%	4127	+12.0%	3.8	161	+14.8%	92	+8.5%
1996	8320	+11.7%	4536	+9.9%	3.7	175	+9.0%	99	+7.3%
1997	9962	+19.7%	4690	+3.4%	3.2	202	+15.5%	98	-0.2%
1998	11048	+10.9%	4026	-14.2%	2.5	218	+7.9%	82	-16.5%
1999	13396	+21.2%	4140	+2.8%	2.1	260	+19.1%	83	+1.0%
2000	12329	-8.0%	4007	-3.2%	2.2	233	-10.6%	78	-5.9%
2001	10428	-15.4%	3998	-0.2%	2.6	195	-16.0%	77	-0.9%
2002	7825	-25.0%	4049	+1.3%	3.6	142	-27.1%	76	-1.6%
2003	9121	+16.6%	4121	+1.8%	3.1	161	+13.4%	75	-1.0%
2004	9961	+9.2%	4428	+7.5%	3.1	170	+5.5%	78	+3.8%
2005	11764	+18.1%	5058	+14.2%	3.0	197	+15.5%	87	+11.8%
2006	13311	+13.2%	5549	+9.7%	2.9	213	+8.3%	92	+5.0%
2007	13580	+2.0%	5978	+7.7%	3.0	209	-1.9%	95	+3.5%
2008	9129	-32.8%	5974	-0.1%	4.5	139	-33.4%	94	-1.0%
2009	11407	+25.0%	5321	-10.9%	3.2	170	+22.0%	82	-13.0%
2010	12655	+10.9%	5331	+0.2%	2.9	180	+5.9%	78	-4.4%
2011	11808	-6.7%	6059	+13.6%	3.5	160	-11.0%	85	+8.4%
2012	12782	+8.2%	6651	+9.8%	3.6	168	+5.0%	90	+6.5%
2013	14915	+16.7%	7131	+7.2%	3.3	191	+13.6%	94	+4.4%
2014	14597	-2.1%	7170	+0.6%	3.4	184	-3.7%	93	-1.0%

FIGURE 8
Barclays UK Gilt Index

Year	Gilt Price Index December		Yield %	Gilt Price Index Adjusted for Cost of Living	
1899	100.0			100.0	
1900	98.4	-1.6%	2.8	95.2	-4.8%
1901	94.6	-3.8%	2.9	91.5	-3.8%
1902	93.7	-0.9%	3.0	87.8	-4.0%
1903	88.3	-5.8%	2.9	82.8	-5.8%
1904	89.4	+1.2%	2.8	83.8	+1.2%
1905	90.1	+0.8%	2.8	84.4	+0.8%
1906	86.6	-3.8%	2.9	86.6	+2.6%
1907	84.1	-2.9%	3.0	76.5	-11.7%
1908	84.6	+0.6%	3.0	74.7	-2.4%
1909	83.6	-1.3%	3.0	73.7	-1.3%
1910	80.0	-4.3%	3.1	70.6	-4.3%
1911	77.7	-2.8%	3.2	66.6	-5.6%
1912	75.8	-2.4%	3.3	63.2	-5.1%
1913	72.3	-4.7%	3.5	60.2	-4.7%
1914	73.0	+1.0%	3.4	60.9	+1.0%
1915	73.0	0.0	3.4	49.2	-19.1%
1916	55.7	-23.8%	4.5	31.7	-35.7%
1917	54.9	-1.4%	4.6	25.8	-18.4%
1918	59.4	+8.3%	4.2	24.3	-6.0%
1919	51.9	-12.7%	4.8	20.7	-14.6%
1920	45.6	-12.1%	5.5	15.2	-26.5%
1921	50.6	+11.1%	4.9	22.9	+50.2%
1922	56.2	+10.9%	4.4	28.1	+22.6%
1923	56.1	-0.2%	4.5	28.5	+1.5%
1924	57.7	+2.9%	4.3	28.6	+0.6%
1925	55.4	-3.9%	4.5	28.1	-1.7%
1926	54.5	-1.6%	4.6	27.4	-2.7%
1927	55.9	+2.6%	4.5	29.8	+8.7%
1928	56.7	+1.3%	4.4	30.3	+1.9%
1929	53.3	-6.0%	4.7	28.7	-5.4%
1930	57.8	+8.5%	4.3	33.5	+16.9%
1931	55.0	-4.7%	4.5	33.4	-0.2%
1932	74.7	+35.6%	3.3	46.9	+40.4%
1933	74.6	-0.1%	3.3	46.9	-0.1%
1934	92.8	+24.4%	2.7	57.9	+23.5%
1935	87.4	-5.8%	2.9	53.4	-7.8%
1936	85.1	-2.6%	2.9	50.7	-5.2%
1937	74.8	-12.2%	3.3	42.0	-17.1%
1938	70.7	-5.4%	3.5	40.8	-3.0%
1939	68.9	-2.6%	3.6	35.8	-12.2%
1940	77.4	+12.3%	3.2	35.7	-0.3%
1941	83.1	+7.4%	3.0	37.2	+4.2%
1942	82.9	-0.3%	3.0	37.2	+0.2%
1943	80.0	-3.4%	3.1	36.1	-3.0%
1944	82.1	+2.6%	3.0	36.7	+1.6%
1945	91.8	+11.8%	2.7	40.6	+10.7%
1946	99.2	+8.0%	2.5	43.7	+7.5%
1947	82.5	-16.8%	3.0	35.2	-19.4%
1948	80.6	-2.3%	3.1	32.8	-6.9%
1949	70.9	-12.0%	3.5	27.9	-15.0%
1950	71.3	+0.5%	3.5	27.2	-2.6%

Year	Gilt Price Index December		Yield %	Gilt Price Index Adjusted for Cost of Living	
1951	61.9	-13.1%	4.0	21.1	-22.4%
1952	59.0	-4.8%	4.2	18.9	-10.5%
1953	64.7	+9.7%	3.9	20.5	+8.5%
1954	66.1	+2.2%	3.8	20.1	-1.7%
1955	56.9	-13.8%	4.4	16.4	-18.6%
1956	52.7	-7.5%	4.7	14.7	-10.2%
1957	46.9	-10.9%	5.3	12.5	-14.9%
1958	52.4	+11.7%	4.8	13.7	+9.6%
1959	50.4	-3.9%	5.0	13.2	-3.9%
1960	44.3	-11.9%	5.6	11.4	-13.5%
1961	38.3	-13.7%	6.5	9.4	-17.3%
1962	45.3	+18.3%	5.4	10.9	+15.3%
1963	44.5	-1.7%	5.5	10.5	-3.5%
1964	41.0	-7.9%	6.1	9.2	-12.1%
1965	40.3	-1.7%	6.2	8.7	-6.0%
1966	39.5	-2.1%	6.4	8.2	-5.5%
1967	37.9	-4.1%	6.9	7.7	-6.4%
1968	34.4	-9.3%	7.6	6.6	-14.4%
1969	31.7	-7.6%	8.5	5.8	-11.7%
1970	30.1	-5.2%	9.3	5.1	-12.2%
1971	35.4	+17.6%	8.3	5.5	+7.8%
1972	31.0	-12.3%	9.6	4.5	-18.5%
1973	25.3	-18.6%	11.9	3.3	-26.4%
1974	18.3	-27.5%	17.0	2.0	-39.2%
1975	21.8	+19.2%	14.8	1.9	-4.6%
1976	21.6	-1.1%	15.0	1.6	-14.0%
1977	28.2	+30.6%	10.9	1.9	+16.4%
1978	24.4	-13.3%	13.2	1.5	-20.0%
1979	22.2	-9.2%	14.7	1.2	-22.6%
1980	23.5	+6.2%	13.9	1.1	-7.8%
1981	20.7	-12.1%	15.8	0.9	-21.6%
1982	28.2	+36.2%	11.1	1.1	+29.2%
1983	29.5	+4.9%	10.5	1.1	-0.4%
1984	28.5	-3.4%	10.6	1.0	-7.7%
1985	28.7	+0.4%	10.5	1.0	-5.0%
1986	28.8	+0.4%	10.5	0.9	-3.2%
1987	30.6	+6.2%	9.5	1.0	+2.4%
1988	30.6	+0.0%	9.3	0.9	-6.3%
1989	29.4	-3.7%	10.0	0.8	-10.6%
1990	28.1	-4.5%	10.6	0.7	-12.7%
1991	30.4	+8.0%	9.8	0.7	+3.4%
1992	33.0	+8.7%	8.7	0.8	+6.0%
1993	39.4	+19.3%	6.4	0.9	+17.1%
1994	32.2	-18.1%	8.6	0.7	-20.4%
1995	35.5	+10.3%	7.6	0.8	+6.8%
1996	35.7	+0.6%	7.6	0.8	-1.8%
1997	40.0	+11.8%	6.3	0.8	+7.9%
1998	47.4	+18.6%	4.4	0.9	+15.4%
1999	43.4	-8.4%	5.3	0.8	-10.0%
2000	45.2	+4.0%	4.7	0.9	+1.0%
2001	43.4	-3.8%	5.0	0.8	-4.5%
2002	45.5	+4.8%	4.4	0.8	+1.8%
2003	44.1	-3.2%	4.7	0.8	-5.8%
2004	45.2	+2.5%	4.5	0.8	-1.0%
2005	47.0	+3.9%	4.1	0.8	+1.7%

Year	Gilt Price Index December		Yield %	Gilt Price Index Adjusted for Cost of Living	
2006	44.8	-4.6%	4.7	0.7	-8.6%
2007	45.1	+0.6%	4.5	0.7	-3.3%
2008	48.8	+8.3%	3.4	0.7	+7.3%
2009	46.4	-5.0%	4.2	0.7	-7.3%
2010	48.7	+5.0%	3.6	0.7	+0.3%
2011	57.2	+17.4%	2.4	0.8	+12.0%
2012	57.9	+1.3%	2.2	0.8	-1.7%
2013	51.8	-10.6%	3.3	0.7	-12.9%
2014	59.3	+14.4%	2.1	0.7	+12.6%

FIGURE 9
Barclays UK Treasury Bill Index

Year	Treasury Bill Index December		Treasury Bill Index adjusted for cost of living	
1899	100		100	
1900	104	+4.0%	101	+0.6%
1901	107	+2.5%	103	+2.5%
1902	110	+3.0%	103	-0.3%
1903	114	+3.4%	106	+3.4%
1904	117	+2.9%	110	+2.9%
1905	119	+2.2%	112	+2.2%
1906	123	+3.0%	123	+9.9%
1907	128	+3.8%	116	-5.7%
1908	130	+2.2%	115	-0.8%
1909	133	+2.1%	118	+2.1%
1910	137	+3.1%	121	+3.1%
1911	141	+2.8%	121	-0.1%
1912	144	+2.0%	120	-0.8%
1913	148	+3.0%	124	+3.0%
1914	153	+3.0%	127	+3.0%
1915	158	+3.0%	106	-16.6%
1916	162	+3.0%	92	-13.1%
1917	167	+3.0%	79	-14.7%
1918	172	+3.0%	70	-10.5%
1919	179	+3.6%	71	+1.3%
1920	190	+6.5%	64	-11.0%
1921	199	+4.7%	90	+41.5%
1922	204	+2.6%	102	+13.4%
1923	210	+2.7%	107	+4.4%
1924	217	+3.5%	108	+1.2%
1925	226	+4.2%	115	+6.6%
1926	237	+4.6%	119	+3.5%
1927	247	+4.4%	131	+10.5%
1928	257	+4.3%	138	+4.9%
1929	271	+5.4%	146	+6.1%
1930	278	+2.5%	161	+10.5%
1931	289	+3.7%	175	+8.6%
1932	293	+1.5%	184	+5.0%
1933	295	+0.6%	185	+0.6%
1934	297	+0.7%	185	+0.0%
1935	298	+0.5%	182	-1.5%
1936	300	+0.6%	179	-2.1%
1937	302	+0.6%	170	-5.1%
1938	304	+0.6%	175	+3.2%
1939	308	+1.3%	160	-8.6%
1940	311	+1.0%	143	-10.4%
1941	314	+1.0%	140	-2.0%
1942	317	+2.0%	143	+1.5%
1943	320	+1.0%	145	+1.5%
1944	324	+1.0%	145	+0.0%
1945	327	+0.9%	145	-0.1%
1946	328	+0.5%	145	+0.0%
1947	330	+0.5%	141	-2.6%
1948	332	+0.5%	135	-4.2%
1949	333	+0.5%	131	-2.9%
1950	335	+0.5%	128	-2.6%
1951	337	+0.5%	115	-10.3%
1952	344	+2.1%	110	-4.0%
1953	352	+2.4%	111	+1.3%
1954	359	+1.9%	109	-2.0%
1955	371	+3.5%	107	-2.2%

Year	Treasury Bill Index December		Treasury Bill Index adjusted for cost of living	
1956	390	+5.0%	109	+1.9%
1957	409	+5.0%	109	+0.4%
1958	430	+5.1%	113	+3.2%
1959	445	+3.4%	117	+3.4%
1960	467	+5.0%	120	+3.2%
1961	491	+5.1%	121	+0.7%
1962	513	+4.5%	123	+1.8%
1963	533	+3.8%	126	+1.9%
1964	556	+4.4%	125	-0.4%
1965	591	+6.3%	127	+1.7%
1966	627	+6.1%	130	+2.4%
1967	664	+5.9%	135	+3.4%
1968	714	+7.4%	137	+1.4%
1969	770	+7.9%	141	+3.1%
1970	828	+7.5%	140	-0.4%
1971	879	+6.2%	137	-2.6%
1972	927	+5.4%	134	-2.1%
1973	1010	+9.0%	132	-1.4%
1974	1137	+12.6%	125	-5.5%
1975	1259	+10.8%	110	-11.3%
1976	1402	+11.3%	107	-3.2%
1977	1534	+9.4%	104	-2.4%
1978	1658	+8.1%	104	-0.3%
1979	1881	+13.5%	101	-3.2%
1980	2204	+17.2%	102	+1.8%
1981	2507	+13.8%	104	+1.5%
1982	2817	+12.4%	111	+6.6%
1983	3103	+10.1%	116	+4.6%
1984	3399	+9.5%	121	+4.8%
1985	3803	+11.9%	129	+5.8%
1986	4219	+10.9%	137	+7.0%
1987	4624	+9.6%	145	+5.7%
1988	5133	+11.0%	151	+4.0%
1989	5880	+14.6%	161	+6.4%
1990	6812	+15.9%	170	+6.0%
1991	7602	+11.6%	182	+6.8%
1992	8322	+9.5%	194	+6.7%
1993	8810	+5.9%	202	+3.9%
1994	9286	+5.4%	207	+2.4%
1995	9911	+6.7%	214	+3.4%
1996	10522	+6.2%	221	+3.6%
1997	11246	+6.9%	228	+3.1%
1998	12137	+7.9%	240	+5.0%
1999	12805	+5.5%	249	+3.7%
2000	13601	+6.2%	257	+3.2%
2001	14349	+5.5%	269	+4.8%
2002	14939	+4.1%	272	+1.1%
2003	15500	+3.8%	274	+0.9%
2004	16211	+4.6%	277	+1.1%
2005	17022	+5.0%	285	+2.7%
2006	17856	+4.9%	286	+0.4%
2007	18903	+5.9%	291	+1.8%
2008	19891	+5.2%	303	+4.2%
2009	20026	+0.7%	298	-1.7%
2010	20126	+0.5%	286	-4.1%
2011	20228	+0.5%	274	-4.1%
2012	20294	+0.3%	267	-2.7%
2013	20363	+0.3%	261	-2.3%
2014	20444	+0.4%	258	-1.2%

FIGURE 10
Barclays UK Index-linked Gilt Index

Year	Index Linked Gilt Price Index December		Real yield %	Money yield %	Index Linked Gilt Price Index adjusted for Cost of Living	
1982	100		2.7	8.3	100	
1983	98.1	-1.9%	3.2	8.7	93.2	-6.8%
1984	101.6	+3.6%	3.3	8.1	92.3	-1.0%
1985	98.5	-3.1%	3.9	9.8	84.6	-8.3%
1986	101.4	+3.0%	4.1	7.9	84.0	-0.7%
1987	105.1	+3.6%	4.0	7.9	84.0	-0.1%
1988	116.0	+10.4%	3.8	10.8	86.8	+3.3%
1989	129.1	+11.3%	3.5	11.5	89.7	+3.3%
1990	130.8	+1.3%	4.0	13.8	83.1	-7.4%
1991	133.2	+1.8%	4.5	9.2	81.0	-2.5%
1992	151.1	+13.4%	3.9	6.6	89.6	+10.6%
1993	177.1	+17.2%	2.9	4.9	103.0	+15.0%
1994	158.3	-10.6%	4.0	7.0	89.5	-13.1%
1995	171.1	+8.1%	3.6	6.9	93.7	+4.7%
1996	176.2	+3.0%	3.6	6.1	94.2	+0.5%
1997	193.4	+9.8%	3.1	6.9	99.8	+5.9%
1998	227.4	+17.6%	2.0	4.8	114.2	+14.4%
1999	233.7	+2.8%	2.2	4.0	115.3	+1.0%
2000	235.4	+0.8%	2.3	5.3	112.9	-2.1%
2001	227.7	-3.3%	2.7	3.4	108.4	-4.0%
2002	240.7	+5.7%	2.1	5.1	111.3	+2.7%
2003	251.9	+4.7%	1.7	4.5	113.3	+1.8%
2004	267.6	+6.3%	1.7	5.3	116.3	+2.7%
2005	286.7	+7.1%	1.5	3.8	121.9	+4.8%
2006	287.0	+0.1%	1.6	6.0	116.9	-4.1%
2007	297.9	+3.8%	1.4	5.5	116.6	-0.3%
2008	290.3	-2.5%	1.4	2.3	112.5	-3.5%
2009	302.5	+4.2%	0.8	3.2	114.5	+1.8%
2010	328.3	+8.5%	0.4	5.2	118.6	+3.6%
2011	369.5	+12.5%	-0.5	4.2	127.4	+7.4%
2012	363.6	-1.6%	-0.5	2.6	121.6	-4.5%
2013	355.7	-2.2%	-0.2	2.5	115.9	-4.7%
2014	409.6	+15.2%	-0.8	0.8	131.3	+13.3%

FIGURE 11

Barclays UK Equity, Gilt and Treasury Bill Funds

	Equities				Gilts				Treasury Bills			
Year	Value of Fund December £		Adjusted for Cost of Living		Value of Fund December£		Adjusted for Cost of Living		Value of Fund December £		Adjusted for Cost of Living	
1945	100		100		100		100		100		100	
1946	118	+17.9%	117	+17.3%	111	+10.7%	110	+10.2%	101	+0.5%	100	+0.0%
1947	115	-2.3%	111	-5.3%	95	-14.3%	92	-16.9%	101	+0.5%	97	-2.6%
1948	111	-3.8%	102	-8.3%	96	+0.7%	88	-4.0%	102	+0.5%	93	-4.2%
1949	104	-5.8%	93	-8.9%	87	-8.9%	77	-12.0%	102	+0.5%	91	-2.9%
1950	116	+10.9%	100	+7.4%	91	+4.0%	78	+0.8%	103	+0.5%	88	-2.6%
1951	126	+8.5%	97	-3.1%	82	-9.6%	63	-19.3%	103	+0.5%	79	-10.3%
1952	126	-0.1%	91	-6.1%	81	-0.8%	59	-6.7%	105	+2.1%	76	-4.0%
1953	156	+24.2%	111	+22.9%	93	+14.0%	66	+12.8%	108	+2.4%	77	+1.3%
1954	232	+48.6%	159	+42.9%	98	+6.1%	67	+2.0%	110	+1.9%	75	-2.0%
1955	257	+10.9%	167	+4.8%	88	-10.1%	57	-15.0%	114	+3.5%	74	-2.2%
1956	234	-9.0%	147	-11.7%	85	-3.2%	54	-6.0%	119	+5.0%	75	+1.9%
1957	231	-1.1%	139	-5.5%	80	-6.2%	48	-10.4%	125	+5.0%	75	+0.4%
1958	342	+47.9%	202	+45.2%	94	+17.0%	55	+14.9%	132	+5.1%	78	+3.2%
1959	529	+54.8%	313	+54.8%	95	+0.9%	56	+0.9%	136	+3.4%	81	+3.4%
1960	539	+1.8%	313	-0.1%	88	-7.0%	51	-8.7%	143	+5.0%	83	+3.2%
1961	548	+1.7%	305	-2.5%	81	-8.1%	45	-11.9%	150	+5.1%	84	+0.7%
1962	550	+0.4%	298	-2.2%	101	+24.7%	55	+21.5%	157	+4.5%	85	+1.8%
1963	659	+19.9%	351	+17.7%	105	+3.7%	56	+1.8%	163	+3.8%	87	+1.9%
1964	623	-5.4%	317	-9.8%	102	-2.3%	52	-6.7%	170	+4.4%	87	-0.4%
1965	694	+11.4%	337	+6.6%	107	+4.4%	52	-0.1%	181	+6.3%	88	+1.7%
1966	666	-4.0%	312	-7.4%	111	+4.2%	52	+0.5%	192	+6.1%	90	+2.4%
1967	895	+34.3%	410	+31.1%	114	+2.6%	52	+0.1%	203	+5.9%	93	+3.4%
1968	1326	+48.1%	573	+39.8%	111	-2.4%	48	-7.8%	219	+7.4%	94	+1.4%
1969	1168	-11.9%	482	-15.9%	112	+0.2%	46	-4.2%	236	+7.9%	97	+3.1%
1970	1127	-3.5%	431	-10.5%	116	+3.6%	44	-4.0%	253	+7.5%	97	-0.4%
1971	1652	+46.5%	579	+34.4%	147	+27.3%	52	+16.8%	269	+6.2%	94	-2.6%
1972	1922	+16.4%	626	+8.1%	142	-3.8%	46	-10.7%	284	+5.4%	92	-2.1%
1973	1382	-28.1%	407	-35.0%	129	-8.9%	38	-17.6%	309	+9.0%	91	-1.4%
1974	690	-50.1%	171	-58.1%	109	-15.2%	27	-28.8%	348	+12.6%	86	-5.5%
1975	1719	+149.3%	341	+99.6%	150	+36.8%	30	+9.5%	386	+10.8%	76	-11.3%
1976	1759	+2.3%	303	-11.1%	170	+13.7%	29	-1.1%	429	+11.3%	74	-3.2%
1977	2614	+48.6%	401	+32.5%	247	+44.8%	38	+29.1%	470	+9.4%	72	-2.4%
1978	2839	+8.6%	402	+0.2%	242	-1.8%	34	-9.4%	508	+8.1%	72	-0.3%
1979	3165	+11.5%	382	-4.9%	252	+4.1%	30	-11.2%	576	+13.5%	70	-3.2%
1980	4268	+34.8%	448	+17.1%	305	+20.9%	32	+5.0%	675	+17.2%	71	+1.8%
1981	4846	+13.6%	454	+1.3%	310	+1.8%	29	-9.2%	768	+13.8%	72	+1.5%
1982	6227	+28.5%	553	+21.9%	469	+51.3%	42	+43.6%	863	+12.4%	77	+6.6%
1983	8019	+28.8%	676	+22.3%	544	+15.9%	46	+10.0%	950	+10.1%	80	+4.6%
1984	10552	+31.6%	851	+25.8%	581	+6.8%	47	+2.1%	1041	+9.6%	84	+4.8%
1985	12680	+20.2%	968	+13.7%	644	+11.0%	49	+5.0%	1165	+11.9%	89	+5.8%
1986	16139	+27.3%	1188	+22.7%	715	+11.0%	53	+7.0%	1292	+10.9%	95	+7.0%
1987	17536	+8.7%	1244	+4.8%	831	+16.3%	59	+12.1%	1416	+9.6%	100	+5.7%
1988	19552	+11.5%	1299	+4.4%	909	+9.4%	60	+2.4%	1572	+11.0%	104	+4.0%
1989	26498	+35.5%	1635	+25.8%	963	+5.9%	59	-1.7%	1801	+14.6%	111	+6.4%

Year	Equities				Gilts				Treasury Bills			
	Value of Fund December £		Adjusted for Cost of Living		Value of Fund December£		Adjusted for Cost of Living		Value of Fund December £		Adjusted for Cost of Living	
1990	23947	-9.6%	1351	-17.4%	1017	+5.6%	57	-3.4%	2086	+15.9%	118	+6.0%
1991	28936	+20.8%	1563	+15.7%	1209	+18.9%	65	+13.8%	2328	+11.6%	126	+6.8%
1992	34672	+19.8%	1826	+16.8%	1432	+18.4%	75	+15.4%	2549	+9.5%	134	+6.7%
1993	44207	+27.5%	2285	+25.1%	1844	+28.8%	95	+26.4%	2698	+5.9%	139	+3.9%
1994	41590	-5.9%	2089	-8.6%	1635	-11.3%	82	-13.8%	2844	+5.4%	143	+2.4%
1995	51163	+23.0%	2490	+19.2%	1945	+19.0%	95	+15.3%	3035	+6.7%	148	+3.4%
1996	59275	+15.9%	2815	+13.1%	2095	+7.7%	100	+5.1%	3222	+6.2%	153	+3.6%
1997	73263	+23.6%	3358	+19.3%	2503	+19.4%	115	+15.3%	3444	+6.9%	158	+3.1%
1998	83284	+13.7%	3715	+10.6%	3129	+25.0%	140	+21.7%	3717	+7.9%	166	+5.0%
1999	103120	+23.8%	4520	+21.7%	3018	-3.5%	132	-5.2%	3921	+5.5%	172	+3.7%
2000	97023	-5.9%	4132	-8.6%	3296	+9.2%	140	+6.1%	4165	+6.2%	177	+3.2%
2001	84226	-13.2%	3562	-13.8%	3340	+1.3%	141	+0.6%	4394	+5.5%	186	+4.8%
2002	65440	-22.3%	2689	-24.5%	3668	+9.8%	151	+6.7%	4575	+4.1%	188	+1.1%
2003	78643	+20.2%	3143	+16.9%	3725	+1.6%	149	-1.2%	4747	+3.8%	190	+0.9%
2004	88508	+12.5%	3418	+8.8%	3994	+7.2%	154	+3.6%	4964	+4.6%	192	+1.1%
2005	107609	+21.6%	4066	+18.9%	4329	+8.4%	164	+6.0%	5213	+5.0%	197	+2.7%
2006	125243	+16.4%	4531	+11.4%	4323	-0.1%	156	-4.4%	5468	+4.9%	198	+0.4%
2007	131639	+5.1%	4577	+1.0%	4550	+5.2%	158	+1.2%	5789	+5.9%	201	+1.8%
2008	92460	-29.8%	3185	-30.4%	5135	+12.9%	177	+11.8%	6091	+5.2%	210	+4.2%
2009	119238	+29.0%	4011	+25.9%	5087	-1.0%	171	-3.3%	6133	+0.7%	206	-1.7%
2010	136107	+14.1%	4370	+8.9%	5565	+9.4%	179	+4.4%	6163	+0.5%	198	-4.1%
2011	131469	-3.4%	4027	-7.8%	6755	+21.4%	207	+15.8%	6195	+0.5%	190	-4.1%
2012	147384	+12.1%	4379	+8.7%	7078	+4.8%	210	+1.6%	6215	+0.3%	185	-2.7%
2013	177620	+20.5%	5140	+17.4%	6569	-7.2%	190	-9.6%	6236	+0.3%	180	-2.3%
2014	179695	+1.2%	5118	-0.4%	7773	+18.3%	221	+16.4%	6261	+0.4%	178	-1.2%

Note: Original Investment of £100 December 1945, gross income reinvested.

FIGURE 12

Barclays UK Treasury Bills and Building Society Accounts

Year	Treasury Bills Annual Return %	Building Society Acc. Annual Rate of Interest	Basic Rate Income Tax Calendar Year Average	Year	Treasury Bills Annual Return %	Building Society Acc. Annual rate of Interest	Basic Rate Income Tax Calendar Year Average
1946	0.51	6.51	46.25				
1947	0.51	6.36	45.00				
1948	0.51	6.36	45.00				
1949	0.52	6.36	45.00				
1950	0.52	6.36	45.00	**1990**	15.86	12.04	25.00
1951	0.52	4.82	46.88	**1991**	11.59	9.32	25.00
1952	2.09	4.65	47.50	**1992**	9.47	9.59	24.68
1953	2.36	4.60	45.62	**1993**	5.86	4.12	24.50
1954	1.89	4.55	45.00	**1994**	5.40	3.69	20.00
1955	3.50	4.69	43.12	**1995**	6.74	3.93	20.00
1956	5.02	5.44	42.50	**1996**	6.16	2.61	20.00
1957	5.01	6.09	42.50	**1997**	6.88	3.06	20.00
1958	5.11	6.09	42.50	**1998**	7.92	7.06	20.00
1959	3.42	5.59	39.69	**1999**	5.51	5.11	23.00
1960	5.04	5.52	38.75	**2000**	6.22	5.50	22.00
1961	5.14	5.81	38.75	**2001**	5.50	4.70	22.00
1962	4.46	6.12	38.75	**2002**	4.12	3.40	22.00
1963	3.80	5.81	38.75	**2003**	3.75	3.33	22.00
1964	4.40	5.71	38.75	**2004**	4.59	4.21	22.00
1965	6.29	6.50	40.62	**2005**	5.00	3.95	22.00
1966	6.12	6.81	41.25	**2006**	4.90	4.36	22.00
1967	5.90	7.23	41.25	**2007**	5.87	4.77	22.00
1968	7.43	7.52	41.25	**2008**	5.23	0.85	20.00
1969	7.93	8.29	41.25	**2009**	0.68	0.25	20.00
1970	7.45	8.51	41.25	**2010**	0.50	0.20	20.00
1971	6.18	8.25	39.38	**2011**	0.51	0.20	20.00
1972	5.42	8.16	38.75	**2012**	0.32	0.20	20.00
1973	9.01	9.70	32.19	**2013**	0.34	0.20	20.00
1974	12.56	11.07	32.25	**2014**	0.39	0.25	20.00
1975	10.75	11.01	34.50				
1976	11.34	10.65	35.00				
1977	9.44	10.65	34.25				
1978	8.06	9.42	33.25				
1979	13.45	12.22	30.75				
1980	17.17	15.00	30.00				
1981	13.76	12.94	30.00				
1982	12.38	12.19	30.00				
1983	10.14	9.64	30.00				
1984	9.55	9.99	30.00				
1985	11.87	10.81	30.00				
1986	10.95	10.55	29.26				
1987	9.58	9.66	27.50				
1988	11.01	8.26	25.50				
1989	14.55	10.71	25.00				

Note:

1. Annual returns on Treasury bills are based on four consecutive investments in 91-day bills.
2. The building society rate of interest above is gross of tax.

FIGURE 13
Barclays Index-linked Funds

	Index Linked gilts			
	Value of Fund December £		Adjusted for Cost of Living	
1982	100		100	
1983	101	+0.8%	96	-4.3%
1984	107	+6.6%	98	+1.9%
1985	107	-0.2%	92	-5.5%
1986	114	+6.1%	94	+2.3%
1987	122	+6.9%	97	+3.1%
1988	138	+13.7%	103	+6.5%
1989	158	+14.5%	110	+6.3%
1990	165	+4.4%	105	-4.5%
1991	174	+5.2%	106	+0.7%
1992	204	+17.1%	121	+14.1%
1993	247	+21.1%	144	+18.9%
1994	227	-7.9%	128	-10.5%
1995	254	+12.0%	139	+8.5%
1996	271	+6.5%	145	+4.0%
1997	307	+13.4%	158	+9.4%
1998	369	+20.3%	186	+17.1%
1999	388	+5.0%	191	+3.2%
2000	400	+3.1%	192	+0.1%
2001	396	-0.9%	189	-1.6%
2002	428	+8.2%	198	+5.1%
2003	457	+6.8%	206	+3.9%
2004	497	+8.6%	216	+4.9%
2005	542	+9.1%	231	+6.7%
2006	554	+2.3%	226	-2.1%
2007	585	+5.5%	229	+1.4%
2008	578	-1.2%	224	-2.1%
2009	610	+5.6%	231	+3.1%
2010	673	+10.3%	243	+5.3%
2011	808	+19.9%	278	+14.4%
2012	834	+3.3%	279	+0.2%
2013	824	-1.3%	268	-3.9%
2014	954	+15.9%	306	+14.0%

FIGURE 14
Barclays US Equity Index

Year	Equity Price Index December		Equity Income Index December		Income Yield %	Equity Price Index Adjusted for Cost of Living		Equity Income Index Adjusted for Cost of Living	
1925	100					100			
1926	104	+4.3%	100		5.3	105	+5.5%	100	
1927	132	+26.6%	119	+19.0%	5.0	137	+29.6%	121.7074	+21.7%
1928	177	+33.7%	132	+11.3%	4.2	185	+35.3%	137.1045	+12.7%
1929	144	-18.2%	98	-26.3%	3.8	150	-18.7%	100.5217	-26.7%
1930	98	-32.1%	80	-17.7%	4.6	109	-27.5%	88.3734	-12.1%
1931	51	-47.7%	54	-32.6%	5.9	63	-42.3%	65.70176	-25.7%
1932	44	-14.1%	55	+1.7%	7.0	60	-4.2%	74.44178	+13.3%
1933	66	+50.9%	53	-4.4%	4.4	90	+49.8%	70.63025	-5.1%
1934	66	-1.0%	50	-5.7%	4.2	88	-2.4%	65.63299	-7.1%
1935	92	+39.6%	71	+42.2%	4.3	119	+35.6%	90.62134	+38.1%
1936	116	+26.7%	95	+34.1%	4.5	149	+24.9%	119.7611	+32.2%
1937	72	-38.1%	69	-27.4%	5.3	90	-39.8%	84.57095	-29.4%
1938	89	+23.0%	70	+1.6%	4.4	113	+26.5%	88.37328	+4.5%
1939	86	-2.9%	75	+7.1%	4.8	110	-2.9%	94.62172	+7.1%
1940	75	-12.8%	79	+5.7%	5.9	95	-13.4%	99.3167	+5.0%
1941	63	-16.1%	81	+1.9%	7.1	73	-23.7%	92.04035	-7.3%
1942	69	+9.1%	87	+8.3%	7.1	73	+0.0%	91.41445	-0.7%
1943	84	+21.6%	80	-8.6%	5.3	86	+18.1%	81.17977	-11.2%
1944	96	+15.5%	90	+12.7%	5.2	97	+12.9%	89.42189	+10.2%
1945	129	+33.5%	98	+9.0%	4.2	127	+30.6%	95.32691	+6.6%
1946	116	-10.2%	86	-12.6%	4.1	96	-24.0%	70.50384	-26.0%
1947	113	-2.3%	115	+34.5%	5.7	87	-10.2%	87.15088	+23.6%
1948	108	-4.1%	125	+8.1%	6.4	81	-6.9%	91.50819	+5.0%
1949	122	+12.1%	156	+25.6%	7.2	92	+14.5%	117.3343	+28.2%
1950	148	+21.7%	194	+24.3%	7.3	106	+14.9%	137.6241	+17.3%
1951	169	+14.3%	178	-8.3%	5.9	114	+7.8%	119.0512	-13.5%
1952	182	+7.4%	182	+2.2%	5.6	122	+6.6%	120.734	+1.4%
1953	173	-5.0%	175	-3.8%	5.7	115	-5.7%	115.3204	-4.5%
1954	247	+43.4%	225	+28.5%	5.1	166	+44.4%	149.2457	+29.4%
1955	298	+20.4%	228	+1.1%	4.3	199	+20.0%	150.3591	+0.7%
1956	311	+4.4%	225	-1.4%	4.0	202	+1.3%	144.0197	-4.2%
1957	267	-14.1%	205	-8.6%	4.3	168	-16.5%	127.8885	-11.2%
1958	372	+39.3%	270	+31.6%	4.0	231	+36.9%	165.3901	+29.3%
1959	406	+9.1%	240	-11.1%	3.3	247	+7.2%	144.5078	-12.6%
1960	397	-2.2%	251	+4.5%	3.5	238	-3.5%	148.9918	+3.1%
1961	490	+23.3%	266	+5.9%	3.0	292	+22.5%	156.7545	+5.2%
1962	425	-13.3%	262	-1.3%	3.4	250	-14.4%	152.7379	-2.6%
1963	497	+17.1%	291	+11.0%	3.3	288	+15.2%	166.7967	+9.2%
1964	561	+12.8%	310	+6.6%	3.1	322	+11.8%	176.0222	+5.5%
1965	623	+11.0%	343	+10.6%	3.1	350	+8.9%	190.9574	+8.5%
1966	550	-11.7%	327	-4.7%	3.3	299	-14.6%	175.8412	-7.9%
1967	686	+24.7%	381	+16.5%	3.1	362	+21.0%	198.7692	+13.0%
1968	761	+10.9%	404	+6.1%	3.0	384	+5.9%	201.3076	+1.3%
1969	658	-13.5%	361	-10.5%	3.1	312	-18.6%	169.5865	-15.8%
1970	636	-3.4%	413	+14.4%	3.6	286	-8.5%	183.7472	+8.4%

Year	Equity Price Index December		Equity Income Index December		Income Yield %	Equity Price Index Adjusted for Cost of Living		Equity Income Index Adjusted for Cost of Living	
1971	717	+12.8%	389	-5.9%	3.0	312	+9.2%	167.4684	-8.9%
1972	819	+14.3%	405	+4.0%	2.8	345	+10.5%	168.4823	+0.6%
1973	646	-21.2%	344	-15.0%	3.0	250	-27.5%	131.7533	-21.8%
1974	445	-31.1%	348	+1.1%	4.4	154	-38.6%	118.5986	-10.0%
1975	587	+31.8%	453	+30.3%	4.3	189	+23.3%	144.5524	+21.9%
1976	715	+21.9%	515	+13.7%	4.0	220	+16.3%	156.752	+8.4%
1977	663	-7.3%	553	+7.3%	4.6	191	-13.1%	157.6118	+0.5%
1978	685	+3.3%	629	+13.8%	5.1	181	-5.3%	164.4744	+4.4%
1979	810	+18.3%	764	+21.4%	5.2	189	+4.4%	176.2464	+7.2%
1980	1030	+27.1%	910	+19.2%	4.9	214	+13.0%	186.6452	+5.9%
1981	944	-8.4%	804	-11.7%	4.7	180	-15.9%	151.3247	-18.9%
1982	1078	+14.2%	1059	+31.7%	5.5	198	+10.0%	191.9924	+26.9%
1983	1271	+17.9%	936	-11.6%	4.1	225	+13.6%	163.4811	-14.9%
1984	1257	-1.1%	985	+5.3%	4.4	214	-4.9%	165.5295	+1.3%
1985	1589	+26.5%	1141	+15.8%	4.0	260	+21.8%	184.7011	+11.6%
1986	1777	+11.8%	1096	-3.9%	3.4	288	+10.6%	175.5055	-5.0%
1987	1753	-1.4%	1012	-7.6%	3.2	272	-5.5%	155.2007	-11.6%
1988	1980	+13.0%	1452	+43.5%	4.1	294	+8.2%	213.2228	+37.4%
1989	2456	+24.0%	1594	+9.8%	3.6	349	+18.5%	223.712	+4.9%
1990	2225	-9.4%	1454	-8.8%	3.6	298	-14.6%	192.3235	-14.0%
1991	2885	+29.6%	1640	+12.8%	3.2	374	+25.8%	210.4701	+9.4%
1992	3061	+6.1%	1533	-6.5%	2.8	386	+3.1%	191.1616	-9.2%
1993	3330	+8.8%	1547	+0.9%	2.6	409	+5.9%	187.7915	-1.8%
1994	3221	-3.3%	1502	-2.9%	2.6	385	-5.8%	177.6459	-5.4%
1995	4268	+32.5%	1876	+24.9%	2.4	498	+29.2%	216.3456	+21.8%
1996	5069	+18.8%	1876	+0.0%	2.1	572	+15.0%	209.4134	-3.2%
1997	6498	+28.2%	2011	+7.2%	1.7	721	+26.0%	220.6758	+5.4%
1998	7831	+20.5%	2082	+3.5%	1.5	855	+18.6%	224.8463	+1.9%
1999	9682	+23.6%	2308	+10.9%	1.3	1030	+20.4%	242.7806	+8.0%
2000	8507	-12.1%	1688	-26.9%	1.1	875	-15.0%	171.6951	-29.3%
2001	7448	-12.4%	1779	+5.4%	1.3	754	-13.8%	178.1937	+3.8%
2002	5801	-22.1%	1660	-6.7%	1.6	574	-23.9%	162.4155	-8.9%
2003	7587	+30.8%	2511	+51.3%	1.8	737	+28.4%	241.1224	+48.5%
2004	8409	+10.8%	2970	+18.3%	2.0	791	+7.3%	276.2662	+14.6%
2005	8862	+5.4%	2929	-1.4%	1.8	806	+1.9%	263.4717	-4.6%
2006	10106	+14.0%	3474	+18.6%	1.9	896	+11.2%	304.7062	+15.7%
2007	10638	+5.3%	3674	+5.8%	1.9	907	+1.1%	309.6048	+1.6%
2008	6420	-39.65%	2639	-28.18%	2.3	547	-39.71%	222.1679	-28.24%
2009	8223	+28.08%	3767	+42.76%	2.6	682	+24.69%	308.76	+38.98%
2010	9476	+15.23%	3692	-2.00%	2.2	774	+13.54%	298.1215	-3.45%
2011	9181	-3.11%	3438	-6.88%	2.1	728	-5.89%	269.6247	-9.56%
2012	10368	+12.92%	4719	+37.29%	2.5	808	+10.99%	363.8265	+34.94%
2013	13238	+27.68%	5233	+10.89%	2.2	1017	+25.79%	397.4745	+9.25%
2014	14328	+8.23%	5444	+4.02%	2.1	1092	+7.42%	410.3615	+3.24%

FIGURE 15
Barclays US Bond Index

Year	Bond Price Index December		Yield %	Bond Price Index adjusted for Cost of Living	
1925	100			100	
1926	104	+3.9%	3.5	105	+5.1%
1927	110	+5.4%	3.2	113	+7.8%
1928	106	-3.1%	3.4	111	-2.0%
1929	106	-0.2%	3.4	110	-0.8%
1930	107	+1.3%	3.3	119	+8.2%
1931	98	-8.5%	4.1	120	+0.9%
1932	111	+12.9%	3.2	151	+25.8%
1933	107	-3.1%	3.4	146	-3.9%
1934	115	+6.8%	2.9	153	+5.2%
1935	117	+2.1%	2.8	152	-0.8%
1936	122	+4.6%	2.6	157	+3.1%
1937	119	-2.5%	2.7	148	-5.2%
1938	123	+2.8%	2.5	157	+5.8%
1939	127	+3.5%	2.3	163	+3.5%
1940	132	+3.8%	1.9	167	+3.0%
1941	131	-1.0%	2.0	151	-10.0%
1942	131	+0.7%	2.4	139	-7.6%
1943	131	-0.4%	2.5	135	-3.3%
1944	131	+0.3%	2.4	132	-1.9%
1945	142	+8.1%	2.0	140	+5.8%
1946	139	-2.4%	2.1	115	-17.4%
1947	132	-4.9%	2.4	101	-12.6%
1948	133	+0.9%	2.4	99	-2.0%
1949	138	+4.0%	2.1	105	+6.2%
1950	135	-2.3%	2.2	97	-7.8%
1951	127	-6.3%	2.7	86	-11.6%
1952	125	-1.4%	2.8	84	-2.1%
1953	126	+0.9%	2.7	84	+0.2%
1954	131	+4.1%	2.6	88	+4.9%
1955	126	-3.6%	3.0	84	-4.0%
1956	115	-9.1%	3.4	75	-11.7%
1957	120	+4.7%	3.2	76	+1.8%
1958	110	-8.4%	3.8	68	-10.0%
1959	103	-6.4%	4.4	63	-8.0%
1960	112	+9.0%	3.8	68	+7.5%
1961	109	-3.4%	4.0	65	-4.0%
1962	113	+4.0%	3.8	67	+2.6%
1963	108	-4.3%	4.1	63	-5.8%
1964	109	+0.4%	4.1	62	-0.6%
1965	104	-3.9%	4.4	59	-5.7%
1966	104	+0.0%	4.5	57	-3.3%
1967	94	-9.9%	5.2	50	-12.6%
1968	89	-14.9%	5.7	45	-21.1%
1969	79	-11.1%	6.6	37	-16.3%
1970	85	+7.0%	6.2	38	+1.4%

Year	Bond Price Index December		Yield %	Bond Price Index adjusted for Cost of Living	
1971	95	+12.2%	4.5	41	+8.6%
1972	96	+1.3%	4.5	40	-2.1%
1973	88	-8.8%	7.1	34	-16.1%
1974	84	-3.8%	7.7	29	-14.4%
1975	83	-1.7%	7.7	27	-8.0%
1976	91	+9.8%	6.9	28	+4.7%
1977	86	-6.0%	7.5	25	-11.9%
1978	77	-10.3%	8.8	20	-17.7%
1979	69	-10.0%	9.9	16	-20.5%
1980	60	-13.3%	11.6	12	-22.9%
1981	53	-11.5%	13.7	10	-18.7%
1982	65	+23.3%	10.5	12	+18.8%
1983	59	-9.4%	11.6	10	-12.7%
1984	61	+2.5%	11.3	10	-1.4%
1985	72	+18.7%	9.3	12	+14.3%
1986	84	+16.1%	7.6	14	+14.8%
1987	75	-11.0%	8.8	12	-14.8%
1988	74	-0.6%	8.8	11	-4.8%
1989	81	+9.5%	7.9	12	+4.6%
1990	79	-2.8%	8.2	11	-8.4%
1991	86	+9.1%	7.3	11	+5.9%
1992	86	-0.3%	7.3	11	-3.1%
1993	93	+8.8%	6.4	11	+5.9%
1994	80	-14.3%	7.9	10	-16.5%
1995	97	+21.1%	5.9	11	+18.1%
1996	90	-7.0%	6.6	10	-10.0%
1997	97	+7.7%	5.9	11	+5.9%
1998	103	+6.1%	5.3	11	+4.4%
1999	88	-14.5%	6.7	9	-16.8%
2000	100	+13.3%	5.5	10	+9.6%
2001	98	-2.1%	5.7	10	-3.6%
2002	108	+10.5%	4.8	11	+7.9%
2003	105	-2.9%	5.0	10	-4.7%
2004	107	+2.4%	4.8	10	-0.8%
2005	110	+2.2%	4.6	10	-1.2%
2006	105	-4.1%	4.8	9	-6.5%
2007	109	+4.1%	4.5	9	-0.0%
2008	131	+19.8%	3.1	11	+19.7%
2009	107	-17.9%	4.5	9	-20.1%
2010	113	+4.8%	4.1	9	+3.3%
2011	137	+21.7%	2.5	11	+18.2%
2012	138	+0.4%	2.7	11	-1.3%
2013	116	-15.4%	3.7	9	-16.7%
2014	140	+20.2%	2.4	11	+19.3%

FIGURE 16
Barclays US Treasury Bill Index

Year	Treasury Bill Index December		Treasury Bill Index adjusted for Cost of Living	
1925	100		100	
1926	103	+3.2%	104	+4.4%
1927	106	+3.1%	110	+5.5%
1928	110	+3.8%	116	+5.0%
1929	116	+4.7%	120	+4.1%
1930	118	+2.3%	132	+9.3%
1931	120	+1.0%	147	+11.4%
1932	121	+0.8%	165	+12.3%
1933	121	+0.3%	164	-0.5%
1934	121	+0.2%	162	-1.3%
1935	121	+0.2%	157	-2.7%
1936	122	+0.2%	155	-1.3%
1937	122	+0.3%	152	-2.5%
1938	122	+0.0%	156	+2.9%
1939	122	+0.0%	156	+0.0%
1940	122	-0.1%	155	-0.8%
1941	122	+0.0%	141	-9.0%
1942	122	+0.3%	130	-8.0%
1943	123	+0.3%	126	-2.5%
1944	123	+0.3%	124	-1.9%
1945	124	+0.3%	121	-1.9%
1946	124	+0.4%	103	-15.1%
1947	125	+0.5%	95	-7.7%
1948	126	+1.0%	93	-2.0%
1949	127	+1.1%	96	+3.2%
1950	129	+1.2%	92	-4.5%
1951	131	+1.5%	88	-4.3%
1952	133	+1.6%	89	+0.9%
1953	135	+1.8%	90	+1.0%
1954	136	+0.9%	91	+1.6%
1955	138	+1.6%	92	+1.2%
1956	142	+2.4%	92	-0.5%
1957	146	+3.1%	92	+0.2%
1958	148	+1.4%	92	-0.3%
1959	152	+2.8%	93	+1.1%
1960	156	+2.6%	94	+1.2%
1961	160	+2.2%	95	+1.5%
1962	164	+2.7%	97	+1.4%
1963	169	+3.2%	98	+1.5%
1964	175	+3.5%	101	+2.5%
1965	182	+4.0%	103	+2.0%
1966	191	+4.7%	104	+1.2%
1967	199	+4.1%	105	+1.1%
1968	209	+9.7%	105	+0.5%
1969	223	+6.6%	106	+0.4%
1970	237	+6.4%	107	+0.8%
1971	247	+4.3%	108	+1.0%

Year	Treasury Bill Index December		Treasury Bill Index adjusted for Cost of Living	
1972	257	+3.9%	108	+0.5%
1973	275	+7.1%	107	-1.5%
1974	297	+8.1%	103	-3.8%
1975	315	+5.8%	102	-1.0%
1976	331	+5.2%	102	+0.3%
1977	348	+5.2%	100	-1.5%
1978	373	+7.3%	99	-1.6%
1979	413	+10.7%	96	-2.3%
1980	461	+11.5%	96	-0.9%
1981	529	+14.9%	101	+5.4%
1982	586	+10.7%	107	+6.6%
1983	638	+8.8%	113	+4.9%
1984	701	+10.0%	119	+5.8%
1985	755	+7.7%	124	+3.7%
1986	801	+6.1%	130	+4.9%
1987	844	+5.4%	131	+0.9%
1988	897	+6.3%	133	+1.8%
1989	971	+8.2%	138	+3.4%
1990	1046	+7.7%	140	+1.5%
1991	1103	+5.5%	143	+2.4%
1992	1141	+3.4%	144	+0.5%
1993	1174	+2.9%	144	+0.1%
1994	1219	+3.9%	146	+1.2%
1995	1287	+5.5%	150	+2.9%
1996	1353	+5.1%	153	+1.8%
1997	1422	+5.1%	158	+3.3%
1998	1490	+4.8%	163	+3.1%
1999	1558	+4.6%	166	+1.8%
2000	1647	+5.8%	169	+2.3%
2001	1710	+3.8%	173	+2.2%
2002	1738	+1.6%	172	-0.7%
2003	1755	+1.0%	170	-0.8%
2004	1776	+1.2%	167	-2.0%
2005	1829	+3.0%	166	-0.4%
2006	1916	+4.8%	170	+2.2%
2007	2006	+4.7%	171	+0.6%
2008	2036	+1.5%	173	+1.4%
2009	2038	+0.1%	169	-2.6%
2010	2040	+0.1%	167	-1.4%
2011	2041	+0.04%	162	-2.8%
2012	2042	+0.06%	159	-1.7%
2013	2043	+0.03%	157	-1.5%
2014	2043	+0.02%	156	-0.7%

CHAPTER 11

Total investment returns

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Our final chapter presents a series of tables showing the performance of equity and fixed-interest investments over any period since December 1899.

The first section reviews the performance of each asset class, taking inflation into account, since December 1960. On each page, we provide two tables illustrating the same information in alternative forms. The first table shows the average annual real rate of return; the second shows the real value of a portfolio at the end of each year, which includes reinvested income. This section provides data on equities and gilts, with dividend income reinvested gross. Finally, we provide figures for Treasury bills and building society shares.

The final pullout section provides the annual real rate of return on UK and US equities and bonds (with reinvestment of income for each year since 1899 for the UK, and since 1925 for the US). There is also a table showing the real capital value of equities for the UK. The sources for all data in this chapter are the Barclays indices, as outlined in Chapter 8.

1960-2014

- Equities – income gross
- Gilts – income gross
- Treasury Bills – income gross
- Building society shares – income gross
- Index-linked gilts

UK: 1899-2014
US: 1925-2014

- UK and US real bond returns – income gross
- UK and US real equities returns – income gross
- UK equities – real capital value

Real return on equities - Gross income re-invested

Average Annual Real Rate of Return

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	(2.5)																																																				
1962	(2.4)	(2.2)																																																				
1963	3.9	7.3	17.7																																																		
1964	0.3	1.3	3.0	(9.8)																																																	
1965	1.5	2.6	4.2	(1.9)	6.6																																																
1966	(0.0)	0.5	1.2	(3.8)	(0.7)	(7.4)																																															
1967	3.9	5.0	6.6	3.9	9.0	10.2	31.1																																													
1968	7.8	9.4	11.5	10.3	16.0	19.3	35.4	39.8																																												
1969	4.9	5.9	7.1	5.4	8.8	9.3	15.5	8.5	(15.9)																																											
1970	3.3	3.9	4.7	3.0	5.3	5.0	8.4	1.7	(13.2)	(10.5)																																									
1971	5.8	6.6	7.7	6.5	9.0	9.4	13.2	9.1	0.4	9.7	34.4																																								
1972	6.0	6.8	7.7	6.7	8.9	9.2	12.3	8.9	2.3	9.1	20.5	8.1																																							
1973	2.1	2.4	2.9	1.5	2.8	2.4	3.9	(0.1)	(6.6)	(4.1)	(1.9)	(16.2)	(35.0)																																						
1974	(4.2)	(4.4)	(4.5)	(6.3)	(6.0)	(7.3)	(7.3)	(11.8)	(18.3)	(18.7)	(20.7)	(33.5)	(47.8)	(58.1)																																					
1975	0.6	0.8	1.0	(0.2)	0.7	0.1	1.0	(2.3)	(7.2)	(5.6)	(4.6)	(12.4)	(18.4)	(8.6)	99.6																																					
1976	(0.2)	(0.0)	0.1	(1.1)	(0.4)	(1.0)	(0.3)	(3.3)	(7.7)	(6.4)	(5.7)	(12.2)	(16.6)	(9.4)	33.2	(11.1)																																					
1977	1.5	1.7	2.0	1.0	1.8	1.5	2.3	(0.2)	(3.9)	(2.3)	(1.0)	(5.9)	(8.5)	(0.4)	33.0	8.5	32.5																																				
1978	1.4	1.6	1.9	0.9	1.7	1.4	2.1	(0.2)	(3.5)	(2.0)	(0.9)	(5.1)	(7.1)	(0.3)	23.9	5.7	15.2	0.2																																				
1979	1.1	1.3	1.5	0.5	1.3	0.9	1.6	(0.6)	(3.6)	(2.3)	(1.3)	(5.1)	(6.8)	(1.1)	17.5	2.9	8.1	(2.4)	(4.9)																																				
1980	1.8	2.0	2.3	1.4	2.2	1.9	2.6	0.7	(2.0)	(0.7)	0.4	(2.8)	(4.1)	1.4	17.4	5.6	10.3	3.7	5.5	17.1																																				
1981	1.8	2.0	2.2	1.4	2.1	1.9	2.5	0.7	(1.8)	(0.5)	0.5	(2.4)	(3.5)	1.4	15.0	4.9	8.4	3.1	4.1	8.9	1.3																																				
1982	2.6	2.9	3.1	2.4	3.2	3.0	3.6	2.0	(0.2)	1.1	2.1	(0.4)	(1.2)	3.5	15.8	7.2	10.6	6.6	8.3	13.1	11.1	21.9																																				
1983	3.4	3.7	4.0	3.3	4.1	3.9	4.6	3.2	1.1	2.5	3.5	1.3	0.7	5.2	16.5	9.0	12.2	9.1	11.0	15.3	14.7	22.1	22.3																																				
1984	4.3	4.6	4.9	4.3	5.1	5.0	5.7	4.4	2.5	3.9	5.0	3.0	2.6	6.9	17.4	10.7	13.8	11.3	13.3	17.4	17.4	23.3	24.0	25.8																																				
1985	4.6	4.9	5.3	4.7	5.5	5.4	6.1	4.9	3.1	4.5	5.5	3.7	3.4	7.5	17.1	11.0	13.8	11.6	13.4	16.7	16.7	20.8	20.5	19.6	13.7																																				
1986	5.3	5.6	5.9	5.4	6.2	6.2	6.9	5.8	4.1	5.4	6.5	4.9	4.7	8.6	17.5	12.0	14.6	12.8	14.5	17.6	17.7	21.2	21.0	20.6	18.1	22.7																																				
1987	5.2	5.6	5.9	5.4	6.1	6.1	6.8	5.7	4.2	5.4	6.4	4.9	4.7	8.3	16.5	11.4	13.7	12.0	13.4	15.9	15.7	18.3	17.6	16.5	13.5	13.4	4.8																																				
1988	5.2	5.5	5.8	5.4	6.1	6.0	6.7	5.7	4.2	5.4	6.3	4.9	4.7	8.0	15.6	10.9	12.9	11.3	12.4	14.6	14.2	16.2	15.3	13.9	11.2	10.3	4.6	4.4																																				
1989	5.9	6.2	6.5	6.1	6.8	6.8	7.5	6.5	5.1	6.3	7.3	5.9	5.8	9.1	16.3	11.9	13.9	12.4	13.6	15.6	15.5	17.4	16.7	15.8	13.9	14.0	11.2	14.6	25.8																																				
1990	5.0	5.3	5.5	5.1	5.7	5.7	6.3	5.3	4.0	5.0	5.9	4.6	4.4	7.3	13.8	9.6	11.3	9.8	10.6	12.2	11.7	12.9	11.8	10.4	8.0	6.9	3.3	2.8	2.0	(17.4)																																				
1991	5.3	5.6	5.9	5.5	6.1	6.1	6.7	5.7	4.5	5.5	6.3	5.1	4.9	7.8	13.9	10.0	11.6	10.2	11.0	12.4	12.0	13.2	12.2	11.0	9.1	8.3	5.6	5.9	6.4	(2.2)	15.7																																		
1992	5.7	5.9	6.2	5.9	6.5	6.5	7.0	6.2	5.0	6.0	6.8	5.6	5.5	8.2	14.1	10.4	11.9	10.6	11.4	12.8	12.4	13.5	12.7	11.7	10.0	9.5	7.4	8.0	8.9	3.7	16.2	16.8																																		
1993	6.2	6.5	6.8	6.4	7.1	7.1	7.6	6.8	5.7	6.7	7.5	6.4	6.4	9.0	14.6	11.2	12.6	11.5	12.3	13.6	13.4	14.4	13.8	12.9	11.6	11.3	9.8	10.7	11.9	8.7	19.1	20.9	25.1																																		
1994	5.7	6.0	6.3	5.9	6.5	6.5	7.0	6.2	5.1	6.0	6.8	5.7	5.6	8.1	13.3	10.0	11.3	10.2	10.8	12.0	11.6	12.5	11.7	10.8	9.4	8.9	7.3	7.7	8.2	5.0	11.5	10.1	7.0	(8.6)																																		
1995	6.1	6.4	6.6	6.3	6.9	6.9	7.4	6.7	5.6	6.5	7.3	6.3	6.2	8.6	13.6	10.5	11.7	10.7	11.3	12.4	12.1	12.9	12.3	11.5	10.2	9.9	8.6	9.1	9.7	7.3	13.0	12.3	10.9	4.4	19.2																																		
1996	6.3	6.6	6.8	6.5	7.1	7.1	7.6	6.9	5.9	6.8	7.5	6.5	6.5	8.8	13.6	10.6	11.8	10.8	11.4	12.5	12.2	12.9	12.3	11.6	10.5	10.2	9.0	9.5	10.1	8.1	13.0	12.5	11.4	7.2	16.1	13.1																																		
1997	6.6	6.9	7.2	6.9	7.4	7.4	8.0	7.3	6.3	7.2	7.9	7.0	6.9	9.2	13.8	11.0	12.1	11.2	11.8	12.8	12.6	13.3	12.8	12.1	11.1	10.9	9.9	10.4	11.1	9.4	13.9	13.6	13.0	10.1	17.1	16.1	19.3																																		
1998	6.7	7.0	7.3	7.0	7.5	7.5	8.0	7.4	6.4	7.3	8.0	7.1	7.1	9.2	13.7	10.9	12.1	11.2	11.8	12.7	12.5	13.2	12.6	12.0	11.1	10.9	10.0	10.5	11.1	9.5	13.5	13.2	12.6	10.2	15.5	14.3	14.9	10.6																																		
1999	7.1	7.4	7.6	7.4	7.9	7.9	8.4	7.8	6.9	7.7	8.4	7.6	7.6	9.7	14.0	11.4	12.5	11.6	12.2	13.1	12.9	13.6	13.2	12.6	11.8	11.6	10.8	11.3	12.0	10.7	14.4	14.2	13.8	12.0	16.7	16.1	17.1	16.0	21.7																																		
2000	6.7	6.9	7.2	6.9	7.4	7.4	7.9	7.3	6.4	7.2	7.8	7.0	7.0	9.0	13.0	10.5	11.5	10.7	11.2	12.0	11.8	12.3	11.8	11.2	10.4	10.2	9.3	9.7	10.1	8.8	11.8	11.4	10.7	8.8	12.0	10.7	10.1	7.2	5.5	(8.6)																																		
2001	6.1	6.3	6.6	6.3	6.8	6.8	7.2	6.6	5.7	6.5	7.0	6.2	6.2	8.1	11.9	9.4	10.4	9.5	9.9	10.7	10.4	10.9	10.3	9.7	8.8	8.5	7.6	7.8	8.1	6.7	9.2	8.6	7.7	5.7	7.9	6.2	4.8	1.5	(1.4)	(11.2)	(13.8)																																		
2002	5.3	5.5	5.7	5.4	5.8	5.8	6.2	5.5	4.7	5.3	5.9	5.1	5.0	6.7	10.3	8.0	8.8	7.9	8.2	8.8	8.5	8.8	8.2	7.5	6.6	6.2	5.2	5.3	5.3	3.9	5.9	5.1	3.9	1.8	3.2	1.1	(0.8)	(4.3)	(7.8)	(15.9)	(19.3)	(24.5)																																		
2003	5.5	5.7	5.9	5.6	6.1	6.0	6.4	5.8	5.0	5.7	6.2	5.4	5.3	7.0	10.6	8.3	9.1	8.2	8.6	9.2	8.8	9.2	8.6	8.0	7.1	6.8	5.9	6.0	6.1	4.8	6.7	6.0	5.1	3.2	4.6	3.0	1.6	(1.1)	(3.3)	(8.7)	(8.7)	(6.1)	16.9																																		
2004	5.6	5.8	6.0	5.7	6.1	6.1	6.5	5.9	5.1	5.8	6.3	5.5	5.4	7.1	10.5	8.3	9.0	8.3	8.6	9.2	8.8	9.2	8.6	8.0	7.2	6.9	6.0	6.1	6.2	5.0	6.9	6.2	5.4	3.7	5.0	3.6	2.5	0.3	(1.4)	(5.4)	(4.6)	(1.4)	12.8	8.8																																		
2005	5.9	6.1	6.3	6.0	6.4	6.4	6.8	6.2	5.4	6.1	6.6	5.9	5.8	7.5	10.8	8.6	9.4	8.6	8.9	9.5	9.2	9.6	9.1	8.5	7.7	7.4	6.7	6.8	6.9	5.9	7.6	7.1	6.4	4.9	6.2	5.0	4.2	2.4	1.3	(1.8)	(0.3)	3.4	14.8	13.7	18.9																																		
2006	6.0	6.2	6.4	6.1	6.5	6.5	6.9	6.4	5.6	6.2	6.8	6.1	6.0	7.6	10.8	8.7	9.4	8.7	9.0	9.6	9.3	9.6	9.2	8.6	7.9	7.6	6.9	7.0	7.2	6.2	7.9	7.4	6.7	5.4	6.7	5.6	4.9	3.4	2.5	0.0	1.5	4.9	13.9	13.0	15.1	11.4																																		
2007	5.9	6.1	6.3	6.0	6.4	6.4	6.8	6.2	5.5	6.1	6.6	5.9	5.8	7.4	10.5	8.5	9.2	8.5	8.7	9.3	9.0	9.3	8.8	8.3	7.6	7.3	6.6	6.7	6.9	5.9	7.4	6.9	6.3	5.1	6.2	5.2	4.5	3.1	2.3	0.2	1.5	4.3	11.2	9.9	10.2	6.1	1.0																																		
2008	5.0	5.1	5.3	5.0	5.4	5.4	5.7	5.1	4.4	5.0	5.4	4.7	4.6	6.1	9.0	7.0	7.6	6.9	7.1	7.6	7.3	7.5	7.0	6.4	5.7	5.3	4.6	4.6	4.6	3.6	4.9	4.3	3.5	2.2	3.1	1.9	1.0	(0.5)	(1.5)	(3.8)	(3.2)	(1.6)	2.9	0.3	(1.8)	(7.8)	(16.2)	(30.4)																																		
2009	5.3	5.5	5.7	5.4	5.8	5.8	6.1	5.6	4.9	5.4	5.9	5.2	5.1	6.6	9.4	7.5	8.1	7.5	7.7	8.1	7.9	8.1	7.6	7.1	6.4	6.1	5.4	5.5	5.5	4.6	5.9	5.4	4.7	3.6	4.4	3.5	2.8	1.5	0.7	(1.2)	(0.3)	1.5	5.9	4.1	3.3	(0.3)	(4.0)	(6.4)	25.9																																		
2010	5.4	5.6	5.8	5.5	5.9	5.9	6.2	5.7	5.0	5.5	6.0	5.3	5.2	6.6	9.4	7.6	8.2	7.5	7.7	8.2	7.9	8.1	7.7	7.2	6.5	6.2	5.6	5.6	5.7	4.8	6.0	5.6	5.0	3.9	4.7	3.8	3.2	2.0	1.4	(0.3)	0.6	2.3	6.3	4.8	4.2	1.5	(0.9)	(1.5)	17.1	8.9																																		
2011	5.1	5.3	5.5	5.2	5.6	5.5	5.8	5.3	4.6	5.2	5.6	5.0	4.9	6.2	8.9	7.1	7.7	7.0	7.2	7.6	7.3	7.5	7.1	6.6	5.9	5.6	5.0	5.0	5.0	4.2	5.3	4.8	4.3	3.2	3.9	3.1	2.4	1.3	0.6	(1.0)	(0.2)	1.2	4.6	3.1	2.4	(0.2)	(2.3)	(3.2)	8.1	0.2	(7.8)																																		
2012	5.2	5.4	5.5	5.3	5.6	5.6	5.9	5.4	4.7	5.3	5.7	5.1	5.0	6.3	8.9	7.1	7.7	7.1	7.3	7.7	7.4	7.6	7.1	6.7	6.0	5.8	5.1	5.2	5.2	4.4	5.5	5.0	4.5	3.5	4.2	3.4	2.8	1.8	1.2	(0.2)	0.5	1.9	5.0	3.8	3.1	1.1	(0.6)	(0.9)	8.3	3.0	0.1	8.7																																	
2013	5.4	5.6	5.7	5.5	5.9	5.8	6.1	5.7	5.0	5.5	5.9	5.3	5.3	6.5	9.1	7.4	8.0	7.3	7.6	7.9	7.7	7.9	7.5	7.0	6.4	6.1	5.6	5.6	5.7	4.9	6.0	5.6	5.1	4.1	4.9	4.1	3.6	2.7	2.2	0.9	1.7	3.1	6.1	5.0	4.6	3.0	1.8	2.0	10.0	6.4	5.6	13.0	17.4																																	
2014	5.3	5.5	5.6	5.4	5.7	5.7	6.0	5.5	4.9	5.4	5.8	5.2	5.1	6.4	8.9	7.2	7.7	7.1	7.3	7.7	7.4	7.6	7.2	6.7	6.2	5.9	5.4	5.4	5.4	4.7	5.7	5.3	4.8	3.9	4.6	3.9	3.4	2.5	2.0	0.8	1.5	2.8	5.5	4.5	4.1	2.6	1.5	1.6	8.2	5.0	4.0	8.3	8.1	(0.4)																																	

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have lost 2.5% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1963) would have given an average annual real return of 3.9%. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real Value of £100 Invested

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	97																																																				
1962	95	98																																																			
1963	112	115	118																																																		
1964	101	104	106	90																																																	
1965	108	111	113	96	107																																															
1966	100	102	105	89	99	93																																														
1967	131	134	137	117	129	121	131																																													
1968	183	188	192	163	181	170	183	140																																												
1969	154	158	162	137	152	143	154	118	84																																											
1970	138	141	145	123	136	128	138	105	75	89																																										
1971	185	190	194	165	183	172	185	141	101	120	134																																									
1972	200	205	210	179	198	186	201	153	109	130	145	108																																								
1973	130	134	137	116	129	121	130	99	71	85	94	70	65																																							
1974	55	56	57	49	54	51	55	42	30	35	40	29	27	42																																						
1975	109	112	114	97	108	101	109	83	59	71	79	59	54	84	200																																					
1976	97	99	102	86	96	90	97	74	53	63	70	52	48	74	177	89																																				
1977	128	132	135	114	127	119	128	98	70	83	93	69	64	98	235	118	133																																			
1978	128	132	135	115	127	119	129	98	70	83	93	69	64	99	236	118	133	100																																		
1979	122	125	128	109	121	113	122	93	67	79	89	66	61	94	224	112	126	95	95																																		
1980	143	147	150	128	141	133	143	109	78	93	104	77	71	110	262	132	148	112	111	117																																	
1981	145	149	152	129	143	134	145	111	79	94	105	78	72	111	266	133	150	113	113	119	101																																
1982	177	181	186	158	175	164	177	135	97	115	128	95	88	136	324	162	183	138	138	145	124	122																															
1983	216	222	227	193	214	200	217	165	118	140	157	117	108	166	396	199	223	169	168	177	151	149	122																														
1984	272	279	286	243	269	252	272	208	149	177	197	147	136	209	499	250	281	212	212	223	190	188	154	126																													
1985	309	317	325	276	306	287	310	236	169	201	224	167	154	238	567	284	320	241	241	253	216	213	175	143	114																												
1986	380	390	398	339	375	352	380	290	207	246	275	205	190	292	696	349	392	296	295	311	265	262	215	176	140	123																											
1987	398	408	417	355	393	369	398	304	217	258	289	215	199	305	729	365	411	310	310	325	278	274	225	184	146	129	105																											
1988	415	426	436	370	411	385	416	317	227	270	301	224	207	319	762	382	429	324	323	340	290	286	235	192	153	134	109	104																											
1989	523	536	549	466	517	485	523	399	286	339	379	282	261	401	958	480	540	408	407	428	365	360	296	242	192	169	138	131	126																											
1990	432	443	453	385	427	400	433	330	236	280	313	233	216	332	792	397	446	337	336	353	302	298	244	200	159	140	114	109	104	83																											
1991	500	513	524	446	494	463	500	382	273	324	363	270	250	384	916	459	516	390	389	409	349	344	283	231	184	162	132	126	120	96	116																										
1992	584	599	613	521	577	541	584	446	319	379	423	315	291	448	1070	536	603	455	454	478	408	402	330	270	215	189	154	147	141	112	135	117																									
1993	730	749	766	651	722	677	731	558	399	474	530	394	365	561	1339	671	755	569	568	597	510	503	413	338	268	236	192	184	176	140	169	146	125																									
1994	668	685	701	596	660	619	669	510	365	434	485	361	333	513	1224	613	690	521	520	546	467	460	378	309	245	216	176	168	161	128	155	134	114	91																									
1995	796	817	835	710	787	738	797	608	435	517	577	430	397	611	1459	731	822	621	619	651	556	549	450	368	292	257	210	200	192	152	184	159	136	109	119																									
1996	900	923	944	803	889	834	901	687	492	584	653	486	449	691	1650	827	930	702	700	736	629	620	509	416	331	291	237	226	217	172	208	180	154	123	135	113																									
1997	1073	1101	1126	957	1061	995	1075	820	586	697	779	579	536	824	1968	986	1109	837	835	878	750	740	607	496	394	347	283	270	258	205	248	215	184	147	161	135	119																									
1998	1187	1218	1246	1059	1174	1101	1189	907	649	771	862	641	593	912	2177	1091	1227	926	924	972	830	819	672	549	436	384	313	299	286	227	275	238	203	163	178	149	132	111																								
1999	1445	1482	1516	1289	1428	1340	1447	1104	789	938	1048	780	722	1110	2649	1327	1493	1127	1124	1182	1009	996	817	668	531	467	381	363	348	276	334	289	248	198	216	182	161	135	122																							
2000	1321	1355	1386	1178	1305	1224	1323	1009	722	858	958	713	660	1014	2422	1213	1365	1030	1028	1081	923	910	747	611	485	427	348	332	318	253	306	264	226	181	198	166	147	123	111	91																						
2001	1138	1168	1195	1016	1125	1056	1140	870	622	739	826	615	569	874	2088	1046	1177	888	886	932	795	785	644	527	418	368	300	286	274	218	264	227	195	156	171	143	127	106	96	79	86																					
2002	859	882	902	766	849	797	861	656	470	558	624	464	429	660	1576	790	888	670	669	703	600	592	486	397	316	278	226	216	207	164	199	172	147	118	129	108	95	80	72	59	65	75																			
2003	1005	1031	1054	896	993	931	1006	767	549	652	729	542	502	771	1842	923	1038	783	782	822	702	693	568	465	369	325	265	253	242	192	233	201	172	138	150	126	112	94	85	70	76	88	117																	
2004	1092	1121	1147	974	1080	1013	1094	835	597	709	793	590	546	839	2003	1004	1129	852	850	894	763	753	618	505	402	353	288	275	263	209	253	219	187	150	164	137	121	102	92	76	83	96	127	109															
2005	1299	1333	1364	1159	1284	1205	1301	993	710	844	943	702	649	998	2383	1194	1343	1013	1011	1063	908	896	735	601	478	420	342	327	313	249	301	260	223	178	195	163	144	121	109	90	98	114	151	129	119											
2006	1448	1486	1520	1292	1432	1343	1450	1106	791	940	1051	782	723	1112	2656	1331	1497	1129	1127	1185	1012	998	819	670	532	468	382	364	349	277	335	290	248	198	217	182	161	135	122	100	110	127	169	144	133	111									
2007	1463	1501	1536	1305	1446	1356	1465	1118	799	950	1062	790	731	1124	2683	1344	1512	1141	1139	1197	1022	1009	827	677	538	473	385	368	352	280	339	293	251	200	219	184	163	136	123	101	111	129	170	146	134	113	101							
2008	1018	1045	1068	908	1006	944	1019	778	556	661	739	550	508	782	1867	935	1052	794	792	833	711	702	576	471	374	329	268	256	245	195	236	204	174	139	152	128	113	95	86	70	77	89	118	101	93	78	70	70						
2009	1282	1316	1346	1144	1267	1189	1284	979	700	832	930	692	640	985	2351	1178	1325	1000	998	1049	896	884	725	593	471	414	338	322	309	245	297	257	220	176	192	161	142	119	108	89	97	113	149	128	117	99	89	88	126				
2010	1397	1433	1466	1246	1381	1295	1399	1067	763	907	1014	754	698	1073	2561	1283	1444	1089	1087	1143	976	963	790	646	513	452	368	351	336	267	323	280	239	191	209	176	155	130	118	97	106	123	163	139	128	107	96	95	137	109			
2011	1287	1321	1351	1148	1272	1193	1289	983	703	836	934	695	643	989	2360	1183	1330	1004	1002	1053	899	887	728	595	473	416	339	324	310	246	298	258	221	176	193	162	143	120	108	89	97	113	150	128	118	99	89	88	126	100	92		
2012	1400	1436	1469	1249	1384	1298	1402	1069	765	909	1016	756	699	1075	2567	1286	1447	1091	1089	1145	978	965	792	647	514	453	369	352	337	268	324	280	240	192	210	176	156	130	118	97	106	123	163	139	128	108	97	96	138	109	100	109	
2013	1643	1686	1724	1465	1624	1523	1645	1255	898	1067	1192	887	821	1262	3013	1510	1698	1281	1279	1344	1148	1133	929	760	604	531	433	413	396	314	380	329	282	225	246	206	183	153	138	114	124	144	191	164	150	126	113	112	161	128	118	128	117
2014	1636	1678	1717	1459	1617	1517	1638	1250	894	1062	1187	883	817	1256	2999	1503	1690	1275	1273	1338	1143	1128	925	757	601	529	431	411	394	313	379	327	280	224	245	206	182	152	138	113	124	144	190	163	150	126	113	112	161	128	117	127	117	100

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have fallen to £97 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £112 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real return on gilts - Gross income re-invested

Average Annual Real Rate of Return

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	(11.9)																																																					
1962	3.5	21.5																																																					
1963	2.9	11.2	1.8																																																			
1964	0.4	4.9	(2.6)	(6.7)																																																		
1965	0.3	3.6	(1.8)	(3.5)	(0.1)																																																	
1966	0.3	3.0	(1.2)	(2.2)	0.2	0.5																																																
1967	0.3	2.5	(0.9)	(1.6)	0.2	0.3	0.1																																														
1968	(0.8)	0.9	(2.1)	(2.9)	(1.9)	(2.5)	(4.0)	(7.8)																																													
1969	(1.1)	0.3	(2.4)	(3.1)	(2.4)	(2.9)	(4.0)	(6.1)	(4.2)																																											
1970	(1.4)	(0.2)	(2.6)	(3.2)	(2.6)	(3.1)	(4.0)	(5.4)	(4.1)	(4.0)																																									
1971	0.1	1.4	(0.6)	(0.9)	(0.1)	(0.1)	(0.2)	(0.3)	2.4	5.9	16.8																																								
1972	(0.9)	0.2	(1.7)	(2.1)	(1.5)	(1.7)	(2.0)	(2.4)	(1.0)	0.0	2.1	(10.7)																																							
1973	(2.3)	(1.4)	(3.3)	(3.7)	(3.4)	(3.8)	(4.4)	(5.1)	(4.6)	(4.7)	(4.9)	(14.2)	(17.6)																																						
1974	(4.4)	(3.8)	(5.7)	(6.4)	(6.3)	(7.0)	(7.9)	(9.0)	(9.1)	(10.1)	(11.6)	(19.4)	(23.4)	(28.8)																																					
1975	(3.6)	(2.9)	(4.6)	(5.1)	(5.0)	(5.4)	(6.1)	(6.8)	(6.7)	(7.1)	(7.7)	(13.0)	(13.7)	(11.7)	9.5																																				
1976	(3.4)	(2.8)	(4.4)	(4.8)	(4.7)	(5.1)	(5.6)	(6.2)	(6.0)	(6.3)	(6.6)	(10.7)	(10.7)	(8.3)	4.1	(1.1)																																				
1977	(1.8)	(1.1)	(2.4)	(2.7)	(2.4)	(2.6)	(2.9)	(3.2)	(2.6)	(2.4)	(2.2)	(5.1)	(3.9)	(0.1)	11.8	13.0	29.1																																				
1978	(2.2)	(1.6)	(2.9)	(3.2)	(2.9)	(3.1)	(3.4)	(3.8)	(3.3)	(3.2)	(3.1)	(5.7)	(4.8)	(2.1)	6.1	5.0	8.1	(9.4)																																				
1979	(2.7)	(2.2)	(3.4)	(3.7)	(3.5)	(3.7)	(4.1)	(4.4)	(4.1)	(4.1)	(4.1)	(6.4)	(5.8)	(3.6)	2.4	0.7	1.3	(10.3)	(11.2)																																				
1980	(2.3)	(1.8)	(2.9)	(3.2)	(3.0)	(3.2)	(3.4)	(3.7)	(3.4)	(3.3)	(3.2)	(5.2)	(4.5)	(2.5)	2.8	1.5	2.2	(5.5)	(3.4)	5.0																																				
1981	(2.7)	(2.2)	(3.3)	(3.6)	(3.4)	(3.6)	(3.8)	(4.1)	(3.8)	(3.8)	(3.8)	(5.6)	(5.0)	(3.3)	1.0	(0.4)	(0.2)	(6.4)	(5.4)	(2.3)	(9.2)																																				
1982	(0.9)	(0.4)	(1.4)	(1.5)	(1.2)	(1.3)	(1.4)	(1.5)	(1.0)	(0.8)	(0.5)	(1.9)	(1.0)	1.0	5.5	5.0	6.0	1.9	5.0	11.1	14.2	43.6																																				
1983	(0.5)	0.1	(0.8)	(1.0)	(0.7)	(0.7)	(0.8)	(0.8)	(0.3)	(0.0)	0.3	(1.0)	(0.1)	1.9	6.0	5.6	6.6	3.2	6.0	10.8	12.8	25.7	10.0																																				
1984	(0.4)	0.2	(0.7)	(0.8)	(0.5)	(0.5)	(0.6)	(0.6)	(0.2)	0.1	0.4	(0.8)	0.1	1.9	5.6	5.2	6.0	3.1	5.3	9.0	10.0	17.3	6.0	2.1																																				
1985	(0.2)	0.4	(0.5)	(0.6)	(0.3)	(0.3)	(0.3)	(0.3)	0.1	0.4	0.7	(0.4)	0.5	2.2	5.6	5.2	5.9	3.3	5.3	8.3	9.0	14.1	5.7	3.6	5.0																																				
1986	0.1	0.6	(0.2)	(0.3)	0.1	0.1	0.0	0.0	0.5	0.8	1.1	0.1	0.9	2.5	5.7	5.3	6.0	3.7	5.5	8.1	8.7	12.6	6.0	4.7	6.0	7.0																																				
1987	0.5	1.0	0.3	0.2	0.6	0.6	0.6	0.6	1.1	1.4	1.7	0.8	1.6	3.2	6.2	5.9	6.6	4.5	6.2	8.6	9.1	12.5	7.2	6.5	8.0	9.5	12.1																																				
1988	0.6	1.1	0.4	0.3	0.6	0.7	0.7	0.7	1.1	1.4	1.7	0.9	1.7	3.1	5.9	5.6	6.2	4.3	5.8	7.9	8.3	11.0	6.4	5.7	6.6	7.1	7.2	2.4																																				
1989	0.5	1.0	0.3	0.2	0.5	0.6	0.6	0.6	1.0	1.3	1.6	0.8	1.5	2.8	5.4	5.1	5.6	3.8	5.1	6.9	7.1	9.4	5.2	4.4	4.9	4.8	4.2	0.4	(1.7)																																		
1990	0.4	0.8	0.2	0.1	0.4	0.4	0.4	0.4	0.8	1.0	1.3	0.6	1.2	2.5	4.8	4.5	4.9	3.3	4.4	5.9	6.0	7.9	4.1	3.3	3.4	3.1	2.2	(0.9)	(2.5)	(3.4)																																		
1991	0.8	1.2	0.6	0.6	0.8	0.9	0.9	0.9	1.3	1.6	1.9	1.2	1.8	3.1	5.3	5.1	5.5	4.0	5.1	6.6	6.7	8.4	5.1	4.5	4.9	4.8	4.4	2.6	2.6	4.8	13.8																																		
1992	1.2	1.7	1.1	1.0	1.3	1.4	1.4	1.5	1.9	2.2	2.5	1.8	2.5	3.7	5.9	5.6	6.1	4.7	5.8	7.2	7.4	9.1	6.1	5.7	6.1	6.3	6.2	5.0	5.7	8.3	14.6	15.4																																		
1993	1.9	2.4	1.8	1.8	2.1	2.2	2.3	2.3	2.8	3.1	3.4	2.8	3.5	4.7	6.8	6.7	7.2	5.9	7.1	8.5	8.8	10.4	7.8	7.6	8.2	8.6	8.9	8.3	9.5	12.5	18.4	20.8	26.4																																		
1994	1.4	1.8	1.3	1.3	1.5	1.6	1.6	1.7	2.1	2.3	2.6	2.0	2.7	3.7	5.7	5.5	5.9	4.7	5.6	6.8	7.0	8.3	5.8	5.4	5.8	5.9	5.7	4.8	5.2	6.7	9.4	7.9	4.4	(13.8)																																		
1995	1.8	2.2	1.7	1.7	2.0	2.0	2.1	2.1	2.5	2.8	3.1	2.6	3.2	4.2	6.1	6.0	6.4	5.2	6.2	7.4	7.5	8.8	6.5	6.2	6.6	6.8	6.7	6.1	6.6	8.1	10.5	9.7	7.9	(0.3)	15.3																																		
1996	1.9	2.3	1.8	1.8	2.1	2.1	2.2	2.2	2.6	2.9	3.2	2.7	3.3	4.3	6.1	5.9	6.3	5.2	6.1	7.2	7.4	8.6	6.4	6.1	6.5	6.6	6.6	6.0	6.4	7.6	9.6	8.8	7.2	1.5	10.1	5.1																																		
1997	2.2	2.6	2.1	2.1	2.4	2.5	2.6	2.7	3.0	3.3	3.6	3.1	3.7	4.7	6.5	6.3	6.7	5.7	6.6	7.7	7.8	9.0	7.0	6.8	7.1	7.3	7.3	6.9	7.4	8.6	10.4	9.8	8.8	4.7	11.8	10.1	15.3																																		
1998	2.7	3.1	2.6	2.7	2.9	3.0	3.1	3.2	3.6	3.9	4.2	3.7	4.3	5.3	7.1	7.0	7.4	6.4	7.3	8.3	8.5	9.7	7.8	7.7	8.1	8.4	8.5	8.1	8.7	10.0	11.7	11.5	10.8	7.9	14.2	13.8	18.4	21.7																																		
1999	2.5	2.9	2.4	2.4	2.7	2.8	2.9	2.9	3.3	3.6	3.8	3.4	4.0	4.9	6.6	6.4	6.8	5.9	6.6	7.6	7.8	8.8	7.0	6.8	7.2	7.3	7.4	7.0	7.4	8.3	9.7	9.2	8.4	5.6	10.0	8.7	9.9	7.4	(5.2)																																		
2000	2.6	3.0	2.5	2.5	2.8	2.9	3.0	3.0	3.4	3.7	3.9	3.5	4.1	5.0	6.5	6.4	6.7	5.9	6.6	7.6	7.7	8.6	7.0	6.8	7.1	7.2	7.3	6.9	7.3	8.1	9.4	8.9	8.1	5.7	9.3	8.2	9.0	7.0	0.3	6.1																																		
2001	2.5	2.9	2.5	2.5	2.7	2.8	2.9	3.0	3.3	3.6	3.8	3.4	3.9	4.8	6.3	6.2	6.5	5.6	6.4	7.2	7.3	8.2	6.6	6.5	6.7	6.8	6.8	6.4	6.8	7.5	8.5	8.0	7.2	5.0	8.1	6.9	7.3	5.3	0.4	3.3	0.6																																		
2002	2.6	3.0	2.6	2.6	2.8	2.9	3.0	3.1	3.4	3.7	3.9	3.5	4.0	4.9	6.3	6.2	6.5	5.7	6.4	7.2	7.3	8.2	6.6	6.5	6.7	6.8	6.8	6.5	6.7	7.4	8.4	7.9	7.2	5.2	7.9	6.9	7.2	5.6	1.9	4.4	3.6	6.7																																		
2003	2.5	2.9	2.5	2.5	2.7	2.8	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.7	6.1	5.9	6.2	5.4	6.1	6.8	6.9	7.7	6.3	6.1	6.3	6.3	6.3	6.0	6.2	6.8	7.6	7.1	6.4	4.6	6.8	5.8	5.9	4.4	1.3	3.0	2.0	2.7	(1.2)																																		
2004	2.5	2.9	2.5	2.5	2.8	2.8	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.6	6.0	5.9	6.1	5.3	6.0	6.7	6.8	7.5	6.1	5.9	6.1	6.2	6.2	5.8	6.0	6.6	7.3	6.8	6.1	4.5	6.5	5.6	5.6	4.3	1.7	3.1	2.4	3.0	1.2	3.6																																		
2005	2.6	3.0	2.6	2.6	2.8	2.9	3.0	3.0	3.4	3.6	3.8	3.4	3.9	4.7	6.0	5.9	6.1	5.4	6.0	6.7	6.7	7.5	6.1	6.0	6.1	6.2	6.2	5.8	6.0	6.5	7.2	6.8	6.1	4.6	6.5	5.6	5.7	4.5	2.3	3.6	3.1	3.7	2.8	4.8	6.0																																		
2006	2.5	2.8	2.4	2.4	2.7	2.7	2.8	2.9	3.1	3.4	3.6	3.2	3.7	4.4	5.6	5.5	5.7	5.0	5.6	6.3	6.3	7.0	5.7	5.5	5.6	5.7	5.6	5.3	5.4	5.9	6.5	6.0	5.4	3.9	5.5	4.7	4.6	3.5	1.4	2.4	1.8	2.1	0.9	1.7	0.7	(4.4)																																		
2007	2.4	2.8	2.4	2.4	2.6	2.7	2.7	2.8	3.1	3.3	3.5	3.2	3.6	4.3	5.5	5.4	5.6	4.9	5.4	6.1	6.1	6.7	5.5	5.3	5.4	5.5	5.4	5.1	5.2	5.6	6.1	5.7	5.1	3.7	5.2	4.4	4.3	3.3	1.4	2.3	1.7	1.9	1.0	1.5	0.9	(1.7)	1.2																																		
2008	2.6	3.0	2.6	2.6	2.8	2.9	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.5	5.7	5.6	5.8	5.1	5.6	6.3	6.3	6.9	5.7	5.5	5.7	5.7	5.7	5.4	5.5	5.9	6.5	6.0	5.5	4.2	5.6	4.9	4.9	4.0	2.4	3.3	2.9	3.3	2.7	3.5	3.5	2.6	6.4	11.8																																		
2009	2.5	2.8	2.5	2.5	2.7	2.7	2.8	2.9	3.1	3.3	3.5	3.2	3.6	4.3	5.4	5.3	5.5	4.8	5.3	5.9	6.0	6.5	5.4	5.2	5.3	5.3	5.3	5.0	5.1	5.4	5.9	5.5	4.9	3.7	5.0	4.3	4.3	3.4	1.9	2.6	2.2	2.4	1.8	2.3	2.1	1.1	3.0	4.0	(3.3)																																		
2010	2.5	2.9	2.5	2.5	2.7	2.8	2.8	2.9	3.2	3.4	3.6	3.2	3.6	4.3	5.4	5.3	5.5	4.8	5.3	5.9	5.9	6.5	5.3	5.2	5.3	5.3	5.2	4.9	5.1	5.4	5.8	5.4	4.9	3.8	5.0	4.3	4.3	3.5	2.1	2.8	2.4	2.6	2.2	2.6	2.5	1.8	3.4	4.1	0.5	4.4																																		
2011	2.8	3.1	2.8	2.8	3.0	3.1	3.1	3.2	3.4	3.6	3.8	3.5	3.9	4.6	5.7	5.5	5.7	5.1	5.6	6.2	6.2	6.8	5.7	5.5	5.7	5.7	5.6	5.4	5.5	5.8	6.3	5.9	5.5	4.4	5.6	5.0	5.0	4.3	3.1	3.8	3.6	3.9	3.6	4.2	4.3	4.0	5.8	6.9	5.4	10.0	15.8																																		
2012	2.8	3.1	2.7	2.7	3.0	3.0	3.1	3.1	3.4	3.6	3.8	3.5	3.9	4.5	5.5	5.4	5.6	5.0	5.5	6.0	6.1	6.6	5.5	5.4	5.5	5.5	5.5	5.2	5.3	5.6	6.1	5.7	5.3	4.3	5.4	4.8	4.8	4.1	3.0	3.6	3.4	3.7	3.4	3.9	4.0	3.7	5.1	5.9	4.4	7.1	8.5	1.6																																		
2013	2.5	2.8	2.5	2.5	2.7	2.7	2.8	2.8	3.1	3.3	3.4	3.1	3.5	4.1	5.1	5.0	5.2	4.6	5.0	5.5	5.6	6.0	5.0	4.9	4.9	4.9	4.9	4.6	4.7	5.0	5.3	5.0	4.5	3.5	4.5	3.9	3.9	3.2	2.1	2.6	2.4	2.5	2.1	2.5	2.4	1.9	2.8	3.1	1.5	2.7	2.1	(4.2)	(9.6)																																		
2014	2.7	3.0	2.7	2.7	2.9	3.0	3.1	3.1	3.4	3.5	3.7	3.4	3.8	4.4	5.4	5.3	5.5	4.9	5.3	5.8	5.9	6.3	5.4	5.2	5.3	5.3	5.3	5.0	5.1	5.4	5.8	5.4	5.0	4.1	5.1	4.6	4.5	3.9	2.9	3.5	3.3	3.5	3.3	3.7	3.7	3.4	4.4	4.9	3.8	5.3	5.5	2.3	2.6	16.4

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have lost 11.9% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1963) would have given an average annual real return of 2.9%. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real Value of £100 Invested

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	88																																																					
1962	107	121																																																				
1963	109	124	102																																																			
1964	102	115	95	93																																																	
1965	101	115	95	93	100																																															
1966	102	116	95	94	100	101																																														
1967	102	116	95	94	100	101	100																																												
1968	94	107	88	86	93	93	92	92																																											
1969	90	102	84	83	89	89	88	88	96																																											
1970	87	98	81	79	85	85	85	85	92	96																																										
1971	101	115	94	93	99	100	99	99	107	112	117																																									
1972	90	102	84	83	89	89	88	88	96	100	104	89																																								
1973	74	84	69	68	73	73	73	73	79	83	86	74	82																																							
1974	53	60	49	49	52	52	52	52	56	59	61	52	59	71																																						
1975	58	66	54	53	57	57	57	57	62	64	67	57	64	78	110																																					
1976	57	65	54	53	56	56	56	56	61	64	66	57	63	77	108	99																																				
1977	74	84	69	68	73	73	73	72	79	82	86	73	82	100	140	128	129																																			
1978	67	76	63	61	66	66	66	66	71	74	77	66	74	90	127	116	117	91																																		
1979	59	68	56	55	59	59	58	58	63	66	69	59	66	80	112	103	104	80	89																																	
1980	62	71	58	57	61	62	61	61	66	69	72	62	69	84	118	108	109	84	93	105																																
1981	57	64	53	52	56	56	56	56	60	63	66	56	63	76	107	98	99	77	85	95	91																															
1982	81	92	76	75	80	80	80	80	87	90	94	81	90	110	154	141	142	110	122	137	130	144																															
1983	90	102	84	82	88	88	88	88	95	99	104	89	99	121	169	155	156	121	134	151	143	158	110																														
1984	92	104	86	84	90	90	90	90	97	102	106	91	101	123	173	158	160	124	137	154	147	161	112	102																												
1985	96	109	90	88	95	95	94	94	102	107	111	95	107	129	182	166	168	130	143	162	154	169	118	107	105																										
1986	103	117	96	94	101	101	101	101	109	114	119	102	114	138	194	177	179	139	153	173	165	181	126	115	112	107																									
1987	115	131	108	106	113	114	113	113	123	128	133	114	128	155	218	199	201	156	172	194	185	203	142	129	126	120	112																								
1988	118	134	110	108	116	116	116	116	126	131	137	117	131	159	223	204	206	160	176	199	189	208	145	132	129	123	115	102																								
1989	116	132	109	107	114	114	114	114	123	129	134	115	129	156	220	200	203	157	173	195	186	205	143	130	127	121	113	101	98																								
1990	112	127	105	103	110	111	110	110	119	125	130	111	124	151	212	194	196	152	167	189	180	198	138	125	123	117	109	97	95	97																								
1991	128	145	119	117	126	126	125	125	136	142	148	126	142	172	241	220	223	173	191	215	204	225	157	142	139	133	124	111	108	110	114																								
1992	147	167	138	135	145	145	144	144	157	164	170	146	163	198	279	254	257	199	220	248	236	260	181	164	161	153	143	128	125	127	131	115																								
1993	186	211	174	171	183	184	183	182	198	207	215	184	206	251	352	321	325	252	278	313	298	328	229	208	203	194	181	162	158	160	166	146	126																								
1994	161	182	150	147	158	158	157	157	171	178	186	159	178	216	303	277	280	217	240	270	257	283	197	179	175	167	156	139	136	138	143	126	109	86																								
1995	185	210	173	170	182	182	181	181	197	205	214	183	205	249	350	319	323	250	276	311	296	326	227	206	202	193	180	160	157	159	165	145	126	99	115																								
1996	195	221	182	179	191	192	191	191	207	216	225	193	216	262	368	336	340	263	290	327	311	343	239	217	213	202	189	169	165	167	173	152	132	104	121	105																								
1997	224	255	210	206	221	221	220	220	238	249	259	222	248	302	424	387	391	303	335	377	359	395	275	250	245	233	218	194	190	193	200	176	152	120	140	121	115																								
1998	273	310	255	250	268	269	267	267	290	303	315	270	302	367	516	471	476	369	407	459	437	481	335	304	298	284	265	237	231	235	243	214	185	146	170	147	140	122																								
1999	259	294	242	237	254	255	254	253	275	287	299	256	287	348	489	446	451	350	386	435	414	456	317	288	282	269	251	224	219	223	230	202	175	139	161	140	133	115	95																								
2000	274	311	256	252	270	270	269	269	292	305	317	272	304	369	519	473	479	371	410	461	439	483	337	306	300	285	267	238	232	236	245	215	186	147	171	148	141	122	101	106																								
2001	276	314	258	253	272	272	271	270	293	306	319	273	306	371	522	476	482	373	412	464	442	487	339	308	302	287	269	239	234	238	246	216	187	148	172	149	142	123	101	107	101																								
2002	295	334	275	270	290	290	289	289	313	327	341	292	326	396	557	508	514	398	440	495	471	519	362	329	322	306	287	255	249	254	263	231	200	158	183	159	151	131	108	114	107	107																								
2003	291	330	272	267	286	287	285	285	309	323	336	288	322	391	550	502	508	393	434	489	466	513	357	325	318	303	283	252	246	251	259	228	197	156	181	157	150	130	107	113	106	105	99																								
2004	301	342	282	277	297	297	296	295	320	335	349	298	334	405	570	520	526	407	450	507	482	531	370	336	329	314	293	261	255	260	269	236	205	162	188	163	155	134	111	117	110	109	102	104																								
2005	320	363	299	293	315	315	313	313	340	355	370	316	354	430	604	552	558	432	477	537	512	563	392	357	349	333	311	277	271	275	285	250	217	172	199	173	164	143	117	124	117	116	109	110	106																								
2006	306	347	286	281	301	301	300	299	325	339	353	303	339	411	578	527	534	413	456	514	489	539	375	341	334	318	297	265	259	263	272	239	207	164	190	165	157	136	112	118	111	111	104	105	101	96																								
2007	309	351	289	284	304	305	303	303	329	343	357	306	343	416	584	534	540	418	462	520	495	545	380	345	338	322	301	268	262	266	276	242	210	166	193	167	159	138	113	120	113	112	105	106	103	97	101																								
2008	346	393	323	317	340	341	339	339	367	384	400	342	383	465	653	597	604	467	516	581	553	609	424	386	378	360	336	300	293	298	308	271	235	186	215	187	178	154	127	134	126	125	117	119	115	108	113	112																								
2009	335	380	313	307	329	330	328	328	355	371	387	331	371	450	632	577	584	452	499	562	535	589	411	373	365	348	325	290	283	288	298	262	227	180	208	181	172	149	123	129	122	121	114	115	111	105	109	108	97																								
2010	349	397	326	321	344	344	342	342	371	388	404	346	387	470	660	603	610	472	521	587	559	615	429	390	382	363	340	303	296	301	311	274	237	187	218	189	180	156	128	135	127	126	119	120	116	109	114	113	101	104																								
2011	405	459	378	371	398	399	397	396	430	449	468	400	448	544	764	698	706	547	604	680	647	713	496	451	442	421	393	351	342	348	360	317	274	217	252	219	208	180	148	156	147	146	137	139	134	127	132	131	117	121	116																								
2012	411	467	384	377	405	405	403	403	437	456	475	407	456	553	777	709	718	556	614	691	658	724	505	459	449	428	400	357	348	354	366	322	279	221	256	222	211	183	151	159	150	149	140	141	136	129	134	133	119	123	118	102																								
2013	372	422	347	341	366	366	364	364	395	412	430	368	412	500	702	641	649	502	555	625	595	655	456	415	406	387	361	322	315	320	331	291	252	199	231	201	191	166	136	144	135	135	126	128	123	116	122	120	107	111	106	92	90																								
2014	433	491	404	397	426	426	424	424	460	480	500	428	479	582	818	747	755	585	646	727	692	762	531	483	473	450	421	375	366	373	386	339	294	232	270	234	222	193	159	167	158	157	147	149	144	135	142	140	125	129	124	107	105	116																								

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have fallen to £88 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £109 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real return on Treasury bills - Gross income re-invested

Average Annual Real Rate of Return

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	0.7																																																				
1962	1.3	1.8																																																				
1963	1.5	1.8	1.9																																																		
1964	1.0	1.1	0.8	(0.4)																																																	
1965	1.1	1.2	1.1	0.7	1.7																																																
1966	1.3	1.5	1.4	1.2	2.0	2.4																																															
1967	1.6	1.8	1.8	1.8	2.5	2.9	3.4																																													
1968	1.6	1.7	1.7	1.7	2.2	2.4	2.4	1.4																																												
1969	1.8	1.9	1.9	1.9	2.4	2.6	2.6	2.3	3.1																																											
1970	1.6	1.6	1.6	1.6	1.9	2.0	1.9	1.4	1.3	(0.4)																																										
1971	1.2	1.2	1.1	1.1	1.3	1.2	0.9	0.4	0.0	(1.5)	(2.6)																																									
1972	0.9	0.9	0.8	0.7	0.8	0.7	0.4	(0.1)	(0.5)	(1.7)	(2.3)	(2.1)																																								
1973	0.7	0.7	0.6	0.5	0.6	0.4	0.2	(0.4)	(0.7)	(1.6)	(2.0)	(1.7)	(1.4)																																							
1974	0.3	0.2	0.1	(0.1)	(0.0)	(0.2)	(0.6)	(1.1)	(1.5)	(2.4)	(2.9)	(3.0)	(3.5)	(5.5)																																							
1975	(0.6)	(0.7)	(0.8)	(1.1)	(1.1)	(1.4)	(1.8)	(2.4)	(3.0)	(4.0)	(4.7)	(5.2)	(6.2)	(8.5)	(11.3)																																						
1976	(0.7)	(0.8)	(1.0)	(1.2)	(1.3)	(1.6)	(2.0)	(2.5)	(3.0)	(3.9)	(4.4)	(4.8)	(5.4)	(6.8)	(7.4)	(3.2)																																						
1977	(0.8)	(0.9)	(1.1)	(1.3)	(1.4)	(1.6)	(2.0)	(2.5)	(2.9)	(3.7)	(4.1)	(4.4)	(4.8)	(5.7)	(5.7)	(2.8)	(2.4)																																					
1978	(0.8)	(0.9)	(1.1)	(1.3)	(1.3)	(1.5)	(1.9)	(2.3)	(2.7)	(3.3)	(3.7)	(3.8)	(4.1)	(4.6)	(4.4)	(2.0)	(1.4)	(0.3)																																					
1979	(0.9)	(1.0)	(1.2)	(1.4)	(1.4)	(1.7)	(2.0)	(2.4)	(2.7)	(3.3)	(3.6)	(3.7)	(4.0)	(4.4)	(4.2)	(2.3)	(2.0)	(1.8)	(3.2)																																					
1980	(0.8)	(0.9)	(1.0)	(1.2)	(1.2)	(1.4)	(1.7)	(2.1)	(2.4)	(2.9)	(3.1)	(3.1)	(3.3)	(3.5)	(3.2)	(1.5)	(1.1)	(0.6)	(0.8)	1.8																																					
1981	(0.7)	(0.8)	(0.9)	(1.0)	(1.1)	(1.3)	(1.5)	(1.8)	(2.1)	(2.5)	(2.7)	(2.7)	(2.8)	(2.9)	(2.5)	(1.0)	(0.5)	(0.1)	(0.0)	1.7	1.5																																				
1982	(0.4)	(0.4)	(0.5)	(0.7)	(0.7)	(0.8)	(1.0)	(1.3)	(1.5)	(1.8)	(1.9)	(1.9)	(1.9)	(1.9)	(1.4)	0.1	0.6	1.2	1.6	3.3	4.0	6.6																																				
1983	(0.2)	(0.2)	(0.3)	(0.4)	(0.4)	(0.5)	(0.7)	(0.9)	(1.1)	(1.4)	(1.5)	(1.4)	(1.3)	(1.3)	(0.8)	0.6	1.2	1.8	2.2	3.6	4.2	5.6	4.6																																				
1984	0.0	0.0	(0.1)	(0.2)	(0.1)	(0.2)	(0.4)	(0.6)	(0.7)	(1.0)	(1.0)	(0.9)	(0.8)	(0.7)	(0.3)	1.1	1.6	2.2	2.6	3.8	4.4	5.3	4.7	4.8																																				
1985	0.3	0.2	0.2	0.1	0.1	0.0	(0.1)	(0.3)	(0.4)	(0.6)	(0.6)	(0.4)	(0.3)	(0.2)	0.3	1.5	2.1	2.6	3.1	4.2	4.7	5.4	5.1	5.3	5.8																																				
1986	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.1	0.0	(0.1)	(0.1)	0.0	0.2	0.3	0.8	2.0	2.6	3.1	3.6	4.6	5.0	5.7	5.5	5.9	6.4	7.0																																				
1987	0.7	0.7	0.7	0.6	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.4	0.6	0.7	1.2	2.3	2.8	3.4	3.8	4.7	5.1	5.7	5.6	5.8	6.2	6.3	5.7																																				
1988	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.5	0.5	0.4	0.4	0.6	0.8	0.9	1.4	2.4	2.9	3.4	3.8	4.6	5.0	5.5	5.3	5.4	5.6	5.5	4.8	4.0																																				
1989	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.9	1.1	1.2	1.7	2.7	3.2	3.7	4.0	4.8	5.1	5.6	5.4	5.6	5.8	5.7	5.3	5.2	6.4																																				
1990	1.2	1.2	1.2	1.1	1.2	1.2	1.1	1.0	1.0	0.9	1.0	1.2	1.4	1.5	2.0	2.9	3.4	3.8	4.2	4.9	5.2	5.6	5.5	5.6	5.8	5.8	5.5	5.4	6.2	6.0																																				
1991	1.3	1.4	1.4	1.3	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.4	1.6	1.8	2.3	3.2	3.6	4.1	4.4	5.1	5.4	5.8	5.7	5.8	5.9	6.0	5.8	5.8	6.4	6.4	6.8																																				
1992	1.5	1.5	1.5	1.5	1.6	1.6	1.5	1.5	1.5	1.4	1.5	1.7	1.9	2.1	2.5	3.4	3.8	4.2	4.6	5.2	5.5	5.8	5.8	5.9	6.0	6.1	5.9	6.0	6.5	6.5	6.8	6.7																																				
1993	1.6	1.6	1.6	1.6	1.7	1.7	1.6	1.6	1.6	1.5	1.6	1.8	2.0	2.1	2.6	3.4	3.8	4.2	4.5	5.1	5.3	5.7	5.6	5.7	5.8	5.8	5.6	5.6	5.9	5.8	5.8	5.3	3.9																																				
1994	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.6	1.6	1.5	1.6	1.8	2.0	2.2	2.6	3.3	3.7	4.1	4.4	4.9	5.1	5.4	5.3	5.4	5.5	5.4	5.2	5.2	5.4	5.2	5.0	4.3	3.2	2.4																																				
1995	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.7	1.9	2.1	2.2	2.6	3.4	3.7	4.1	4.3	4.8	5.0	5.3	5.2	5.2	5.3	5.2	5.0	4.9	5.1	4.9	4.6	4.1	3.2	2.9	3.4																																				
1996	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.7	1.7	1.7	1.8	2.0	2.1	2.3	2.6	3.4	3.7	4.0	4.3	4.7	4.9	5.2	5.1	5.1	5.1	5.1	4.9	4.8	4.9	4.7	4.5	4.0	3.3	3.2	3.5	3.6																																				
1997	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	2.0	2.2	2.3	2.7	3.4	3.7	4.0	4.2	4.7	4.8	5.0	4.9	5.0	5.0	4.9	4.7	4.6	4.7	4.5	4.3	3.9	3.3	3.2	3.4	3.4	3.1																																				
1998	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.1	2.3	2.4	2.8	3.4	3.7	4.0	4.3	4.7	4.8	5.0	4.9	5.0	5.0	4.9	4.7	4.7	4.7	4.5	4.4	4.0	3.6	3.5	3.8	3.9	4.1	5.0																																				
1999	1.9	1.9	1.9	1.9	2.0	2.0	2.0	1.9	2.0	1.9	2.0	2.2	2.3	2.5	2.8	3.4	3.7	4.0	4.2	4.6	4.8	5.0	4.9	4.9	4.9	4.8	4.7	4.6	4.6	4.5	4.3	4.0	3.6	3.5	3.8	3.9	3.9	4.4	3.7																																				
2000	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.4	2.5	2.8	3.4	3.7	4.0	4.2	4.6	4.7	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.3	4.2	3.9	3.5	3.5	3.7	3.7	3.8	4.0	3.4	3.2																																				
2001	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.0	2.1	2.3	2.4	2.6	2.9	3.5	3.8	4.0	4.2	4.6	4.7	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.4	4.2	4.0	3.7	3.7	3.8	3.9	4.0	4.2	3.9	4.0	4.8																																				
2002	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.0	2.0	2.0	2.1	2.2	2.4	2.5	2.8	3.4	3.7	3.9	4.1	4.4	4.5	4.7	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.1	4.0	3.7	3.4	3.4	3.5	3.5	3.5	3.6	3.2	3.0	2.9	1.1																																				
2003	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.3	3.6	3.8	4.0	4.3	4.4	4.5	4.4	4.4	4.4	4.3	4.1	4.1	4.1	3.9	3.7	3.5	3.2	3.1	3.2	3.2	3.1	3.1	2.7	2.5	2.3	1.0	0.9																																				
2004	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.3	2.4	2.7	3.2	3.5	3.7	3.8	4.1	4.2	4.4	4.3	4.2	4.2	4.1	4.0	3.9	3.9	3.7	3.5	3.3	3.0	2.9	3.0	2.9	2.9	2.8	2.5	2.2	2.0	1.0	1.0	1.1																																				
2005	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.3	2.4	2.7	3.2	3.4	3.7	3.8	4.1	4.2	4.3	4.2	4.2	4.1	4.1	3.9	3.8	3.8	3.6	3.5	3.3	3.0	2.9	3.0	2.9	2.8	2.8	2.5	2.3	2.1	1.5	1.6	1.9	2.7																																				
2006	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	1.9	2.0	2.1	2.3	2.4	2.6	3.1	3.3	3.5	3.7	3.9	4.0	4.1	4.0	4.0	4.0	3.9	3.7	3.6	3.6	3.5	3.3	3.1	2.8	2.7	2.8	2.7	2.6	2.5	2.2	2.0	1.8	1.3	1.3	1.4	1.6	0.4																																				
2007	1.9	1.9	1.9	1.9	2.0	2.0	2.0	1.9	2.0	1.9	2.0	2.1	2.2	2.4	2.6	3.1	3.3	3.5	3.6	3.9	3.9	4.0	3.9	3.9	3.9	3.8	3.6	3.5	3.5	3.4	3.2	3.0	2.7	2.7	2.7	2.6	2.5	2.5	2.2	2.0	1.8	1.3	1.4	1.5	1.6	1.1	1.8																																				
2008	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.4	2.7	3.1	3.3	3.5	3.6	3.9	4.0	4.0	3.9	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.1	2.8	2.8	2.8	2.7	2.7	2.6	2.4	2.2	2.1	1.7	1.9	2.0	2.3	2.1	3.0	4.2																																				
2009	1.9	1.9	1.9	1.9	1.9	2.0	1.9	1.9	1.9	1.9	2.0	2.1	2.2	2.3	2.5	3.0	3.2	3.3	3.5	3.7	3.8	3.8	3.7	3.7	3.7	3.6	3.4	3.3	3.3	3.1	3.0	2.8	2.6	2.5	2.5	2.4	2.3	2.3	2.0	1.8	1.7	1.3	1.3	1.4	1.5	1.2	1.4	1.2	(1.7)																																				
2010	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.9	2.0	2.1	2.3	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.4	3.4	3.4	3.3	3.1	3.0	2.9	2.8	2.6	2.4	2.2	2.1	2.1	2.0	1.9	1.8	1.5	1.3	1.1	0.7	0.6	0.6	0.5	0.1	0.0	(0.6)	(2.9)	(4.1)																																				
2011	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.2	2.6	2.7	2.9	3.0	3.2	3.2	3.3	3.2	3.1	3.1	3.0	2.8	2.7	2.6	2.5	2.3	2.1	1.8	1.7	1.7	1.6	1.4	1.3	1.0	0.8	0.6	0.2	0.1	0.0	(0.1)	(0.6)	(0.8)	(1.5)	(3.3)	(4.1)	(4.1)																																				
2012	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.6	1.7	1.8	2.0	2.4	2.6	2.7	2.8	3.0	3.0	3.1	3.0	2.9	2.9	2.7	2.6	2.5	2.4	2.2	2.1	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.8	0.6	0.3	(0.1)	(0.2)	(0.3)	(0.5)	(0.9)	(1.1)	(1.7)	(3.1)	(3.6)	(3.4)	(2.7)																																				
2013	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.5	1.6	1.6	1.7	1.9	2.3	2.4	2.6	2.7	2.8	2.9	2.9	2.8	2.7	2.7	2.6	2.4	2.3	2.2	2.0	1.9	1.7	1.4	1.3	1.2	1.1	1.0	0.8	0.6	0.3	0.1	(0.2)	(0.4)	(0.5)	(0.7)	(1.1)	(1.3)	(1.8)	(3.0)	(3.3)	(3.0)	(2.5)	(2.3)																																				
2014	1.4	1.4	1.4	1.4	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.5	1.6	1.6	1.8	2.2	2.3	2.5	2.6	2.7	2.8	2.8	2.7	2.6	2.5	2.4	2.3	2.1	2.1	1.9	1.7	1.5	1.3	1.2	1.1	1.0	0.9	0.7	0.5	0.2	0.0	(0.3)	(0.4)	(0.6)	(0.7)	(1.1)	(1.3)	(1.7)	(2.7)	(2.9)	(2.6)	(2.1)	(1.7)	(1.2)																																				

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1963 would have lost 0.4% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1966) would have given an average annual real return of 1.2%. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real Value of £100 Invested

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	101																																																					
1962	103	102																																																				
1963	104	104	102																																																			
1964	104	103	102	100																																																	
1965	106	105	103	101	102																																															
1966	108	108	106	104	104	102																																														
1967	112	111	109	107	108	106	103																																												
1968	114	113	111	109	109	107	105	101																																											
1969	117	116	114	112	113	111	108	105	103																																											
1970	117	116	114	112	112	110	108	104	103	100																																										
1971	114	113	111	109	109	107	105	101	100	97	97																																									
1972	111	110	109	106	107	105	103	99	98	95	95	98																																								
1973	110	109	107	105	105	104	101	98	97	94	94	97	99																																							
1974	104	103	101	99	100	98	96	92	91	88	89	91	93	94																																						
1975	92	91	90	88	88	87	85	82	81	78	79	81	83	84	89																																					
1976	89	88	87	85	85	84	82	79	78	76	76	78	80	81	86	97																																				
1977	87	86	85	83	83	82	80	77	76	74	74	76	78	79	84	94	98																																			
1978	86	86	84	83	83	82	80	77	76	74	74	76	78	79	83	94	97	100																																		
1979	84	83	82	80	80	79	77	75	74	71	72	74	75	76	81	91	94	96	97																																		
1980	85	85	83	82	82	80	79	76	75	73	73	75	77	78	82	93	96	98	98	102																																	
1981	86	86	84	83	83	82	80	77	76	74	74	76	78	79	83	94	97	100	100	103	102																																
1982	92	92	90	88	89	87	85	82	81	79	79	81	83	84	89	100	104	106	107	110	108	107																															
1983	96	96	94	92	93	91	89	86	85	82	83	85	87	88	93	105	108	111	111	115	113	111	105																														
1984	101	100	99	97	97	95	93	90	89	86	87	89	91	92	98	110	114	116	117	121	119	117	110	105																													
1985	107	106	104	102	103	101	99	95	94	91	92	94	96	98	103	116	120	123	124	128	126	124	116	111	106																												
1986	114	114	112	109	110	108	106	102	101	98	98	101	103	104	110	124	129	132	132	137	134	132	124	119	113	107																											
1987	121	120	118	116	116	114	112	108	106	103	104	106	109	110	117	132	136	139	140	144	142	140	131	125	120	113	106																											
1988	126	125	123	120	121	119	116	112	111	107	108	111	113	115	121	137	141	145	145	150	148	145	136	130	124	118	110	104																											
1989	134	133	130	128	128	126	123	119	118	114	115	118	120	122	129	145	150	154	155	160	157	155	145	139	132	125	117	111	106																											
1990	142	141	138	136	136	134	131	126	125	121	121	125	127	129	137	154	159	163	164	169	166	164	154	147	140	132	124	117	113	106																											
1991	151	150	148	145	145	143	140	135	133	129	130	133	136	138	146	165	170	174	175	181	178	175	164	157	150	141	132	125	120	113	107																											
1992	161	160	157	155	155	152	149	144	142	138	138	142	145	147	156	176	182	186	187	193	190	187	175	167	160	151	141	134	128	121	114	107																											
1993	168	166	164	161	161	158	155	150	148	143	144	148	151	153	162	183	189	193	194	200	197	194	182	174	166	157	147	139	133	125	118	111	104																											
1994	172	171	168	164	165	162	159	153	151	147	147	151	154	157	166	187	193	198	199	205	202	199	186	178	170	161	150	142	137	129	121	114	106	102																											
1995	178	176	173	170	171	168	164	159	156	152	152	156	160	162	171	193	200	205	205	212	209	205	193	184	176	166	155	147	141	133	125	117	110	106	103																											
1996	184	183	180	176	177	174	170	164	162	157	158	162	166	168	178	200	207	212	213	220	216	213	200	191	182	172	161	152	146	138	130	122	114	110	107	104																											
1997	190	188	185	182	182	179	175	170	167	162	163	167	171	173	183	207	214	219	220	227	223	220	206	197	188	178	166	157	151	142	134	126	118	113	111	107	103																											
1998	199	198	195	191	192	188	184	178	176	170	171	176	179	182	192	217	224	230	231	238	234	231	216	207	197	187	174	165	159	149	141	132	124	119	116	112	108	105																											
1999	207	205	202	198	199	195	191	185	182	177	177	182	186	189	200	225	233	238	239	247	243	239	224	214	205	193	181	171	165	155	146	137	128	123	120	116	112	109	104																											
2000	213	212	208	204	205	202	197	190	188	182	183	188	192	195	206	232	240	246	247	255	250	247	231	221	211	200	187	177	170	160	151	141	132	127	124	120	116	112	107	103																											
2001	224	222	218	214	215	211	206	200	197	191	192	197	201	204	216	243	251	258	258	267	262	258	242	232	221	209	195	185	178	167	158	148	138	133	130	126	121	118	112	108	105																											
2002	226	224	221	216	217	214	209	202	199	193	194	199	203	206	218	246	254	261	261	270	265	261	245	234	224	211	198	187	180	169	160	149	140	135	132	127	123	119	113	109	106	101																											
2003	228	227	223	218	219	216	211	204	201	195	196	201	205	208	220	248	257	263	264	273	268	264	247	237	226	213	200	189	182	171	161	151	141	136	133	128	124	120	114	110	107	102	101																											
2004	231	229	225	221	222	218	213	206	203	197	198	203	207	210	223	251	259	266	267	276	271	267	250	239	228	216	202	191	184	173	163	152	143	137	134	130	125	121	116	112	108	103	102	101																											
2005	237	235	231	227	228	224	219	212	209	202	203	209	213	216	229	258	267	273	274	283	278	274	257	246	235	222	207	196	189	177	167	157	147	141	138	133	129	125	119	115	111	106	105	104	103																											
2006	238	236	232	228	229	225	220	212	210	203	204	210	214	217	230	259	268	274	275	284	279	275	258	247	236	223	208	197	189	178	168	157	147	142	139	134	129	125	119	115	112	106	105	104	103	100																											
2007	242	240	236	232	233	229	223	216	213	207	208	213	218	221	234	264	272	279	280	289	284	280	263	251	240	226	212	200	193	181	171	160	150	144	141	136	132	128	121	117	113	108	107	106	105	102	102																											
2008	252	251	246	242	243	238	233	225	222	216	216	222	227	230	244	275	284	291	292	302	296	292	274	262	250	236	221	209	201	189	178	167	156	150	147	142	137	133	127	122	118	113	112	111	109	107	106	104																											
2009	248	246	242	238	238	234	229	222	218	212	213	218	223	226	240	270	279	286	287	297	291	287	269	257	246	232	217	205	197	186	175	164	154	148	144	140	135	131	124	120	116	111	110	109	108	105	104	102	98																											
2010	238	236	232	228	229	225	220	213	210	203	204	210	214	217	230	259	268	274	275	284	279	275	258	247	236	223	208	197	189	178	168	157	147	142	139	134	129	125	119	115	112	106	105	104	103	100	100	98	94	96																											
2011	228	227	223	218	219	216	211	204	201	195	196	201	205	208	220	248	257	263	264	273	268	264	248	237	226	213	200	189	182	171	161	151	141	136	133	128	124	120	114	110	107	102	101	100	99	96	96	94	90	92	96																											
2012	222	221	217	213	213	210	205	198	196	190	190	196	200	203	214	242	250	256	257	265	261	257	241	230	220	208	194	184	177	166	157	147	138	132	129	125	121	117	111	107	104	99	98	97	96	94	93	92	88	90	93	97																											
2013	217	215	212	208	209	205	200	194	191	185	186	191	195	198	210	236	244	250	251	259	255	251	235	225	215	203	190	180	173	162	153	144	134	129	126	122	118	114	109	105	102	97	96	95	94	92	91	90	86	87	91	95	98																											
2014	214	213	209	205	206	203	198	191	189	183	184	189	193	196	207	233	241	247	248	256	252	248	233	222	212	201	188	177	171	160	151	142	133	128	125	121	117	113	108	104	101	96	95	94	93	91	90	89	85	86	90	94	97	99																											

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1978 would have fallen to £97 (allowing for reinvestment of income and the effect of inflation) in one year but after four years (up to the end of 1982) would have reached £107 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real return on building society account - Gross income re-invested

Average Annual Real Rate of Return

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	1.4																																																					
1962	2.4	3.4																																																						
1963	2.9	3.6	3.9																																																				
1964	2.4	2.7	2.4	0.9																																																			
1965	2.3	2.5	2.2	1.4	1.9																																																		
1966	2.4	2.6	2.4	1.9	2.5	3.0																																																	
1967	2.7	3.0	2.9	2.6	3.2	3.8	4.7																																																
1968	2.6	2.7	2.6	2.4	2.8	3.1	3.1	1.5																																															
1969	2.7	2.8	2.8	2.6	2.9	3.2	3.2	2.5	3.5																																													
1970	2.5	2.6	2.5	2.3	2.5	2.6	2.5	1.8	2.0	0.6																																												
1971	2.2	2.2	2.1	1.9	2.0	2.1	1.9	1.2	1.1	(0.1)	(0.7)																																											
1972	2.0	2.1	2.0	1.7	1.8	1.8	1.6	1.0	0.9	0.1	(0.1)	0.5																																										
1973	1.8	1.8	1.7	1.5	1.6	1.5	1.3	0.7	0.6	(0.1)	(0.3)	(0.2)	(0.8)																																									
1974	1.2	1.1	1.0	0.7	0.7	0.6	0.2	(0.4)	(0.7)	(1.5)	(2.0)	(2.4)	(3.8)	(6.8)																																									
1975	0.3	0.2	(0.0)	(0.3)	(0.4)	(0.7)	(1.1)	(1.8)	(2.2)	(3.2)	(3.9)	(4.7)	(6.3)	(9.0)	(11.1)																																									
1976	0.0	(0.1)	(0.3)	(0.6)	(0.7)	(1.0)	(1.4)	(2.0)	(2.4)	(3.3)	(3.9)	(4.5)	(5.7)	(7.3)	(7.6)	(3.8)																																									
1977	(0.0)	(0.1)	(0.4)	(0.7)	(0.8)	(1.0)	(1.4)	(1.9)	(2.3)	(3.0)	(3.5)	(4.0)	(4.8)	(5.8)	(5.5)	(2.6)	(1.3)																																								
1978	0.0	(0.1)	(0.3)	(0.6)	(0.7)	(0.9)	(1.2)	(1.7)	(2.0)	(2.6)	(3.0)	(3.3)	(3.9)	(4.5)	(3.9)	(1.4)	(0.2)	1.0																																								
1979	(0.2)	(0.3)	(0.5)	(0.8)	(0.9)	(1.1)	(1.4)	(1.9)	(2.2)	(2.8)	(3.1)	(3.4)	(4.0)	(4.5)	(4.0)	(2.1)	(1.6)	(1.7)	(4.3)																																								
1980	(0.2)	(0.3)	(0.5)	(0.8)	(0.9)	(1.0)	(1.3)	(1.8)	(2.0)	(2.5)	(2.8)	(3.1)	(3.5)	(3.9)	(3.4)	(1.7)	(1.2)	(1.2)	(2.2)	(0.1)																																								
1981	(0.2)	(0.2)	(0.4)	(0.7)	(0.8)	(0.9)	(1.2)	(1.6)	(1.8)	(2.2)	(2.5)	(2.7)	(3.0)	(3.3)	(2.8)	(1.3)	(0.8)	(0.7)	(1.2)	0.3	0.8																																							
1982	0.1	0.1	(0.1)	(0.3)	(0.4)	(0.5)	(0.7)	(1.1)	(1.3)	(1.6)	(1.8)	(1.9)	(2.1)	(2.3)	(1.7)	(0.3)	0.4	0.7	0.6	2.3	3.6	6.4																																							
1983	0.3	0.2	0.1	(0.1)	(0.1)	(0.3)	(0.4)	(0.8)	(0.9)	(1.2)	(1.3)	(1.4)	(1.6)	(1.6)	(1.1)	0.3	0.9	1.3	1.3	2.8	3.8	5.3	4.1																																						
1984	0.5	0.5	0.3	0.2	0.1	0.0	(0.1)	(0.4)	(0.5)	(0.8)	(0.9)	(0.9)	(1.0)	(1.0)	(0.4)	0.8	1.4	1.8	2.0	3.2	4.1	5.2	4.6	5.2																																						
1985	0.7	0.6	0.5	0.4	0.3	0.3	0.1	(0.1)	(0.2)	(0.5)	(0.5)	(0.5)	(0.6)	(0.6)	0.0	1.2	1.8	2.2	2.4	3.5	4.3	5.1	4.7	5.0	4.8																																						
1986	0.9	0.9	0.8	0.6	0.6	0.6	0.4	0.2	0.1	(0.1)	(0.1)	(0.0)	(0.1)	(0.0)	0.6	1.7	2.3	2.7	2.9	3.9	4.6	5.4	5.2	5.5	5.7	6.6																																						
1987	1.1	1.0	1.0	0.8	0.8	0.8	0.7	0.5	0.4	0.3	0.2	0.3	0.3	0.4	0.9	2.0	2.6	3.0	3.2	4.2	4.8	5.5	5.3	5.6	5.7	6.2	5.7																																						
1988	1.1	1.1	1.0	0.9	0.9	0.8	0.7	0.5	0.5	0.3	0.3	0.4	0.4	0.4	1.0	2.0	2.5	2.8	3.0	3.9	4.4	4.9	4.6	4.7	4.6	4.5	3.5	1.4																																						
1989	1.1	1.1	1.0	0.9	0.9	0.9	0.8	0.6	0.6	0.4	0.4	0.5	0.5	0.6	1.1	2.0	2.5	2.8	3.0	3.7	4.2	4.6	4.4	4.4	4.3	4.1	3.3	2.1	2.8																																						
1990	1.2	1.2	1.1	1.0	1.0	1.0	0.9	0.7	0.7	0.5	0.5	0.6	0.6	0.7	1.2	2.1	2.5	2.8	2.9	3.6	4.0	4.4	4.1	4.1	4.0	3.8	3.1	2.2	2.6	2.5																																						
1991	1.3	1.3	1.2	1.1	1.1	1.1	1.0	0.9	0.8	0.7	0.7	0.8	0.8	0.9	1.4	2.2	2.6	2.9	3.1	3.7	4.1	4.4	4.2	4.2	4.1	3.9	3.4	2.8	3.3	3.6	4.6																																						
1992	1.5	1.5	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.7	2.5	2.9	3.2	3.3	4.0	4.3	4.6	4.4	4.5	4.4	4.3	4.0	3.6	4.2	4.6	5.7	6.8																																						
1993	1.5	1.5	1.4	1.3	1.4	1.3	1.3	1.1	1.1	1.0	1.0	1.1	1.2	1.3	1.7	2.5	2.9	3.1	3.3	3.8	4.1	4.4	4.2	4.2	4.1	4.1	3.7	3.4	3.8	4.0	4.5	4.5	2.2																																						
1994	1.5	1.5	1.4	1.3	1.3	1.3	1.3	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.7	2.4	2.7	3.0	3.1	3.6	3.9	4.1	3.9	3.9	3.8	3.7	3.3	3.0	3.3	3.4	3.6	3.2	1.5	0.8																																						
1995	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.6	2.3	2.6	2.9	3.0	3.4	3.7	3.9	3.7	3.7	3.5	3.4	3.0	2.7	2.9	2.9	3.0	2.6	1.2	0.7	0.7																																						
1996	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.5	2.2	2.5	2.7	2.8	3.2	3.4	3.6	3.4	3.4	3.2	3.1	2.7	2.4	2.5	2.5	2.5	2.1	0.9	0.5	0.4	0.2																																						
1997	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	1.0	1.0	1.1	1.5	2.1	2.4	2.5	2.6	3.0	3.2	3.4	3.2	3.1	2.9	2.8	2.4	2.1	2.2	2.1	2.1	1.7	0.6	0.3	0.1	(0.2)	(0.5)																																						
1998	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.6	2.2	2.4	2.6	2.7	3.1	3.3	3.4	3.2	3.2	3.0	2.9	2.6	2.3	2.4	2.4	2.3	2.0	1.2	1.0	1.1	1.2	1.8	4.2																																						
1999	1.5	1.5	1.4	1.3	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.3	1.6	2.2	2.5	2.6	2.7	3.1	3.3	3.4	3.2	3.2	3.0	2.9	2.6	2.4	2.5	2.4	2.4	2.2	1.5	1.4	1.5	1.8	2.3	3.7	3.3																																						
2000	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.7	2.2	2.5	2.6	2.7	3.1	3.2	3.4	3.2	3.1	3.0	2.9	2.6	2.4	2.5	2.4	2.4	2.2	1.6	1.6	1.7	1.9	2.3	3.3	2.9	2.5																																						
2001	1.6	1.6	1.5	1.4	1.5	1.4	1.4	1.3	1.3	1.2	1.3	1.3	1.4	1.4	1.8	2.3	2.5	2.7	2.8	3.1	3.3	3.4	3.2	3.2	3.1	3.0	2.7	2.5	2.6	2.6	2.6	2.4	1.9	1.9	2.0	2.2	2.7	3.5	3.3	3.2	4.0																																						
2002	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.7	2.2	2.5	2.6	2.7	3.0	3.1	3.2	3.1	3.0	2.9	2.8	2.6	2.4	2.4	2.4	2.4	2.2	1.8	1.7	1.8	2.0	2.3	2.9	2.5	2.3	2.2	0.4																																						
2003	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.7	2.2	2.4	2.5	2.6	2.9	3.0	3.1	3.0	2.9	2.8	2.7	2.5	2.2	2.3	2.3	2.3	2.1	1.6	1.6	1.7	1.8	2.0	2.5	2.1	1.8	1.6	0.5	0.5																																						
2004	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.6	2.1	2.3	2.5	2.5	2.8	2.9	3.0	2.9	2.8	2.7	2.6	2.4	2.2	2.2	2.2	2.1	2.0	1.6	1.5	1.6	1.7	1.9	2.2	1.9	1.6	1.4	0.6	0.6	0.7																																						
2005	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.6	2.1	2.3	2.4	2.5	2.8	2.9	3.0	2.8	2.8	2.6	2.5	2.3	2.1	2.2	2.1	2.1	1.9	1.6	1.5	1.6	1.7	1.8	2.2	1.9	1.6	1.5	0.8	1.0	1.2	1.7																																						
2006	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.6	2.0	2.2	2.3	2.4	2.6	2.8	2.8	2.7	2.6	2.5	2.4	2.2	2.0	2.1	2.0	2.0	1.8	1.5	1.4	1.4	1.5	1.7	1.9	1.6	1.4	1.2	0.7	0.7	0.8	0.8	(0.1)																																						
2007	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.2	1.2	1.2	1.3	1.6	2.0	2.2	2.3	2.3	2.6	2.7	2.8	2.6	2.5	2.4	2.3	2.1	1.9	2.0	1.9	1.9	1.7	1.4	1.3	1.4	1.4	1.6	1.8	1.5	1.3	1.1	0.7	0.7	0.8	0.8	0.3	0.7																																						
2008	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.3	1.5	1.9	2.1	2.2	2.3	2.5	2.6	2.6	2.5	2.4	2.3	2.2	2.0	1.9	1.9	1.8	1.8	1.6	1.3	1.3	1.3	1.3	1.4	1.6	1.4	1.1	1.0	0.6	0.6	0.6	0.6	0.2	0.3	(0.1)																																						
2009	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.4	1.8	2.0	2.1	2.1	2.3	2.4	2.5	2.3	2.3	2.1	2.0	1.8	1.7	1.7	1.6	1.6	1.4	1.1	1.0	1.1	1.1	1.2	1.3	1.0	0.8	0.6	0.2	0.2	0.1	0.0	(0.4)	(0.5)	(1.1)	(2.1)																																						
2010	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.2	1.6	1.8	1.9	1.9	2.1	2.2	2.2	2.1	2.0	1.9	1.8	1.6	1.4	1.4	1.3	1.3	1.1	0.8	0.7	0.7	0.7	0.7	0.8	0.6	0.3	0.1	(0.3)	(0.4)	(0.5)	(0.7)	(1.2)	(1.5)	(2.2)	(3.2)	(4.4)																																						
2011	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.1	1.4	1.6	1.7	1.7	1.9	2.0	2.0	1.9	1.8	1.6	1.5	1.3	1.1	1.1	1.1	1.0	0.8	0.5	0.4	0.4	0.4	0.4	0.5	0.2	(0.1)	(0.3)	(0.7)	(0.8)	(1.0)	(1.3)	(1.7)	(2.1)	(2.8)	(3.6)	(4.4)	(4.4)																																						
2012	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	1.0	1.3	1.5	1.5	1.6	1.8	1.8	1.8	1.7	1.6	1.5	1.4	1.2	1.0	1.0	0.9	0.8	0.6	0.3	0.2	0.2	0.2	0.2	0.2	(0.0)	(0.3)	(0.5)	(0.9)	(1.0)	(1.2)	(1.5)	(1.9)	(2.2)	(2.8)	(3.4)	(3.9)	(3.6)	(2.8)																																						
2013	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.9	1.2	1.4	1.4	1.5	1.6	1.7	1.7	1.6	1.5	1.3	1.2	1.0	0.9	0.8	0.8	0.7	0.5	0.2	0.1	0.1	0.0	0.0	0.1	(0.2)	(0.4)	(0.7)	(1.0)	(1.2)	(1.3)	(1.6)	(2.0)	(2.2)	(2.7)	(3.2)	(3.5)	(3.2)	(2.6)	(2.4)																																					
2014	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.5	1.4	1.3	1.1	0.9	0.8	0.7	0.7	0.6	0.4	0.1	0.0	0.0	(0.0)	(0.0)	(0.0)	(0.3)	(0.5)	(0.7)	(1.1)	(1.2)	(1.3)	(1.5)	(1.9)	(2.1)	(2.5)	(2.9)	(3.1)	(2.7)	(2.2)	(1.9)	(1.3)

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have grown by 1.4% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1963) would have given an average annual real return of 2.9%. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real Value of £100 Invested

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1961	101																																																					
1962	105	103																																																				
1963	109	107	104																																																			
1964	110	108	105	101																																																	
1965	112	110	107	103	102																																																
1966	115	114	110	106	105	103																																														
1967	121	119	115	111	110	108	105																																												
1968	123	121	117	113	112	109	106	101																																											
1969	127	125	121	116	115	113	110	105	103																																											
1970	127	126	122	117	116	114	111	106	104	101																																										
1971	127	125	121	116	115	113	110	105	103	100	99																																								
1972	127	125	121	117	116	114	110	105	104	100	100	100																																							
1973	126	124	120	116	115	113	109	105	103	100	99	100	99																																						
1974	118	116	112	108	107	105	102	97	96	93	92	93	92	93																																					
1975	105	103	100	96	95	93	91	87	85	82	82	83	82	83	89																																				
1976	101	99	96	92	92	90	87	83	82	79	79	79	79	80	85	96																																			
1977	99	98	95	91	90	89	86	82	81	78	78	78	78	79	84	95	99																																		
1978	100	99	96	92	91	89	87	83	82	79	79	79	79	79	85	96	100	101																																	
1979	96	95	91	88	87	86	83	79	78	76	75	76	75	76	81	92	95	97	96																																	
1980	96	94	91	88	87	86	83	79	78	76	75	76	75	76	81	92	95	97	96	100																																
1981	97	95	92	89	88	86	84	80	79	76	76	76	76	76	82	92	96	97	96	101	101																														
1982	103	101	98	94	94	92	89	85	84	81	81	81	81	81	87	98	102	104	103	107	107	106																														
1983	107	105	102	98	97	96	93	89	87	84	84	84	84	85	91	102	106	108	107	112	112	111	104																													
1984	112	111	107	103	102	100	98	93	92	89	88	89	88	89	96	108	112	113	112	117	117	117	109	105																												
1985	118	116	112	108	107	105	102	98	96	93	92	93	93	93	100	113	117	119	118	123	123	122	115	110	105																											
1986	126	124	120	115	114	112	109	104	103	99	99	99	99	100	107	120	125	127	126	131	131	130	122	118	112	107																										
1987	133	131	127	122	121	119	115	110	108	105	104	105	105	105	113	127	132	134	133	139	139	138	129	124	118	113	106																									
1988	135	133	129	124	123	120	117	112	110	106	106	106	106	107	115	129	134	136	135	141	141	140	131	126	120	114	107	101																									
1989	138	137	132	127	126	124	120	115	113	109	109	109	109	110	118	132	138	140	138	144	145	144	135	130	123	117	110	104	103																									
1990	142	140	135	130	129	127	123	118	116	112	111	112	112	112	121	136	141	143	142	148	148	147	138	133	126	120	113	107	105	102																									
1991	149	146	142	136	135	133	129	123	121	117	116	117	117	118	126	142	148	150	148	155	155	154	145	139	132	126	118	112	110	107	105																									
1992	159	156	151	146	144	142	138	131	129	125	124	125	125	126	135	152	158	160	158	166	166	164	154	148	141	135	126	119	118	115	112	107																									
1993	162	160	155	149	148	145	141	134	132	128	127	128	127	128	138	155	161	163	162	169	169	168	158	152	144	137	129	122	120	117	114	109	102																									
1994	163	161	156	150	149	146	142	135	133	129	128	129	128	129	139	156	163	165	163	170	171	169	159	153	145	139	130	123	121	118	115	110	103	101																									
1995	164	162	157	151	150	147	143	136	134	130	129	130	129	130	140	157	164	166	164	172	172	170	160	154	146	139	131	124	122	119	116	111	104	101	101																									
1996	165	162	157	151	150	147	143	136	134	130	129	130	130	131	140	158	164	166	165	172	172	171	160	154	146	140	131	124	122	119	116	111	104	102	101	100																									
1997	164	162	156	150	149	146	142	136	134	129	129	129	129	130	139	157	163	165	164	171	171	171	170	160	153	146	139	130	123	122	118	115	110	103	101	100	100	99																								
1998	171	168	163	157	155	152	148	141	139	135	134	135	134	135	145	163	170	172	170	178	178	177	166	160	152	145	136	128	127	123	120	115	108	105	104	104	104	104																								
1999	176	174	168	162	161	157	153	146	144	139	138	139	139	140	150	169	175	178	176	184	184	183	172	165	157	150	140	133	131	127	124	119	111	109	108	107	107	108	103																								
2000	181	178	172	166	165	161	157	150	148	143	142	143	142	143	154	173	180	182	180	189	189	187	176	169	161	153	144	136	134	130	127	122	114	111	111	110	110	110	106	102																								
2001	188	185	179	173	171	168	163	156	153	148	147	148	148	149	160	180	187	189	188	196	196	195	183	176	167	159	150	141	139	136	132	127	118	116	115	114	114	115	110	107	104																								
2002	189	186	180	173	172	169	164	156	154	149	148	149	148	150	160	181	188	190	188	197	197	196	184	176	168	160	150	142	140	136	133	127	119	116	116	115	115	115	111	107	104	100																								
2003	190	187	181	174	173	169	164	157	155	150	149	150	149	150	161	181	189	191	189	198	198	197	185	177	169	161	151	143	141	137	134	128	120	117	116	115	115	116	111	108	105	101	101																								
2004	191	188	182	175	174	171	166	158	156	151	150	151	150	151	162	183	190	193	191	199	200	198	186	179	170	162	152	144	142	138	135	129	120	118	117	116	116	117	112	108	106	102	101	101																								
2005	194	192	185	178	177	174	168	161	159	153	152	154	153	154	165	186	193	196	194	203	203	201	189	182	173	165	155	146	144	140	137	131	122	120	119	118	118	119	114	110	108	103	103	102	102																								
2006	194	191	185	178	177	173	168	161	158	153	152	153	153	154	165	186	193	196	194	203	203	201	189	182	173	165	154	146	144	140	137	131	122	120	119	118	118	119	114	110	107	103	103	102	102	100																								
2007	195	193	187	180	178	175	170	162	160	154	153	154	154	155	166	187	194	197	195	204	204	203	190	183	174	166	156	147	145	141	138	132	123	121	120	119	119	119	115	111	108	104	104	103	102	101	101																								
2008	195	193	186	179	178	174	169	162	159	154	153	154	154	155	166	187	194	197	195	204	204	202	190	183	174	166	155	147	145	141	138	132	123	120	120	119	119	119	114	111	108	104	103	103	102	101	101	100																								
2009	191	189	182	176	174	171	166	158	156	151	150	151	150	152	163	183	190	193	191	200	200	198	186	179	170	162	152	144	142	138	135	129	121	118	117	116	116	117	112	108	106	102	101	101	100	98	98	98	98																								
2010	183	180	174	168	166	163	159	151	149	144	143	144	144	145	155	175	182	184	183	191	191	189	178	171	163	155	146	138	136	132	129	123	115	113	112	111	111	112	107	104	101	97	97	96	96	94	94	94	94	96																								
2011	175	172	167	161	159	156	152	145	143	138	137	138	137	139	149	167	174	176	175	182	183	181	170	163	155	148	139	132	130	126	123	118	110	108	107	106	106	107	102	99	97	93	93	92	92	90	90	89	90	91	96																								
2012	170	168	162	156	155	152	147	141	139	134	133	134	134	135	144	163	169	171	170	177	177	176	165	159	151	144	135	128	126	123	120	114	107	105	104	103	103	104	100	96	94	90	90	90	89	87	88	87	87	89	93	97																								
2013	166	164	158	152	151	148	144	137	135	131	130	131	130	131	141	159	165	167	166	173	173	172	161	155	147	141	132	125	123	120	117	112	105	102	102	101	101	101	97	94	92	88	88	87	87	85	85	85	85	87	91	95	98																								
2014	164	161	156	150	149	146	142	136	134	129	128	129	129	130	139	156	163	165	163	171	171	170	159	153	145	139	130	123	121	118	115	110	103	101	100	99	99	100	96	93	91	87	87	86	86	84	84	84	84	86	89	94	96	99																								

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have grown to £101 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £109 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2014 from the year shown below the figure.

Real return on index-linked gilts

Average Annual Real Rate of Return

GROSS INCOME RE-INVESTED

INVESTMENT TO END YEAR

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1983	(4.3)																															
1984	(1.2)	1.9																														
1985	(2.7)	(1.9)	(5.5)																													
1986	(1.5)	(0.5)	(1.7)	2.3																												
1987	(0.6)	0.4	(0.1)	2.7	3.1																											
1988	0.6	1.6	1.5	3.9	4.8	6.5																										
1989	1.4	2.3	2.4	4.5	5.3	6.4	6.3																									
1990	0.6	1.3	1.2	2.7	2.7	2.6	0.8	(4.5)																								
1991	0.6	1.3	1.2	2.3	2.3	2.2	0.7	(1.9)	0.7																							
1992	1.9	2.6	2.7	3.9	4.2	4.4	3.9	3.2	7.2	14.1																						
1993	3.3	4.1	4.4	5.7	6.2	6.7	6.8	6.9	11.0	16.5	18.9																					
1994	2.1	2.7	2.8	3.8	3.9	4.1	3.7	3.1	5.2	6.7	3.1	(10.5)																				
1995	2.6	3.2	3.3	4.2	4.4	4.6	4.3	4.0	5.8	7.1	4.9	(1.5)	8.5																			
1996	2.7	3.2	3.3	4.2	4.4	4.5	4.3	4.0	5.5	6.5	4.6	0.3	6.2	4.0																		
1997	3.1	3.7	3.8	4.6	4.8	5.0	4.8	4.7	6.0	7.0	5.6	2.5	7.3	6.7	9.4																	
1998	3.9	4.5	4.7	5.5	5.8	6.1	6.0	6.0	7.4	8.3	7.4	5.3	9.6	10.0	13.2	17.1																
1999	3.9	4.4	4.6	5.4	5.6	5.8	5.7	5.7	6.9	7.7	6.8	4.9	8.3	8.3	9.7	9.9	3.2															
2000	3.7	4.2	4.3	5.0	5.2	5.4	5.3	5.2	6.2	6.8	5.9	4.2	6.9	6.6	7.2	6.5	1.6	0.1														
2001	3.4	3.8	4.0	4.6	4.7	4.8	4.7	4.6	5.5	5.9	5.1	3.5	5.6	5.2	5.4	4.4	0.5	(0.7)	(1.6)													
2002	3.5	3.9	4.0	4.6	4.7	4.9	4.7	4.6	5.4	5.9	5.1	3.6	5.6	5.2	5.4	4.6	1.7	1.2	1.7	5.1												
2003	3.5	3.9	4.0	4.6	4.7	4.8	4.7	4.6	5.3	5.7	5.0	3.7	5.4	5.0	5.1	4.4	2.1	1.8	2.4	4.5	3.9											
2004	3.6	4.0	4.1	4.6	4.7	4.8	4.7	4.6	5.3	5.6	5.0	3.8	5.3	5.0	5.1	4.5	2.6	2.4	3.0	4.6	4.4	4.9										
2005	3.7	4.1	4.2	4.7	4.8	4.9	4.8	4.7	5.4	5.7	5.1	4.0	5.5	5.2	5.3	4.8	3.2	3.2	3.8	5.2	5.2	5.8	6.7									
2006	3.5	3.8	3.9	4.4	4.5	4.5	4.4	4.3	4.9	5.2	4.6	3.5	4.8	4.5	4.5	4.0	2.5	2.4	2.8	3.7	3.3	3.1	2.2	(2.1)								
2007	3.4	3.7	3.8	4.2	4.3	4.4	4.3	4.2	4.7	4.9	4.4	3.4	4.5	4.2	4.3	3.7	2.4	2.3	2.6	3.3	2.9	2.7	2.0	(0.3)	1.4							
2008	3.2	3.5	3.5	3.9	4.0	4.1	3.9	3.8	4.3	4.5	3.9	3.0	4.1	3.7	3.7	3.2	1.9	1.8	2.0	2.5	2.1	1.7	0.9	(0.9)	(0.4)	(2.1)						
2009	3.2	3.4	3.5	3.9	4.0	4.0	3.9	3.8	4.2	4.4	3.9	3.0	4.0	3.7	3.7	3.2	2.0	1.9	2.1	2.6	2.2	2.0	1.4	0.1	0.8	0.5	3.1					
2010	3.2	3.5	3.6	4.0	4.0	4.1	4.0	3.9	4.3	4.5	4.0	3.2	4.1	3.8	3.8	3.4	2.3	2.2	2.4	2.9	2.6	2.4	2.0	1.1	1.9	2.1	4.2	5.3				
2011	3.6	3.9	4.0	4.3	4.4	4.5	4.4	4.3	4.8	5.0	4.5	3.8	4.7	4.4	4.5	4.1	3.2	3.2	3.5	4.0	3.9	3.9	3.7	3.2	4.3	5.0	7.5	9.8	14.4			
2012	3.5	3.8	3.8	4.2	4.3	4.3	4.2	4.1	4.5	4.7	4.3	3.6	4.4	4.2	4.2	3.8	3.0	2.9	3.2	3.6	3.5	3.4	3.3	2.8	3.6	4.0	5.6	6.5	7.1	0.2		
2013	3.2	3.5	3.5	3.9	3.9	4.0	3.9	3.8	4.2	4.3	3.9	3.2	4.0	3.7	3.7	3.3	2.5	2.4	2.6	3.0	2.8	2.7	2.4	1.9	2.5	2.7	3.7	3.8	3.3	(1.8)	(3.9)	
2014	3.6	3.8	3.9	4.2	4.3	4.3	4.3	4.2	4.6	4.7	4.3	3.7	4.4	4.2	4.2	3.9	3.2	3.2	3.4	3.8	3.7	3.7	3.5	3.2	3.9	4.2	5.3	5.8	5.9	3.2	4.7	14.0

Real Value of £100 Invested

GROSS INCOME RE-INVESTED

INVESTMENT TO END YEAR

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1983	96																															
1984	98	102																														
1985	92	96	94																													
1986	94	98	97	102																												
1987	97	102	100	105	103																											
1988	103	108	106	112	110	106																										
1989	110	115	113	119	117	113	106																									
1990	105	110	108	114	111	108	102	95																								
1991	106	111	108	115	112	109	102	96	101																							
1992	121	126	124	131	128	124	117	110	115	114																						
1993	144	150	147	156	152	148	139	130	137	136	119																					
1994	128	134	132	139	136	132	124	117	122	121	106	89																				
1995	139	146	143	151	148	143	135	127	133	132	115	97	108																			
1996	145	151	148	157	154	149	140	132	138	137	120	101	113	104																		
1997	158	166	162	172	168	163	153	144	151	150	131	110	123	114	109																	
1998	186	194	190	201	197	191	179	169	177	175	154	129	144	133	128	117																
1999	191	200	196	208	203	197	185	174	182	181	158	133	149	137	132	121	103															
2000	192	200	196	208	203	197	185	174	182	181	159	133	149	138	132	121	103	100														
2001	189	197	193	205	200	194	182	171	179	178	156	131	147	135	130	119	102	99	98													
2002	198	207	203	215	210	204	191	180	189	187	164	138	154	142	137	125	107	104	103	105												
2003	206	215	211	223	218	212	199	187	196	194	170	143	160	148	142	130	111	108	107	109	104											
2004	216	226	221	234	229	222	209	196	206	204	179	150	168	155	149	136	116	113	113	115	109	105										
2005	231	241	236	250	244	237	223	210	219	218	191	161	179	165	159	145	124	120	120	122	116	112	107									
2006	226	236	231	245	239	232	218	205	215	213	187	157	176	162	156	142	122	118	118	120	114	110	105	98								
2007	229	239	235	248	243	236	221	208	218	216	190	160	178	164	158	144	123	120	119	121	116	111	106	99	101							
2008	224	234	230	243	238	231	217	204	213	212	186	156	175	161	155	141	121	117	117	119	113	109	104	97	99	98						
2009	231	241	237	251	245	238	223	210	220	218	191	161	180	166	160	146	125	121	121	123	117	112	107	100	102	101	103					
2010	243	254	249	264	258	250	235	221	232	230	202	170	190	175	168	154	131	127	127	129	123	118	113	106	108	106	109	105				
2011	278	291	285	302	295	287	269	253	265	263	231	194	217	200	192	176	150	146	145	148	141	135	129	121	123	122	124	121	114			
2012	279	292	286	303	296	287	270	254	266	264	231	194	217	200	193	176	150	146	146	148	141	136	129	121	124	122	124	121	115	100		
2013	268	280	275	291	285	276	259	244	255	254	222	187	209	193	185	169	145	140	140	142	135	130	124	116	119	117	120	116	110	96	96	
2014	306	320	314	332	324	315	296	278	291	289	253	213	238	220	211	193	165	160	160	162	154	149	142	133	136	134	136	132	126	110	110	114

Analyst Certification
We, Michael Gavin, Keith Parker, Tal Shapsa, Guillermo Felices, Krishna Goradia, Jim McCormick, Michael Gapen, Joseph Abate, Eric Gross, Jeffrey Meli, Brian Monteleone, Conor Pigott, Hamish Pepper, Nikolaos Sgouropoulos, Sreekala Kochugovindan and Siddhartha Sanyal, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

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