3 March 2016

Equity Gilt Study 2016

“Thus inflation is unjust and deflation is inexpedient”
John Maynard Keynes

“One of the greatest pains to human nature is the pain of a new idea”
Walter Bagehot

“All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident”
Arthur Schopenhauer

“The best way out is always through”
Robert Frost

“When you come out of the storm, you won’t be the same person who walked in”
Haruki Murakami

“Good judgment comes from experience, and a lot of that comes from bad judgment”
Will Rogers

FOREWORD

Equity Gilt Study 61st Edition

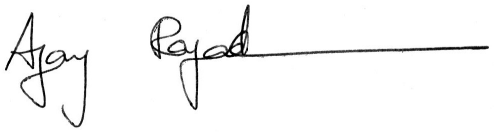
Over the past eight years, global central banks have progressively eased policy, including through unconventional means. The Fed led the way, followed by the Bank of England, and then the Bank of Japan and the European Central Bank. In the initial years, worries centered on whether ultra-easy policy would eventually lead to ultra-high inflation. But in the past few years, there has been a remarkable turn-around. The concern now is that central banks will not be able to boost inflation and nominal growth, no matter what they do. After all, if the current level of unprecedented policy easing has not worked, what will?

Signs of skepticism – about central banks' ability to generate inflation – abound. Medium-term inflation expectations in Japan are close to zero, and are near record lows in Europe and the US. The US fed funds curve is pricing in about two rate hikes by end-2017, well below the Fed's median forecast. And the Bank of Japan's recent negative rate move has been met by a sharp strengthening of the yen – the exact opposite of the hoped-for response.

Barclays' *Equity Gilt Study* provides in-depth analysis of the most topical macro issues, with a medium to long-term horizon. Perhaps no other economic issue is now as important as central bankers' battle to create inflation, and the new tools they are trying to achieve their goal. This is a common theme running through most of this year's publication. Chapter 1 argues that much of the decline in individual countries' domestic inflation has been the result of global factors, including global labor markets. Although policy makers have not yet lost control of inflation developments, easy monetary policies are likely to be around for a long time. Some of these will be radical, including using negative rates to challenge the zero lower bound.

The US is the one major economy where the central bank has felt confident enough to start a hiking cycle. But even in the US, a structural shift has lowered trend growth and the natural rate of interest (r*), as we discuss in Chapter 2. Our framework suggests that US monetary policy is closer to neutral than commonly thought. We expect Fed hikes to proceed very slowly and over many years, in line with a slow rise in r*. For other developed economies struggling with disinflation, negative nominal interest rates are likely to persist. But, as we discuss in Chapter 3, this policy has its own frictions, including the long-term nominal commitments of pensions and insurers, an aversion to nominal losses, and currency as an alternative. But well-designed tiering of negative rates could work around some of these frictions and provide avenues for easing. Finally, in Chapter 4, we explore linkages between population dynamics and global imbalances. In our view, demographic developments imply that China and Europe will remain capital exporters over the next 10-15 years, while the US and UK should remain net capital importers.

The *Equity Gilt Study* has been published continually since 1956, providing data, analysis and commentary on long-term asset returns in the UK and the US. In addition to the macro discussions, this publication contains a uniquely deep and consistent database: the UK data go back to 1899 and the US data, provided by the Center for Research in Security Prices at the University of Chicago, begin in 1925. We hope that this year's effort lives up to the publication's rich history and provides you, our readers and clients, with useful inputs into your long-term investing decisions.



Ajay Rajadhyaksha
Head of Macro Research

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It was a disappointing year for UK assets across the board as real total returns were negative for equities and fixed income products. UK equities underperformed many other developed market indices in 2015. UK nominal price returns were -2.5%, compared with +6.8% for the Eurostoxx 600 and 9.9% for the TOPIX. Much of the performance drag on UK equities was driven by the exposure to oil and mining related sectors, which declined about 20% and 50%, respectively. Fixed income and credit both reported negative real total returns in 2015, in sharp contrast to strong performances in 2014.

Chapter 6

US asset returns since 1925 **63**

Real total returns were just -2.4% in 2015, in contrast to 9.7% the prior year. US 2015 growth expectations were steadily downgraded over the year. Global shocks, such as the China yuan depreciation, actually hit European equities harder initially given the greater exposure to Asian trade. However, European equities still managed to outperform US and UK over the year as the ECB's announcement of QE in January provided European stocks with a headstart. Fixed income markets followed the trends in the UK: nominal bond real returns collapsed from 23% in 2014 to -1.2% in 2015, while inflation-linked bonds were the worst-performing asset in the US as well as the UK.

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We calculate 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.

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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.

CHAPTER 1

The fight to bring back inflation

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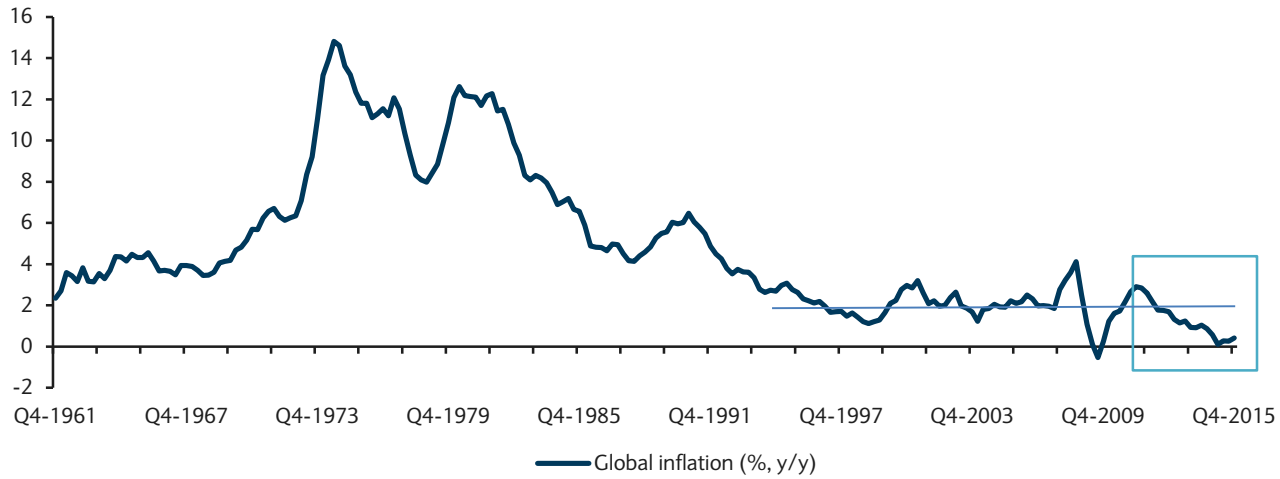
- **Inflation has declined across the globe since the 1980s. Changes in monetary policy regimes, combined with technological progress and globalization (including China's integration into the world economy), have driven this process. However, the blessing of lower inflation seems to have turned into a curse in recent years, as inflation has declined below official targets in many countries, leaving central banks struggling to bring it back up.**
- **Our econometric analysis suggests that more than two-thirds of countries' domestic inflation is determined by a 'common global' factor. We find the trend component of global inflation to have shifted lower since the global financial and euro area crises. According to our analysis, this has been driven by labour market factors, suggesting these have become the most relevant concept for economic slack. Our findings also suggest that policy decisions by core central banks spill over into the global inflation trend (eg, the premature ECB hikes in 2011).**
- **For monetary policy, this does not mean that policymakers have entirely 'lost control' of their domestic inflation developments; however, the apparent global downward trend in inflation implies the need for an aggressive and persistent policy response, which in the current circumstances could also mean challenging the zero lower bound. Spill-over effects suggest that policymakers must take into account policies elsewhere, and, ideally, should coordinate their responses.**
- **The implications for investors are mixed: Although our findings suggest monetary accommodation is here to stay, policies such as negative interest rates could further complicate the investment landscape. Indeed, while such radical policies seem justified from an inflation-targeting perspective, they do also create financial stability risks, which, if materialized, could again be disinflationary. This leaves central bankers in a bind and suggests that: 1) financial volatility is likely to remain high; and 2) once global inflation eventually does turn, the unwinding of increasingly aggressive policies could be a challenge.**

FIGURE 1
After successful disinflation, followed by stabilization around 'target', inflation globally has fallen



Note: CPI inflation of 22 OECD member countries, available from 1961 Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and US. Source: OECD, Barclays Research

The need to understand 'Missingflation'

From decades of welcome global disinflation to recent fears of deflation

Inflation has slowed in recent years, in advanced economies and, with some notable exceptions, in many EM ones. It has remained persistently below official inflation targets; in some countries, it is close to or already in deflation territory. The global decline in inflation is not entirely new: the disinflation process in advanced economies started in the 1980s, followed by most EM economies in the 1990s and continuing into the 2000s. This was a welcome development after previous periods of high and volatile inflation. However, the further drop in recent years to below-target or even deflationary levels, and the apparent inability of policymakers to affect inflation trends meaningfully in their economies, has become a major source of concern.

The oil price collapse cannot explain it all

Large swings in commodity prices have certainly played a role in recent changes in headline inflation. However, although these are difficult to predict (eg, the recent collapse in oil prices), their (transitory) effects on inflation are generally well understood. But other factors seem to be at work as well: evidence is mounting that inflation has been changing over the past two decades against a backdrop of globalisation and technological progress. This has given global factors increased relevance relative to domestic factors and made the effects of cyclical and secular factors on domestic inflation more uncertain.

As a consequence, monetary policy has become more complex. With today's policy frameworks being tightly defined around domestic inflation targets, central banks have to try to bring inflation rates back to target within relatively short time horizons. One response by policymakers has been to employ more radical, ie, unconventional, instruments – starting with QE programs and, more recently, moving to increasingly negative policy rates. In parallel, academics have begun to question the inflation-targeting regimes that have come to prevail in most countries. Suggestions range from mere changes in the target levels to shifting to new regimes that try to target price levels or nominal GDP.

Monetary policy frameworks are fundamentally challenged

How relevant such considerations will become in practice and how much further unconventional policies, including negative interest rates, will be explored will depend heavily on whether inflation can be expected to stay 'missing' or whether the current 'lowflation' environment will prove temporary. The latter, for example, could be true if the recent global inflation decline could be safely described as an oil price-driven phenomenon, the effect of which should fade in the coming quarters. If, however, other global secular trends were at play and these looked likely to be sustained for years to come, the outlook could become even more challenging for policymakers.

Following earlier pieces by our research team on this subject (*How global is inflation?* June 2014; *Twilight of inflation stability?* May 2015), this paper will provide an overview of global inflation developments in recent decades and their drivers. In particular, we examine whether inflation is being driven by common global factors that represent trends, rather than just cyclical phenomena. Given these findings, we discuss some of the potential policy responses, including negative nominal policy rates, which are covered in depth in Chapter 3, "Negative Ascent: Life amid negative nominal interest rates".

Inflation's history and its explanations

Inflation since the 1960s – some stylized facts

Successful disinflation since the 1980s was helped by monetary policy and globalization

Global inflation measures over the past 50-60 years are broadly characterized by two trends. First is a surge in inflation from the early 1960s until the late 1970s, associated with two oil price shocks, a decline in OECD productivity, and prolonged periods of overly accommodative policy across most economies. Second is a decline in inflation since the early 1980s, coinciding with a tightening of the monetary policy stance across advanced economies (followed by emerging markets in the 1990s), an acceleration in globalization since the 1990s (accentuated by the growing influence of China in the 2000s) and about half a dozen cycles along the way, including the global recessions of 1975, 1982, 1991 and 2009.

No more comfort from low and stable inflation in recent years

This global disinflation was a positive development: it meant that it had become possible to achieve official inflation targets – typically 2% for advanced economies – with more accommodative monetary policies; ie, implying a reduced growth-inflation trade-off. With the exception of Japan, a persistent undershooting of inflation targets, or even deflation, seemed no threat. This has changed since the global financial crisis (GFC) of 2008-09. A chart of global headline inflation (Figure 2) suggests that for the past 4-5 years, global disinflation may have entered a new, less benign phase: where inflation below 2%, or even deflation, could become the norm, with all the potentially adverse effects on investment and growth associated with that.

During the disinflationary period of the past three decades, a number of developments have been observed and extensively discussed in the literature[1]:

(i) shocks to inflation have become less persistent;

(ii) pass-through effects from exchange rate changes, as well as exogenous food or energy price shocks, have fallen;

(iii) inflation expectations have shifted down;

(iv) Phillips curves flattened, at least in the short run (ie, a reduced trade-off between unemployment and inflation); and

(v) global rather than local measures of 'slack' have started to play a greater role in explaining domestic inflation developments.

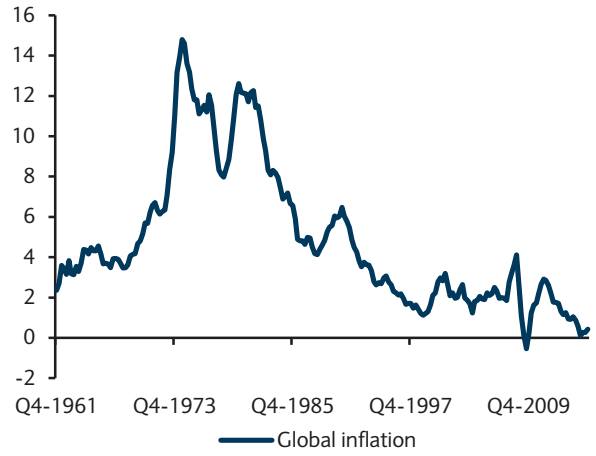
In light of the developments since the GFC, research has also emphasized that[2]:

(vi) global financial shocks have had a greater effect on domestic conditions.

The literature is not entirely conclusive on all of these points, particularly regarding Phillips curves, the role of global measures of slack, or the precise effect of the financial shocks. This is perhaps not surprising, given the empirical challenges such work faces: the data series for some of the more recent developments are still relatively short; more generally, the underlying theories often rely on non-observable variables, such as output gaps, which are difficult to construct on a domestic level and even more so as a global aggregate. However, the research on inflation developments in recent years has lent increasing support to the notion that global factors are gaining more relevance vis-à-vis country-specific factors. Before using our own econometric model to analyze this further – in particular for the post-GFC period – in the next section we set out the explanations that have been put forward with regard to the disinflation that occurred before 2008 (and which we think are relevant today).

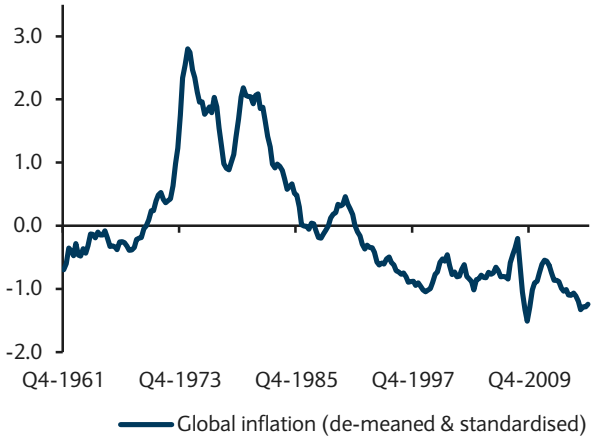
[1] Helbig et al. in IMF WEO 2006, Bean (2006), Borio and Filardo (2007), White (2008), BIS (2015).
[2] Stock and Watson (2012)

FIGURE 2
Inflation has been trending down for decades…



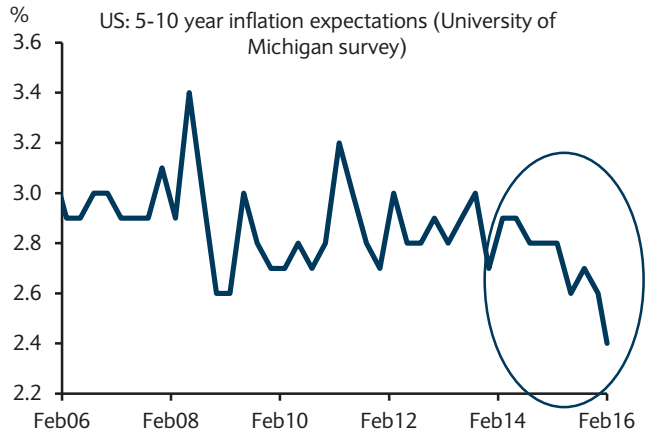
Source: Barclays Research

FIGURE 3
… but in recent years it has fallen below desired levels



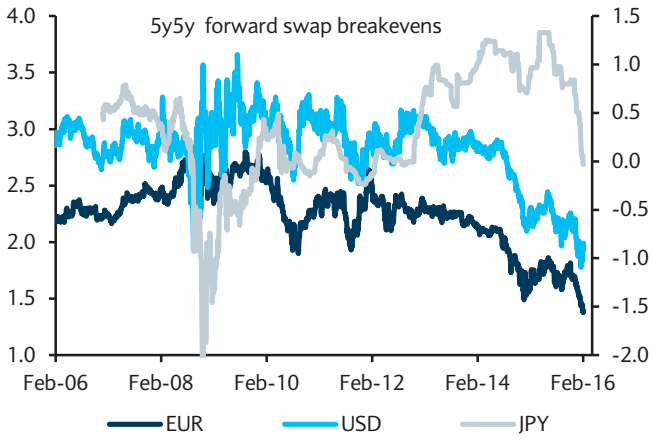
Source: Barclays Research

FIGURE 4
Inflation expectations have dropped in surveys…



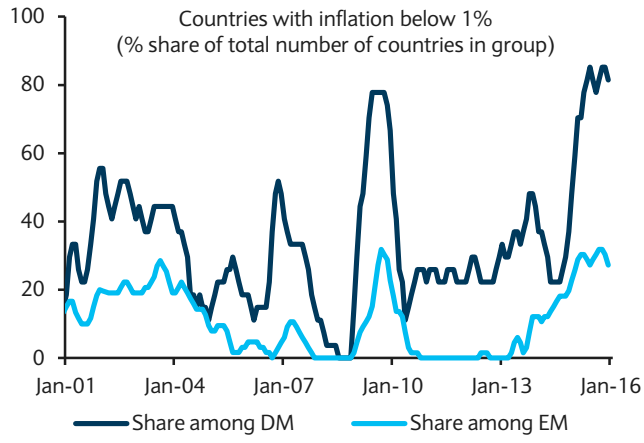
Source: Barclays Research

FIGURE 5
… as well as in market measures



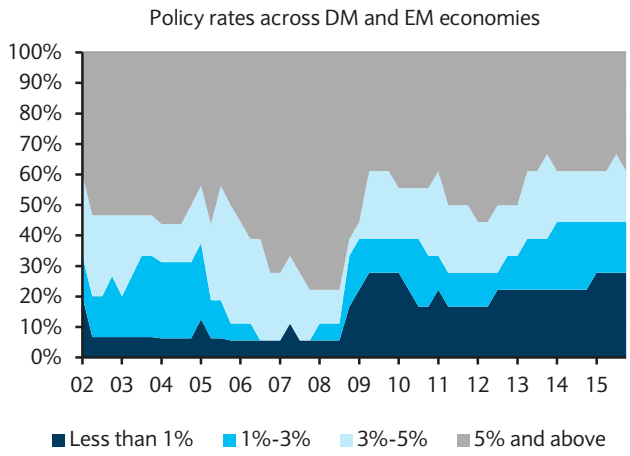
Source: Barclays Research

FIGURE 6
Inflation is now very low in developed and EM economies…



Source: Barclays Research

FIGURE 7
… leading to very low policy rates across economies



Source: Barclays Research

Explaining inflation's global downward trend

Better monetary policies

Early disinflation success was the result of monetary tightening and inflation-targeting regimes

The high inflation of the 1970s coincided with prolonged periods of quite diverse but generally overly accommodative monetary policy across advanced economies. This ultimately led to a strong resolve in the 1980s to bring down inflation through much tighter monetary policies and a general convergence to 'monetarism' (ie, nominal targets). This was succeeded by the widespread introduction of inflation targeting (IT) regimes during the 1990s. Among other things, IT cemented the principles of central bank independence and flexible exchange rates, while also emphasizing the responsibility of central banks to communicate publicly inflation developments and their response to them. These important shifts in monetary policies across countries helped to anchor inflation expectations around official inflation targets, thereby influencing price-and contract-setting behavior.

Liberalization of domestic policies

Increased competition, as domestic policies liberalized markets…

In parallel, there was widespread deregulation of product and factor markets (eg, labor markets in Europe) and privatization of utilities, transportation and telecommunications. Liberalization of labor markets (while inflation expectations stabilized) made the indexation of wages to inflation much less prevalent than it was in the 1970s, contributing to the reduction of inflation persistence. Furthermore, increased competition and advances in productivity put increased pressure on retail and wholesale trade. In turn, this price pressure was passed on to suppliers, making them seek productivity improvements all the way down the value chain, exploring newly available technologies, etc.

Globalization and technological progress

… technology advanced, and global product and factor markets integrated

These domestic developments were paralleled by an increase in global trade and capital flows. Indeed, the intensified international competition may have forced some domestic developments, such as deregulation and privatizations, and possibly even the adoption of more successful monetary policies. Hence, it may be difficult to distinguish truly domestic reforms from those changes that were part of globalization. Similarly, it may not always be possible to separate the effects of globalization from those associated with technology, as it is often the combination of new technologies and reduced barriers to international flows of goods and capital that create intensified competition. In particular, advances in communications technology greatly facilitated the relocation of production and the creation of complex production systems across geographies, with multi-layered international sourcing networks. Indeed, global value chains (GVCs) often cover the full range of activities from a product's conception, through its design, its sourced raw materials and intermediate inputs, its marketing, its distribution and its support to the final consumer.

As a consequence, the inflation process also became globalized

The changes stemming from globalization and technology have manifested themselves in changing wage trends in recent decades. Increased labour competition initially came from the greater integration of low-cost emerging market economies (including formerly state-controlled CEE economies and, notably, China) into the global trading system. The competition then spread and intensified as global integration strengthened and, in part as a result of new technologies, the range of goods and services that could be traded internationally widened. More generally, technological advances allowed the direct substitution of capital for labour, as computers, software and robotics automated previously manual processes. The emergence of cheaper competitors has made labour and product markets much more contestable. Accordingly, the pricing power of the more expensive producers and the bargaining power of labour have been reduced. This also explains in part why labour's share of national income in advanced economies has declined steadily in recent decades and why wage trends seem more correlated across countries.

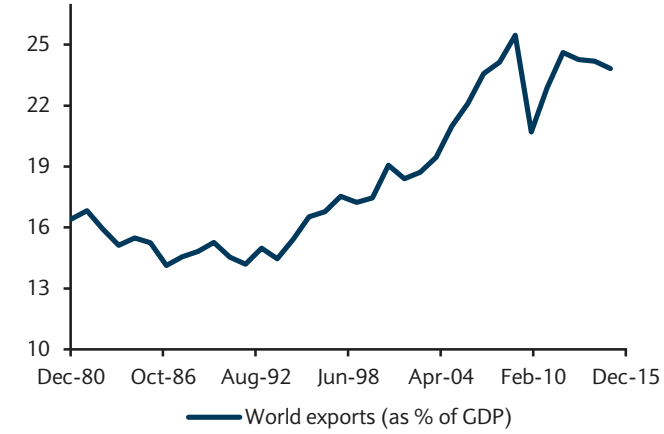
In sum, the combination of globalisation and technological change has contributed to persistent disinflationary tailwinds, even if each effect might not always be easy to measure or separate. Conceptually, these developments also mean that inflation should be approached more as a global than a country-specific phenomenon. This is because:

- goods produced in different countries have become closer substitutes; and
- factor input markets – labour and capital – have become closely integrated.

Thus, domestic factors would provide an incomplete picture of the inflation process in a country, as the link with country-specific/domestic demand – either excess or absence – becomes less relevant for a country's price inflation. Rather, it is the global demand for products that influences their price. By the same token, domestic wages and their relation to domestic prices also become more dependent on labour supply conditions globally. As a corollary, import prices no longer fully capture external influences on domestic inflation.

FIGURE 8

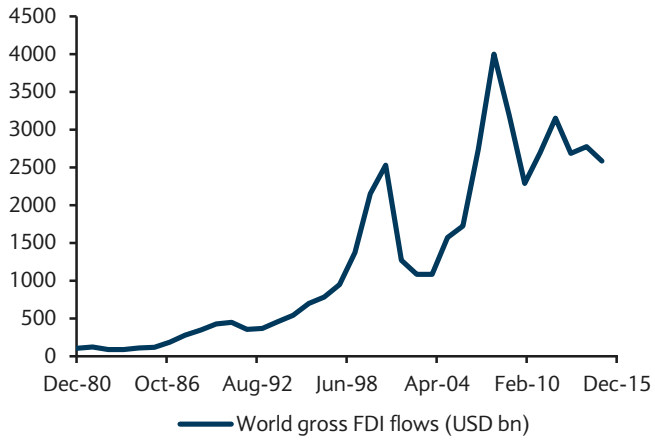
While inflation moderated, global trade surged…



Source: IMF, Barclays Research

FIGURE 9

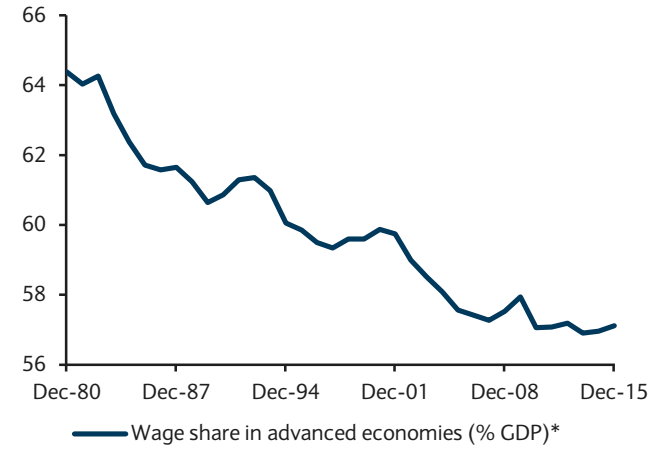
…as did cross-border capital flows



Source: IMF, Barclays Research

FIGURE 10

The share of labor in output fell…



Source: OECD, UN, Barclays Research; *9 countries: Germany, France, Italy, Japan, Australia, Canada, UK, US

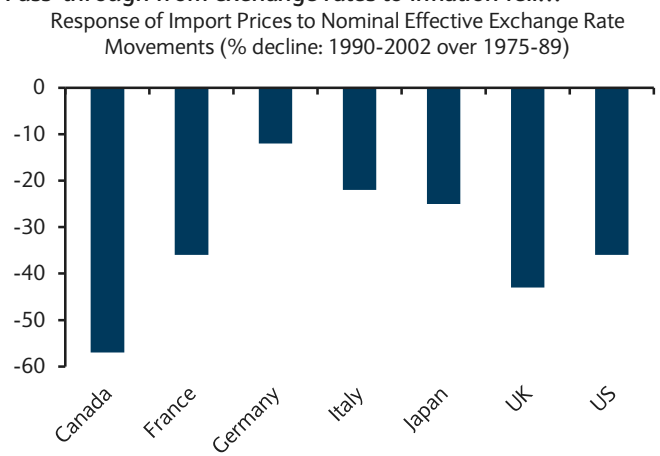
FIGURE 11

… and labor markets became more integrated

Source: BIS (2015), Barclays Research

FIGURE 12

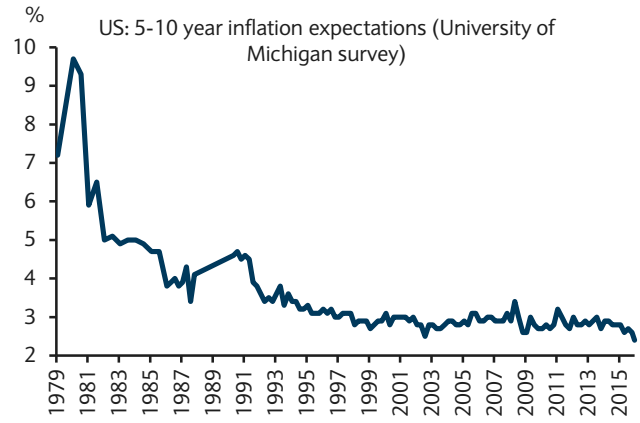
Pass-through from exchange rates to inflation fell…



Source: IMF (2006), Barclays Research

FIGURE 13

.. and inflation expectations fell and then stabilized



Source: Bloomberg, Barclays Research

China's supply and demand effects on global inflation

Although China can, in principle, be regarded as part of the globalization argument, its size and effect on global developments, including on inflation, warrants separate treatment, in our view.

China's integration into the global economy implied immense supply and demand shocks

China's integration into the global economy has affected the world on both the supply and the demand side: China amply supplied labour at low wages, and in many labor-intensive segments, it has achieved a leading market position (even if, more recently, it has started to shift out of them as part of its transition from export- and investment-driven growth toward consumption-led growth). Shifting resources across and within sectors also led to a surge in China's manufacturing productivity. During the 2000s, it became a major (and often dominant) importer of commodities. And with incomes on the rise, China's appetite for capital and consumer goods produced abroad has also expanded rapidly.

These supply- and demand-side effects also affected other countries' inflation rates and contributed to the observed stronger co-movement of inflation worldwide:

- Supply effects: China's low-cost production created downward pressure on import prices and profit margins abroad (as a consequence of competitive pressures), implying disinflationary effects globally.
- Demand effects: China's rising demand, particularly for commodities, affected foreign prices through rising export and commodity prices, implying inflationary effects globally.

Deflationary supply side effects dominated the earlier phase…

Research on these effects seems to reflect the different stages in China's development. Earlier studies based on 1993-2002 data suggest supply effects dominated during this period, with China exports contributing to global disinflation.[3] Later studies, using 2002-11 data, find that both Chinese supply and demand shocks significantly affected prices in other countries through direct channels (ie, import and export prices) and indirect ones (ie, exposure to foreign competition and commodity prices), but that the demand shocks mattered more.[4] Given the China-driven global commodity price boom of 2002-11, this result does not surprise us.

…while inflationary effects from strong (commodity) demand dominated in the years up to 2011

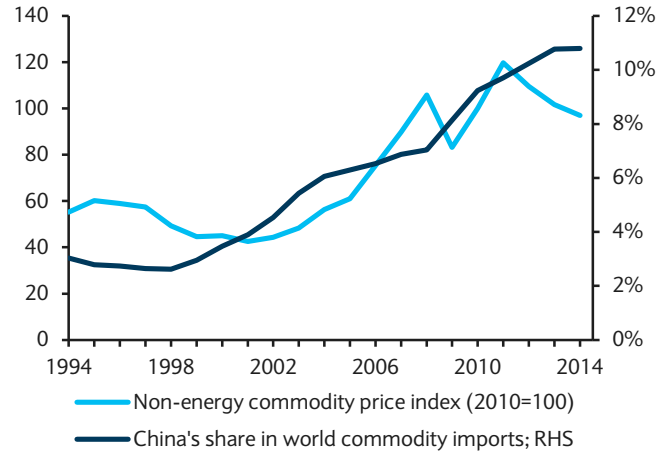
But things have changed significantly since 2011: China's marked growth slowdown since then and the collapse in commodity prices suggest the demand shock has reversed, with China now contributing to global disinflation. A successful transition by China toward a consumer- and service-sector-driven growth model, implying a lower savings rate, should eventually lead to increased Chinese demand for non-commodity imports. Similarly, as it moves past its 'Lewis turning point' and wages rise further, the disinflationary supply-side effects should also fade. However, while such changes could eventually turn China into a global inflationary force, the interim looks quite different: its permanently reduced demand for commodities (after having previously spurred investments in the expansion of commodity supply), its large overcapacity in 'old' industries (eg, steel), and demand-dampening effects from the large debt accumulation of recent years all suggest that China will exert deflationary effects on the world for some time.

Since then, China has become a global disinflationary force

[3] S Kamin, M. Narazzi, J. Schindler: Is China "Exporting Deflation"?, International Finance Discussion Papers, Board of Governors of the Federal Reserve System, No 791, Jan 2004.
[4] Eickmeier and Kühnlenz: China's role in global inflation dynamics; Discussion paper, Deutsche Bundesbank No 07/2013.

FIGURE 14

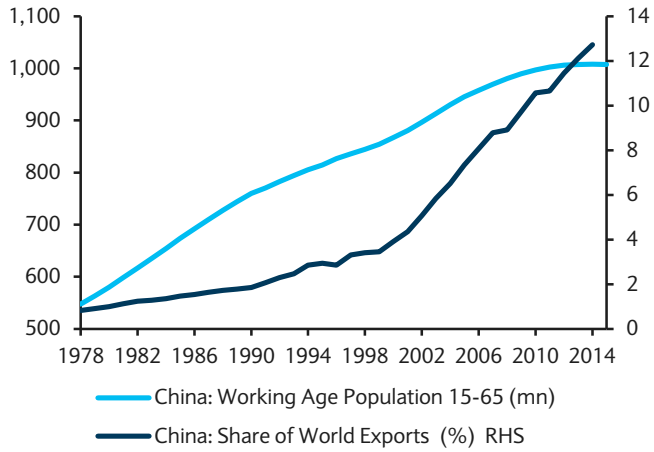
China's integration into the global economy was a mainly disinflationary supply shock until the early 2000s…



Source: IMF, UN, Barclays Research

FIGURE 15

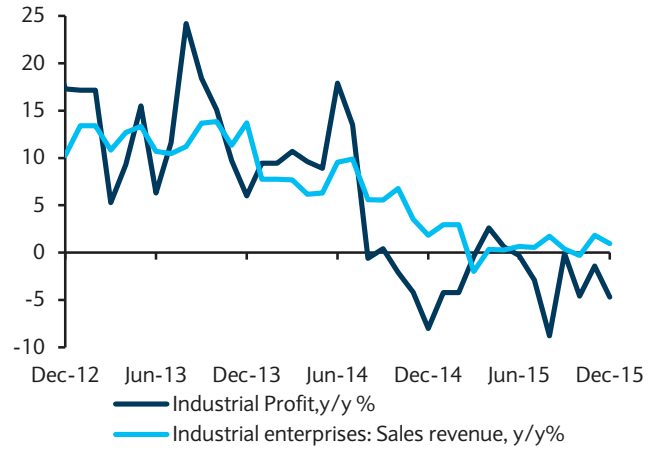
… after which its rising demand for commodities created global inflationary effects – until the recent price collapse…



Source: UNComtrade, World Bank, Barclays Research

FIGURE 16

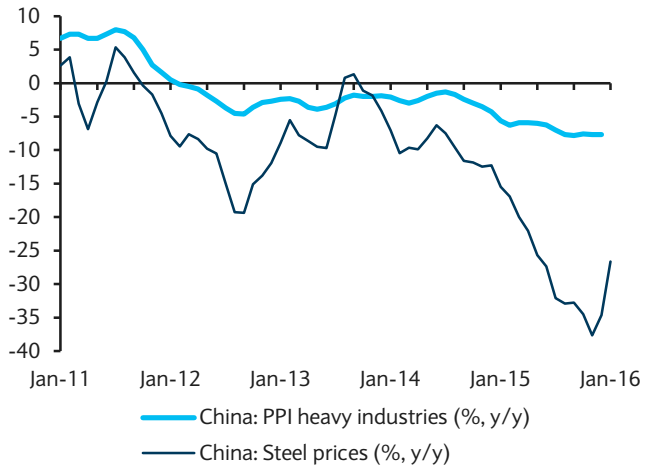
... which, combined with China's industrial overcapacity,…



Source: Haver Analytics, Barclays Research

FIGURE 17

…now adds to global deflationary pressures



Source: Haver Analytics, Barclays Research

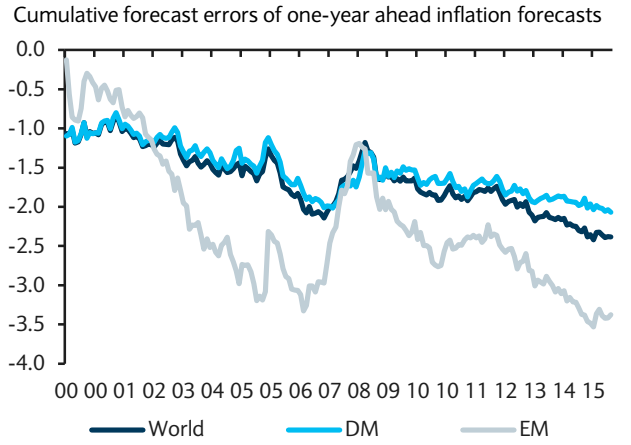
Exploring global trend (dis)inflation

Inflation models have largely continued to focus on domestic variables…

…and have performed poorly in recent years

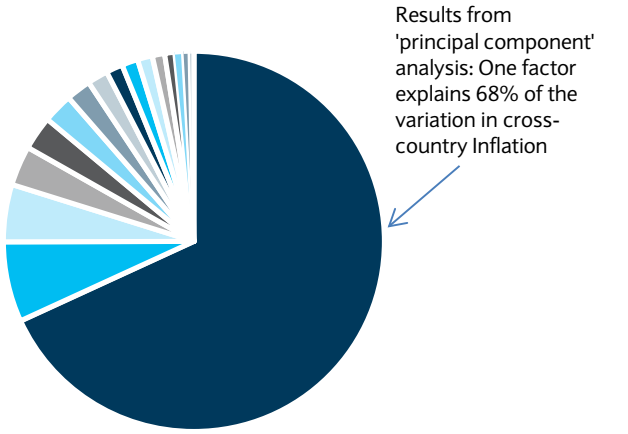
Although the arguments so far suggest that inflation has become a more global phenomenon over the past decades, inflation modelling generally does not seem to incorporate this idea very much: models are still built around frameworks focused on domestic cost pressures, the domestic output gap and domestic inflation expectations as the key determinants of (cyclical core) CPI inflation. Indeed, as inflation-targeting frameworks anchored inflation expectations around target in most advanced economies, the assumption was that the output gap and domestic cost pressures should have strong predictive power with regard to the cyclical component of inflation. However, inflation forecasts based on this framework have not performed well in recent years, systematically over-predicting inflation outturns (Figure 18). This common failure across countries suggests that common trend factors, as opposed to domestic cyclical factors, have been driving the inflation process – something we aim to test below.

FIGURE 18
Inflation outcomes have been systematically over-predicted



Source: Barclays Research

FIGURE 19
One 'common factor' weighs heavily on the inflation process



Source: Barclays Research

Testing for common global factors

The significance of global factors in countries' inflation developments can be tested through econometric techniques, such as principal component analysis and the Kalman filter (see Appendix). Although the components/factors these techniques produce are 'latent' and, hence, devoid of a specific economic meaning, they allow the following interpretations: 1) the country-specific component should reflect the domestic determinants of inflation, such as the output gap and domestic inflation expectations; and 2) the common factor should account for any global influences on inflation.

A common global factor explains more than two-thirds of a country's inflation…

Following earlier work in the literature, we perform a simple extraction of the *principal component* from core CPI inflation for 16 OECD countries since 1976.[5] Comparable to earlier findings, our results suggest that one common component explains 68% of the variation in the data (Figure 19); in other words, a single common factor explains over two-thirds of domestic core CPI inflation and helps to forecast these inflation outcomes. We must add that this very strong degree of co-movement (ie, high % for the common factor) is likely also to reflect the convergence of monetary policy frameworks and strategies across countries: ie, various central banks are responding in the same way to the same underlying common shocks, which in the strict sense is not a global factor as such, but rather a common component. However, the very high share explained by the common factor strongly suggests global shocks play a significant role in the process that determines domestic inflation – contrasting the notion of a process dominated by domestic factors.

Global cycle versus global trend

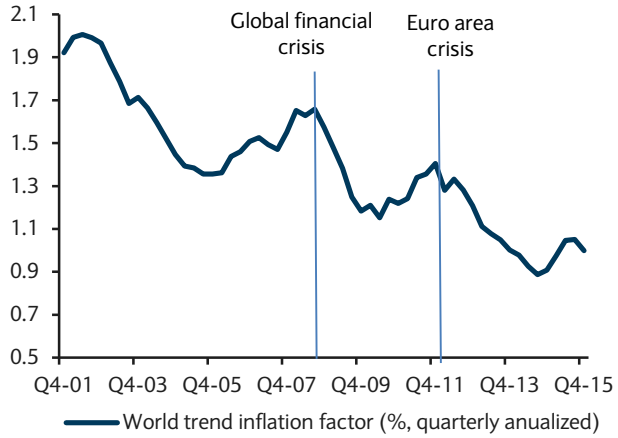
Having demonstrated that global inflation drivers are at work, the question arises whether they are cyclical or represent a trend. This is quite relevant: in principle, central banks can react to shocks – even if they are global – by aggressively loosening or tightening policy to maintain a domestic inflation target. However, this would be easier if such global shocks were cyclical. Leaning against a global trend could require not only aggressive but also persistent easing (or tightening) by central banks – not something the typically cautious central banks are prone to do. For example, the significant rise in US trend inflation[6] in the 1970s was a formidable challenge for the Fed under Paul Volcker, even if successful in the end. Leaning against global trend (dis)inflation could prove to be an even bigger challenge for central banks.

[5] M Ciccarelli and B Mojon, 2010, 'Global Inflation', The Review of Economics and Statistics, vol 92(3), pages 524-535.
[6] G Ascari and A Sbordone, 2014, "The Macroeconomics of Trend Inflation", Journal of Economic Literature, vol 52 (3), pages 679-739.

FIGURE 20
The global trend inflation factor has continued to fall…

Source: Barclays Research

FIGURE 21
…with two further 'breaks' in 2008/9 and 2011/12



Source: Barclays Research

The phenomenon of trend inflation has been examined in some studies on the US, but not yet across OECD countries. We undertake this exercise with a Dynamic Common Factor model and decompose the trend from cycle inflation factors. We estimate the following model on core CPI inflation series for 16 OECD countries:

$$\pi_{i,t} = \alpha_i C_t + \beta_i T_t + \delta_j X_{i,t} + e_{i,t}$$

In this model, $\pi_{i,t}$ is quarterly inflation in country *i*. This is explained by a cyclical (C_t) and trend component (T_t). The trend is modelled as a random walk and we impose a prior condition that it can evolve only slowly.[7] The cyclical component, on the other hand, is assumed to have zero persistence.[8]

The model results for the global cyclical factor (C_t) should reflect the global business cycle and global commodity price shocks.[9] Indeed, we find a clear rise in the global cyclical factor in the late 1980s boom and a decline during the 1991, 2001 and 2008-09 recessions.[10] Notably, the 1991 Q1 peak in the global cyclical factor occurs after the 132% rise in Brent crude between Q2 and Q3 90. Subsequent peaks coincide with the early 2000s and 2007-09.

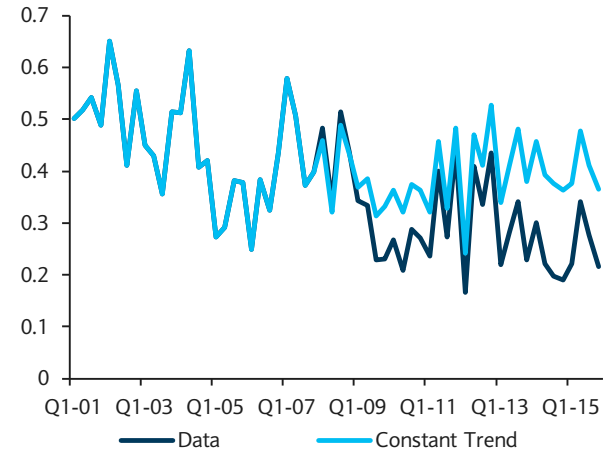
…and this global factor has a declining trend component

The model's global trend component (T_t) should reflect such factors as permanent policy or behavioural changes, including inflation expectations. Similarly, it can also be interpreted as the medium-term level of inflation that – after all shocks have died out – is consistent with a given monetary policy. Indeed, our findings show a sharp fall in the trend inflation factor from 6.3% annualised inflation in the 1980s, consistent with a shift in inflation expectations around this time (Figure 20). A further decline occurs in the mid-1990s, broadly coinciding with the global adoption of inflation targeting and ongoing convergence in Europe ahead of the introduction of the euro. Importantly, there is also a drop in trend inflation in Q3 08, from 1.6% to 1.2% and in 2012, from 1.32% to 1.00% at the end of the sample. As shown in the appendix, our model suggests that both these breaks are statistically significant.

These two recent breaks lower in global trend inflation coincide with the global financial crisis (2008-09) and the euro area crisis (2011-12), as shown in Figure 21. Intuitively, the trend breaks suggest that either inflation expectations shifted down or that the monetary policy

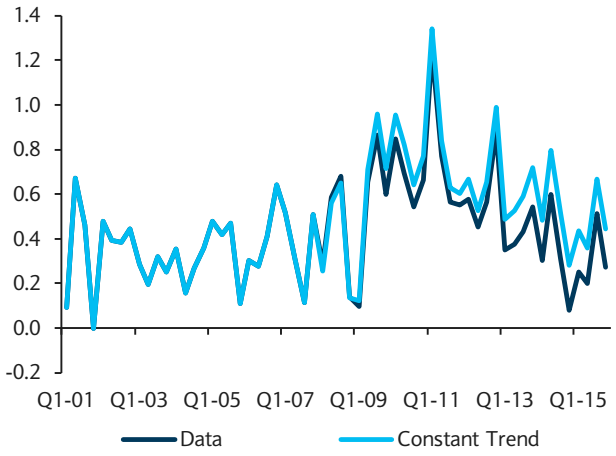
[7] T Cogley, G Primiceri and T Sargent, 2010, "Inflation-Gap persistence in the US", American Economic Journal: Macroeconomics, vol 2(1), pages 43-69.
[8] In a recent study on US trend inflation, Stock and Watson (2015) argue that this is a necessary assumption to allow the separation of these two factors.
[9] As detailed in the Appendix, for the econometric exercise, 'cyclical' is defined as the component having zero persistence.
[10] While 1991, 2001 and 2009 are US recessions as defined by the NBER, the 1991 and 2009 recession are also global recessions—two of the four global recessions since 1960—as defined by recent work of the IMF: When National Cycles Coincide: Tracking Global Recessions and Recoveries IMF Survey February 9, 2016.

FIGURE 22
Euro core actual and constant trend CPI inflation



Source: Barclays Research

FIGURE 23
UK core actual and constant trend CPI inflation



Source: Barclays Research

response was not strong enough to maintain trend inflation at a level consistent with the inflation target.

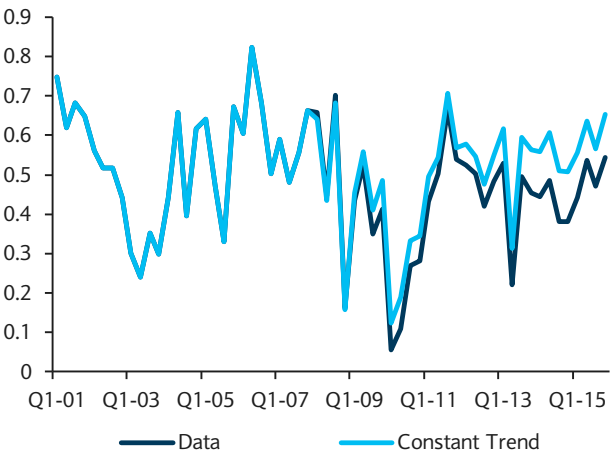
Assuming away the post-2008 disinflation trend

How relevant is the GFC-related decline in global trend inflation for country-specific inflation outcomes? Our model allows us to simulate inflation outcomes under the assumption that trend inflation would have remained at its pre-GFC level: that is, its Q4 07 level of 0.39% for the euro area, the UK, the US and our group of 16 OECD countries.

Abstracting from the trend, headline inflation would have been much closer to target

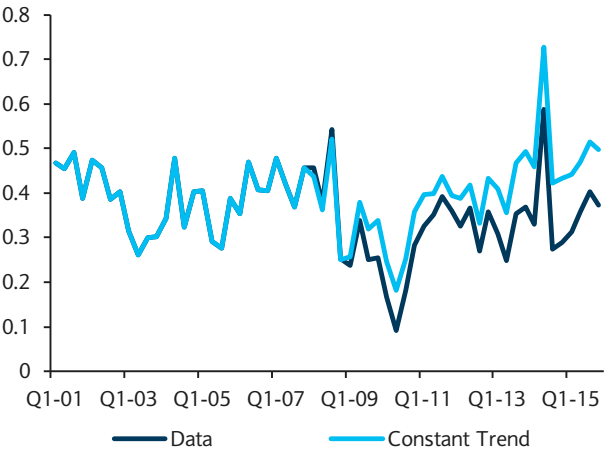
This exercise suggests that, on average, euro area CPI core inflation would have been 10bp higher, at 0.4%, in the absence of the break in trend inflation (Figure 22). This would be 1.6% in annual terms, which is near the ECB's price stability benchmark. The UK is the one OECD country that experienced significant above-target inflation in the immediate aftermath of the crisis. But even here, core CPI inflation outturns with a constant trend would have been 10bp higher and the weak inflation outturns since 2013 would have been avoided (Figure 23). In the US, core CPI inflation would have been 7bp higher, pushing inflation closer to target (Figure 24). Finally, Figure 25 suggests that core CPI inflation outturns for a GDP-weighted average of our 16 OECD countries would have been 7.5bp higher and again, on an annualised basis, would have been closer to the inflation targets of the central banks in these countries.

FIGURE 24
US core actual and constant trend CPI Inflation



Source: Barclays Research

FIGURE 25
OECD core actual and constant trend CPI inflation



Source: Barclays Research

Our interim summary is that: 1) domestic inflation processes seem significantly influenced by a common global factor; 2) the trend component of this global inflation factor has been declining, from very high levels, since the early 1980s, but it has dropped further since the global financial crisis (GFC) and the euro area crisis; and 3) without this trend decline, domestic inflation outcomes would have been closer to official targets in recent years, particularly in the euro area.

Reconsidering 'global' versus 'coincidence of domestic' factors

Exploring the 'unobserved' common factor by re-introducing global and domestic variables

So far, we have argued that there has been a significant global trend in domestic inflation outturns since the 1980s. This appears to have undergone further structural breaks in 2008 and 2012. Our results suggest that this has led to weaker core CPI inflation outturns in OECD countries. However, as we highlighted at the outset, one challenge to our econometric approach is that this extracted trend common factor is an unobserved variable. Hence, we cannot exclude that a mere coincident move of domestic factors might be responsible for the shift in the global trend.

To explore this hypothesis further, particularly for the 2008 and 2012 trend breaks, we include a number of *domestic* exogenous variables in our model. These are the domestic output gap, quarterly/annual growth of wages, unit labour costs, real credit, property prices and labour productivity, the NAIRU, and the unemployment rate. For the output gap measures, we explore different options. Our baseline measure for the output gap is the Hodrick-Prescott filtered measure of domestic real GDP. However, we also test the OECD's model-based output gap and try an output gap measure suggested by Borio et al (2014) that adjusts for demand weakness since the GFC, including real interest rates, real credit growth and real house price growth in the output gap measure. Finally, as long-run trends in core inflation might also be determined by the spending patterns of different demographic groups, we include population growth and old-age dependency ratios to account for these effects.

We include trade-weighted averages to investigate the potential cross-border transmission of slack

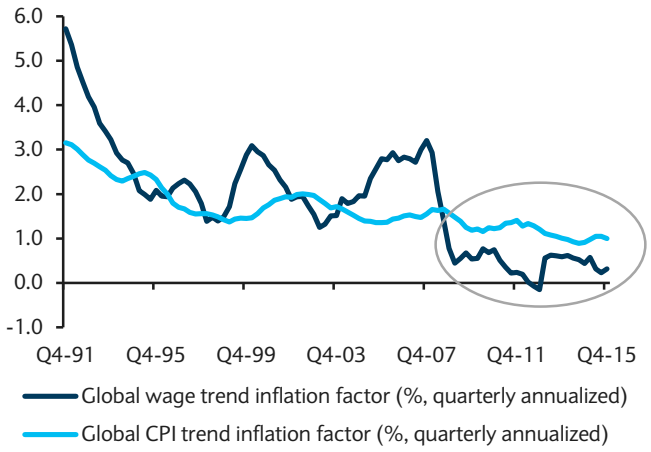
Given the large number of variables we examine, we adopt the following investigative strategy: we include the output gap and population growth and old-age dependency ratios to account for the standard cyclical and trend determinants of inflation in every specification. We then add each one of our proposed variables one-by-one to examine if any one is an important determinant of trend inflation. When we explore alternative measures of spare capacity such as the financially adjusted output gap or the NAIRU, we replace these variables with the standard output gap.

In addition, we want to test whether the *global* counterparts of the above variables may matter more than the domestic ones. We therefore also include the corresponding global variables, which we construct as the GDP-weighted averages of the country-specific variables. To test whether the effect of spare capacity on prices is mainly transmitted through trade between countries (eg, for Canada, the US output gap is most likely significantly more important than implied by GDP-weights) we also include trade-weighted averages of slack in a country's trading partners.

It turns out that among all these candidate variables, *domestic labour market* variables are most significant. Indeed, allowing domestic unit labour costs growth rates to enter in our econometric model leads to a flat global trend inflation component in 2008-12.[11] Although it may seem odd that domestic variables can explain a global factor, this presumably reflects the fact that a sharp increase in labour market slack coincided across OECD countries following the deep global recession associated with the GFC. However, domestic labour market variables alone still cannot explain the further decline in trend inflation since 2012. Adding global output gap measures cannot explain this last decline, either. Only when we include global annual wage growth, weighted by trading partner into our model, does the recent

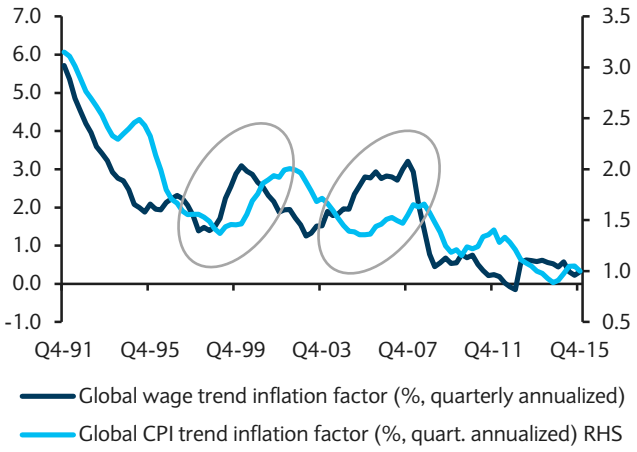
[11] In our baseline model, the output gap, population growth and the old-age dependency ratio are always included. We explore the importance of the other variables by including them one-by-one.

FIGURE 26
Wage inflation tended to lead trend CPI inflation …



Source: Barclays Research

FIGURE 27
…but wage inflation has remained very weak since the GFC



Source: Barclays Research

break in the trend disappear. This suggests the presence of another global trend, in common to prices and wages, that is likely responsible for this last trend break in inflation.

Labor markets matter most for recent decline in trend inflation

To examine this idea, we then estimate the global trend in quarterly wage growth rates for our sample of countries and compare with global CPI trend inflation. This suggests that historically, the global trend in wage inflation leads the CPI trend inflation factor by about a year (Figure 26)[12]. Since the GFC, the global wage trend inflation factor has remained weak, which is likely to keep global CPI trend inflation weak for some time (Figure 27).

Overall, these final findings about the post-GFC period suggest that: 1) both local and global labour market factors have been important determinants of trend inflation since 2008; 2) therefore, labour market variables in general seem to have become the most relevant concept of economic slack in recent years; and 3) global wage weakness is likely to keep CPI trend inflation low for some time to come.

Implications for monetary policy and beyond

Central banks face a challenge: the trend is not their friend

The global disinflation trend since the 1980s is explained by a number of factors, including changes in monetary policy regimes, domestic deregulation, and the effects of technological advances combined with increased global flows of goods, services and capital. This globalization, accelerated by the integration of China into the world economy, has meant that global drivers have gained in relevance compared with the domestic drivers of inflation in a given country. Our findings suggest that the common global factor is not merely cyclical (ie, business cycles) or a proximate driver (ie, oil price swings) but includes a significant trend component that has been trending lower. They also show that this trend component has shifted down further since the GFC (2008-09) and the euro area crisis (2011-12), suggesting it may be the main driver of the below-target inflation in advanced economies.

Has inflation-targeting become a 'mission impossible'?

Such a global disinflationary trend is challenging news for central banks mandated to keep inflation around certain annual targets (ie, 2% for most of them). Does it imply that central banks are no longer in control of their domestic inflation developments? In other words, has their mission become impossible?

[12] Indeed, standard tests suggest that these variables are co-integrated.

Domestic labor market variables are still significant …

…and monetary policy seems to affect trend inflation…

Our findings suggest a nuanced answer. First, a closer look at drivers of the disinflation trend in the post-GFC period suggests that domestic and global labour market variables have both been significant. Indeed, technically it remains difficult to distinguish truly 'global' from 'coincident domestic' factors. Second, the global trend in wage inflation has historically been a powerful leading indicator of the global trend in core CPI inflation. The recent weakness in the former suggests that CPI trend inflation is likely to remain low for some time to come. However, the breaks in the trend component do seem related to monetary policy changes: declines in trend inflation seem to have followed rises in OECD monetary policy rates (Figure 28). The most recent break, in 2012, occurred after the ECB's policy rate increase in Q2 and Q3 11, suggesting that the tightening of monetary policy in the euro area played a role in shifting global trend inflation lower (Figure 29).

… but it has become harder for central bankers to achieve their desired outcome …

… and the actions of others now matter more

Taken together, the following conclusions seem to emerge: monetary policy may not be powerless, but with domestic inflation outcomes exposed to global factors beyond its control, the disinflationary trend it faces may simply be too strong for the policies central banks have been willing to deploy. In other words, monetary policy has simply not been loose enough for the slack, in particular in labour markets, created by the GFC, which is in line with our analysis in Chapter 2, "When absolute zero isn't low enough". Almost certainly a consequence of globalization, monetary policies in core economies seem to affect the global trend component. Thus, for example, the ECB's rate hikes in 2011 – later revised – seem to have affected our global inflation measure. How global trend inflation could be affected by the Federal Reserve's current hiking cycle remains to be seen. But the ECB's experience suggests that a potential policy mistake by the Fed of premature or too aggressive hikes could worsen global trend inflation further.

Policies have to be 'aggressive and persistent'…

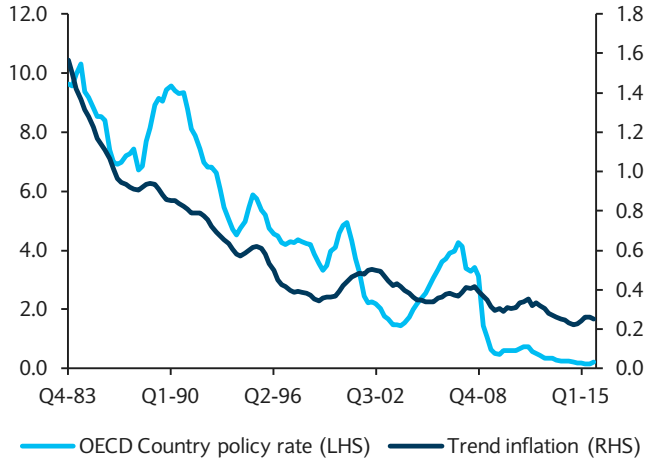
…and the policies of others must be taken into account…

… and, ideally, should be coordinated

This suggests that: 1) central banks may have to be even more aggressive and persistent to lean against the powerful disinflation trend; and 2) that they must take into account the policies of others, as these can spill over into their own inflation outlook (and vice versa). These suggestions come with formidable challenges, however. Aggressively and persistently leaning against a trend was difficult for the Fed in the 1980s, when the trend was for rising inflation and the response was obvious (tightening through higher rates). Now, the trend is for disinflation and the necessary policy response of easing is constrained by the zero lower bound (ZLB). However, our findings suggest that central banks may have to continue down this path to turn the disinflation trend around. Given the above-mentioned spill-overs, they ideally should do this in a coordinated manner, in awareness of the effect their policies have elsewhere. Indeed, the simultaneous cuts by core central banks early on during the GFC and the subsequent pursuit of QE by the Fed and the BoE could be considered as an example of a successful simultaneous policy move.

FIGURE 28

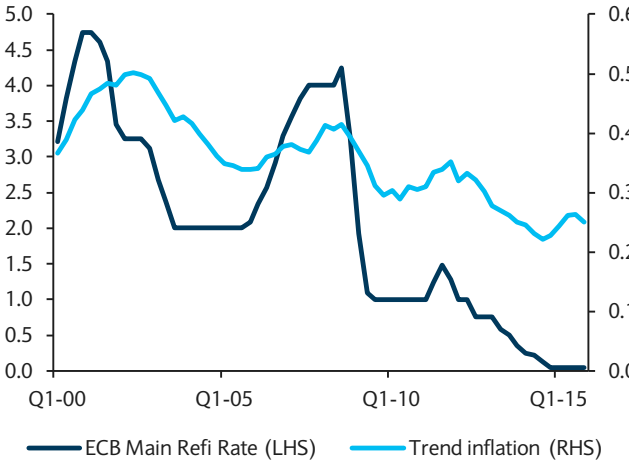
Trend inflation and OECD monetary policy



Source: Barclays Research

FIGURE 29

Trend inflation and ECB refinancing rate



Source: Barclays Research

Negative policy rates may become a fixture of the menu

The need to be aggressive and persistent seems to have now been accepted by most central banks, judging not only by the QE programs but also by the more recent moves by a number of central banks to challenge the ZLB and move policy rates into negative territory. We explore the consequences of such policies in more depth in Chapter 3, "Negative Ascent: Life amid negative nominal interest rates". In addition, the Fed's very cautious attitude toward hiking its policy rate suggests an increased recognition of global spill-over effects, even if this comes from the perspective of how other countries (eg, China) affect US inflation, rather than how US policy would affect theirs. An active coordination of policies – which would be complicated by having to include exchange rate considerations – may ultimately require a more urgent sense of crisis.

But policies to bring back inflation also bring financial stability risk…

…leaving central bankers in a bind and investors in a volatile environment

Last, our analysis is purely concerned with inflation and monetary policies' effect on it. However, aggressive and persistent monetary easing, including with unconventional policies, to overcome a strong disinflation trend can also have significant unintended consequences for financial stability. And to the extent that financial instability could cause further global disinflationary shocks down the line, such a policy could become counter-productive. In principle, this points toward the need for support from fiscal and/or structural policies. Indeed, this is something the ECB and other central banks have been asking for, albeit with limited success. Without this support, but a mandate to bring inflation to target, central bankers will have to continue testing the extremes. For investors, this means that: 1) financial volatility is likely here to stay; and 2) although there is little to suggest a turn in global inflation anytime soon, when it does happen, the unwinding of these policies could be challenging.

Appendix: Data and Models

Data

In this appendix, we first describe the data and then the two models that we estimate on the dataset. Table 1 shows the list of countries in our sample, while Table 2 shows the variables in our model.

TABLE 1

List of countries

Australia	Germany	Sweden
Austria	Italy	Switzerland
Canada	Japan	US
Denmark	Netherlands	UK
Finland	Luxembourg	
France	Spain	

Note: This list of countries was constrained by the availability of core CPI inflation data. We included all OECD countries were data was available starting in 1976Q3.

TABLE 2

List of variables

No.	Variable	Transformation	Source
1	Core CPI Inflation	Growth rate of Core CPI	OECD Economic Outlook
2	Output Gap	HP-filtered log of real GDP	OECD Economic Outlook
3	Real Interest Rates	Policy rate – CPI inflation	OECD Economic Outlook
4	House Price Growth	Growth rate of real credit	BIS
5	Real Credit Growth	Growth rate of real credit	BIS
6	Population Growth	5-year Growth Pop. Growth	UN Population Statistics
7	Labour Productivity Growth	Growth in Output/Employee	OECD Economic Outlook
8	Labour Productivity Growth	Growth in Output/Hour	OECD Economic Outlook
9	Unit Labour Costs Growth	Growth rate in ULC	OECD Economic Outlook
10	Real Exchange Rates	Growth rate in RFX	OECD Economic Outlook

No.	Variable	Transformation	Source
11	Oil Prices	Growth rate in Oil prices	OECD Economic Outlook
12	Commodity Prices	Growth Rate in Com, prices	OECD Economic Outlook
13	Wage Rate Growth	Wage Rate growth rate	OECD Economic Outlook
14	Participation Rate Growth	Interpolated to quarterly	OECD Economic Outlook
15	OECD Output gap	Interpolated to quarterly	OECD Economic Outlook
16	Dependency ratio	Dependency Ratio	UN Population Statistics
17	Unemployment Rate	No transformation	OECD Economic Outlook
18	NAIRU	Interpolated to quarterly	OECD Economic Outlook
19-29	Variables 4-14 as annual growth rates		
30-66	The global versions of variables 2-29 by applying GDP weights to them		
67-93	The global versions of variables 2-29 by applying bilateral trade weights to them		

Note: Our estimation methodology requires a balanced panel dataset. But due to the unification of Germany, continuous time series are not always available. This is why we interpolated it based on outturns in Austria.

Models

In this paper, we use statistical models to estimate a common component from a panel of inflation series. The way to express this idea mathematically is:

$$\pi_{i,t} = \theta_i PC_t + e_{i,t}$$

Where $\pi_{i,t}$ is Core CPI inflation in country *i* at time *t*, PC_t is a component that varies only over time and is in common with all of the countries in the panel. θ_i is a coefficient that indicates the degree to which each country is exposed to this common component. $e_{i,t}$ is an error term that reflects any movement in inflation in that country not picked up by the common component.

The common component in this model is unobservable. But it can be estimated based on the assumption that it is in common to all of the inflation series. In that case, it can be estimated directly from the correlation matrix of the panel of inflation series. The common component can then be obtained by multiplying the eigenvector associated with the highest eigenvalue by the data. This is also referred to as a principal component and is the simplest way of summarising a large number of variables into one indicator.

But this simple estimator has several caveats which limit its use in analysis, other than as a descriptive tool. First of all, it does not allow for the inclusion of any exogenous variables, such as the output gap, which could be important domestic determinants of inflation. It is also well known that the volatility of inflation has declined significantly since the 1980s and it is also important to control for that. Finally, the principal component estimators ignore dynamics, which means that it is not possible to separate a trend from a cyclical component. In other words, it is not possible to assess whether the temporary weakness in inflation is temporary or permanent. To allow for these effects, we include exogenous variables $X_{i,t}$ in our model. We replace $e_{i,t}$ by $\sqrt{e^{lnh_{it}}}v_{f,t}$ to allow for changing volatility of inflation over time. We also replace $\theta_i PC_t$ by $\alpha_i C_t + \beta_i T_t$ to allow for a separate trend (T_t) and cycle (C_t) component. The trend component is modelled as a random walk to ensure that this component only picks up permanent or very persistent changes in inflation. This extended model, which we estimate on Core CPI inflation series for the 16 OECD countries listed in table 1 is:

$$\pi_{i,t} = \alpha_i C_t + \beta_i T_t + \delta_j X_{i,t} + \sqrt{e^{lnh_{it}}}v_{f,t} \qquad v_{f,t} \sim N(0,1)$$

$$C_t = \sqrt{e^{lnh_t}}v_t \qquad v_t \sim N(0,1)$$

$$T_t = T_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim N(0, \gamma \propto 1)$$

$$\ln h_{it} = \ln h_{it-1} + \mu_{i,t} \quad \mu_{i,t} \sim N(0, \omega_i)$$

$$\ln h_t = \ln h_{t-1} + \mu_t \quad \mu_t \sim N(0, \omega)$$

In this model, $\pi_{i,t}$ is quarterly inflation in country *i*. This is explained by a cyclical (C_t) and trend component (T_t), as well as a vector of exogenous variables $X_{i,t}$. The cyclical component, on the other hand, is assumed to have zero persistence.[13] The trend is modelled as a random walk and we impose a prior that it can only evolve slowly over time.[14] Specifically, we impose a prior that γ, is .0001, meaning that the trend can only move by one percent of the standard deviation at a time. Cogely, Primiceri and Sargent (2010) argue that setting the prior in this manner will ensure that the trend component only picks up permanent structural change. We also allow the variances of the model to vary over time via h_{it} and h_t. This is an important model feature as it picks up the changed in inflation volatility over time. Clearly, interpreting any regression with all 92 potential explanatory variables listed in table 1 will be challenging. For this reason, we investigate the explanatory power of these variables one by one. But our model does include several standard determinants of the inflation trend and cycle in each regression. These are the output gap, population growth and the dependency ratio. To estimate the model, we cast the model into State Space form and use Bayesian Kalman filter with Gibbs sampling to estimate the model.

For the aficionado

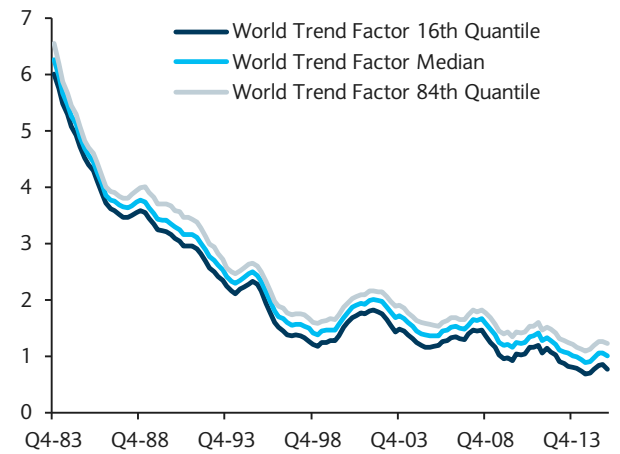
Other than separating the trend from the cycle, a challenge in unobserved components models is the separation of the scale of the trend and cycle factors. In particular, one could multiply both α_i and C_t by $\frac{1}{2}$ each, that model would be observationally equivalent to the model described above. To address the scaling issue, we use a standard solution and fix the scale of the variance of both the trend and the cycle to 1. This determines the scale of the factors and therefore also the coefficients.

In the main text, we also claim that our trend inflation results are statistically significant. Below, we demonstrate how we arrived at this conclusion. Figure 30 shows the trend and the 16th and 84th quantile for the entire period. Figure 31 zooms in on the most recent period and performs an overlapping quantiles test. So long as the lowest quantile does not overlap with the higher quantile, the test indicates that two points in time are statistically significant. The dotted line in Figure 31 shows that this is indeed the case for both of the structural breaks that we are interested in.

Cogely, Primiceri and Sargent (2010) argue that this type of test actually understates the degree of statistical significance because it conflates uncertainty about the trend inflation estimate at a point in time with trend inflation across time periods. They argue that for the question that we are interested in, only the latter type of uncertainty matters. The degree of relevant statistical significance is therefore most likely greater than indicated above.

FIGURE 30

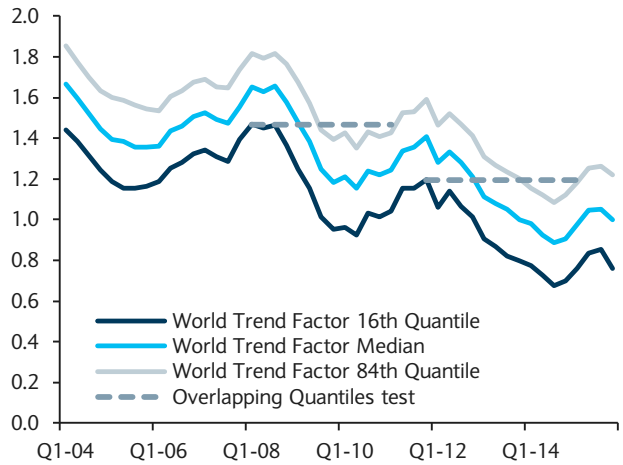
Trend inflation with 68% quantiles



Source: Barclays Research

FIGURE 31

Recent trend inflation and overlapping quantiles test



Source : Barclays Research

[13] In a recent study on US trend inflation, Stock and Watson (2015) argue that his is a necessary assumption to allow the separation of these two factors.

[14] T Cogley, G Primiceri and T Sargent, 2010, "Inflation-Gap persistence in the US", American Economic Journal: Macroeconomics, vol 2(1), pages 43-69.

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CHAPTER 2

When absolute zero isn't low enough

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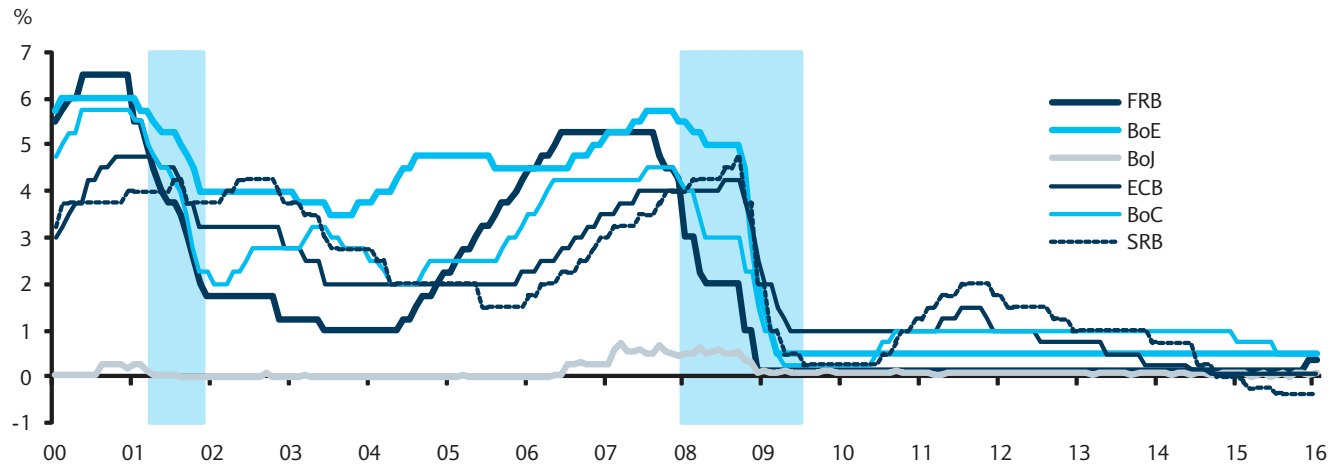
- **Despite the seemingly unprecedented level of monetary support, including zero interest rates, economic growth remains well below its pre-crisis average in almost every developed country. Inflation, which many feared would be the inevitable outcome of easy money, has yet to emerge, and most developed market central banks have struggled to hit their inflation targets from below.**
- **The combination of slow growth, falling unemployment, and soft inflation in most developed economies suggests monetary policy is not as accommodative as previously thought. This would be the case if the natural rate of interest were also low. To test this hypothesis, we use a multivariate framework to estimate the real equilibrium rate of interest in the US, UK, Germany, and Japan. We find that real equilibrium policy rates have fallen to near-zero levels across the developed world.**
- **Our estimates reinforce our view that US and UK monetary policy tightening is likely to proceed gradually lest interest rate policy becomes restrictive too quickly. In the remaining economies, our results imply that policy rates may need to fall further below (absolute) zero for interest rate policy to become sufficiently accommodative.**
- **Absent a meaningful rise in the natural rate of interest, our finding of a structurally low nominal growth environment means major central banks are likely to find themselves returning to the zero lower-bound and expanding balance sheets more frequently. Hence, unconventional policy is likely to become conventional.**

In response to the intensification of the global recession in late 2008, most major central banks slashed rates aggressively, with most reaching the zero lower bound by mid-2009 (Figure 1). Seven full years after the end of the last US recession, G10 monetary policy rates remain mired at record low levels. The ECB and the Riksbank both tried to raise rates soon after the recession and both were pushed back to zero as economic developments thwarted such an optimistic policy stance. The Riksbank is now among a handful of banks actively testing the limits of how far below the zero lower bound they can push rates.

FIGURE 1
Seven years after the end of the US recession, the policy rate of almost every developed economy remains mired near zero



Note: Shaded areas designate US recessionary periods. Source: Federal Reserve, Bank of England, Bank of Japan, European Central Bank, Bank of Canada, Swedish Riksbank, NBER, Haver Analytics

Besides pushing rates lower, these central banks expanded their balance sheets substantially. Through various programs, particularly asset purchases, the Fed and the ECB both increased their balance sheets to about 25% of GDP (Figure 2). The Bank of Japan, in a monumental effort to boost the Japanese economy and produce inflation, began an asset purchase program in 2013 that has since ballooned its balance sheet to more than 70% of GDP.

Central banks have struggled to stimulate activity and achieve inflation targets

The unprecedented monetary response to the crisis led many academics and policymakers to fear a resurgence of inflation in which central banks would be forced to abruptly tighten policy to bring inflation back to target. Now, as central banks struggle to meet inflation targets from below, concerns have shifted. The absence of inflation now leads many to worry about the fundamental ability of monetary policy to produce it. Add to this that economic growth remains below its pre-crisis average in almost every developed country and the concern deepens. See *Chapter 1: The fight to bring back inflation*, for a discussion of the implications for the global economy if monetary policy has indeed lost its ability to stimulate either inflation or growth.

Modest growth and falling unemployment means potential growth is lower…

…while falling unemployment and low inflation point to low natural rates of unemployment

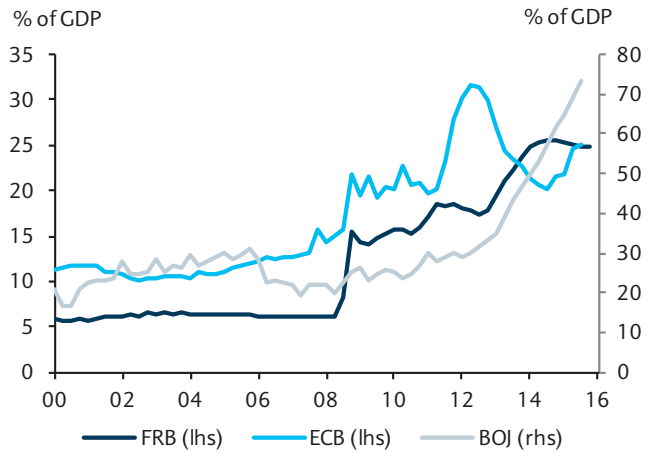
In this chapter, we take a different tack. Focusing on four G10 economies – the US, UK, Germany, and Japan – we move beyond simply observing the level of policy rates and attempt to compare the level of the target rate to the evolution of the natural rate of interest. The natural rate, simply put, is the rate of interest that tends to be neutral with respect to both growth and inflation. If the economy is running at potential and inflation is at the central bank's target, setting the policy rate at the natural rate would tend to keep the economy at potential and inflation close to target. To judge the expected policy response, one must measure the distance of current interest rates from the natural rate, as this difference determines the tightness or looseness of monetary policy.

That monetary policy has failed to achieve more robust outcomes suggests the natural rate of interest has also fallen

Policy that was viewed as accommodative has proved less so

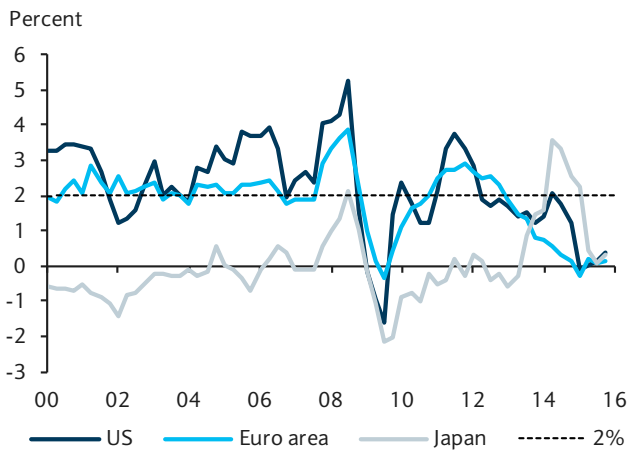
We use a multivariate framework, introduced in *The great destruction, Equity Gilt Study 2015* to measure potential output, the output gap, the natural rate of unemployment, and the natural rate of interest simultaneously. The combination of slow output growth and falling unemployment points to lower potential growth. Our framework finds this to be the case; because of inflection points in demographics and the end of the technology boom, trend growth in the developed world is likely to have slowed significantly from the robust growth rates achieved in the 1990s. In addition, economic downturns that coincide with severe financial crises destroy output and lower potential growth. The fact that inflation remains subdued suggests that the natural rate of unemployment has also remained low. Finally, that near-zero policy rates have not stimulated faster output growth nor spurred inflation suggests interest rate policy is not excessively stimulative. In other words, the natural rate of interest is likely to have fallen. We find this to be the case; indeed, we find that real equilibrium policy rates have fallen to near-zero levels across the developed world

FIGURE 2
Central banks have expanded their balance sheets



Source: Federal Reserve, European Central Bank, Bank of Japan, Haver Analytics

FIGURE 3
Inflation has not increased relative to pre-crisis levels



Source: BLS, ES, MIC, Haver Analytics

We estimate that the natural rate has fallen to near-zero levels

Our estimates imply that monetary policy is (and has been) closer to neutral than commonly perceived and we expect policy rates in the US and UK to rise only gradually over the next several years as the Federal Reserve and Bank of England strive to balance the removal of accommodation with the desire to maintain a supportive policy stance on balance. Although a policy rate of zero would seem to be very easy monetary policy – and was once thought to be the absolute lowest level policy rates could go – our estimates indicate that the decline in the natural rate left monetary policy tighter than desired in the years following the recession. Hence, major central banks have been forced to pursue balance sheet expansion via liquidity programs and asset purchases. More recently, in the case of the ECB and BoJ, a low natural rate of interest has made policymakers willing to test the true lower bound of policy by inching front-end rates into negative territory.[1]

We believe zero interest rates and balance sheet policies will become conventional responses to economic downturns

Our view that the natural rate of interest has moved lower has important implications for the conduct of monetary policy. A low natural rate of interest is, among other factors, a consequence of a low nominal growth environment across the developed world. A lower natural rate of interest means policymakers have less support on average from traditional interest rate policy to counter downturns in activity. Even after policy rates move higher, central banks are likely to find themselves frequently back at the zero lower bound (ZLB) and looking at negative policy rates or unconventional balance sheet policies to deliver further easing. Over a 5- to 10-year horizon, we think central bank balance sheets are as likely to expand as they are to contract. Zero rates and large balance sheets suggest unconventional policy is the new conventional policy.

Defining and estimating the natural rate of interest

The real rate of interest is in equilibrium when output equals potential and prices are stable

We define the equilibrium interest rate, r*, or natural rate of interest, as the real rate of interest consistent with output equal to potential output and stable prices. This definition takes a long-term perspective given that economic theory defines potential output as the level of output consistent with price stability, absent transitory shocks to supply and demand. Since booms and busts may take years to resolve (as the current recovery from the recent global recession has made abundantly clear) our definition of the natural rate of interest is more akin to the level expected to prevail between five and 10 years after cyclical disturbances are assumed to have fully dissipated. This definition has a natural monetary policy interpretation given that most major central banks use a short-term interest rate as the main tool of policy; real policy rates in excess of the real equilibrium interest rate would tend to suppress activity and reduce inflationary pressures (monetary policy is "tight"), while real policy rates below this rate would boost activity and prices (monetary policy is "loose"). This concept of the natural rate of interest dates to Knut Wicksell, a Swedish economist most famous for his 1898 book *Interest and Prices,* which influenced both John Maynard Keynes and Milton Friedman.

The natural rate of interest is linked to potential growth

A primary determinant of the level of r is potential growth; fast-growing economies have higher returns on investment and higher interest rates for a given level of saving*

The level of the natural rate of interest is not fixed and many of the factors that influence it change over time. A primary factor, and one that we focus on in this analysis, is the rate of potential growth. At its core, the interest rate is a price that equates the level of saving with the demand for borrowing. If the interest rate is too low, demand for borrowing outpaces the available supply of savings, as savers are unwilling to supply additional funds at that price. If the interest rate is too high, borrowers pull back from the market. Since the time of David Hume[2], economists have believed that faster growth, or higher future income will, all else equal, cause the interest rate to rise, as higher incomes naturally increase the pool of borrowers as individuals try to borrow against future wealth. As people try to borrow more,

[1] See Gapen, Michael and Celine Rochon, "Absolute zero," Business at Oxford, Spring 2009.
[2] "High interest arises from three circumstances: A great demand for borrowing; little riches to supply that demand; and great profits arising from commerce. Low interest, on the other hand, proceeds from the three opposite circumstances: A small demand for borrowing; great riches to supply that demand; and small profits arising from commerce: And these circumstances are all connected together, and proceed from the encrease of industry and commerce." David Hume, "*Of Interest*", in Essays, Moral, Political, and Literary, 1742.

FIGURE 4
Potential output growth and its components by decade (%)

	1970-79	1980-89	1990-99	2000-09	2010-present
United States					
Potential output	3.4	3.1	3.0	2.5	1.1
Total hours	2.2	1.4	1.0	0.9	0.3
Productivity	1.5	1.7	2.0	2.0	0.9
United Kingdom					
Potential output	1.8	2.9	2.9	1.4	1.8
Total hours	-0.8	0.1	0.6	-0.3	1.1
Productivity	2.6	2.9	2.3	1.7	0.7
Germany					
Potential output	2.3	1.7	1.2	1.1	1.2
Total hours	-0.8	-0.1	-0.1	-0.2	0.3
Productivity	3.1	1.8	1.3	1.2	1.0
Japan					
Potential output		3.6	1.9	0.2	0.3
Total hours		-0.2	-0.7	-1.0	-0.5
Productivity		3.8	2.6	1.3	0.8

Note: Categories may not add up due to rounding and model structure. Our US model includes output and employment sector ratios that are not shown here. See Appendix for details. Total hours comprise the sum of trend growth in population, labor force participation, employment, and hours. 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. UK data begin in 1975 and Japan in 1981. Source: Barclays Research

the interest rate must rise to encourage other individuals to lend. Rapidly growing economies with higher returns on investment are likely to have higher equilibrium interest rates given the high return on capital investment. The opposite is also true. Slower-growing economies are viewed as having more limited investment opportunities, lower returns to capital, and low equilibrium real rates of interest.

*Government policies, demographics, and other global forces can also cause shifts in r**

In addition to potential growth and its relationship to return on investment, other factors that could cause the real equilibrium interest rate to change include: government spending and taxation policies (because government borrowing diverts savings away from private investment); demographics (eg, the life cycle of the "baby-boom" generation is thought to have induced important shifts in the equilibrium US saving rate over time);[3] the large outflow of official sector savings from emerging Asia in recent decades (eg, the "global savings glut"); the shortage of safe-haven assets following the recession and the collapse of the asset-backed securities market;[4] and changes in the regulatory environment that encourage the holding of government securities in bank credit[5], among other factors.[6]

Estimating r* in a business cycle framework

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

Although defining the natural rate of interest is fairly straightforward, estimating it is much more difficult. Simple long-run moving average concepts are appropriate when inflation, output, and labor markets are relatively stable, but averaging is unlikely to be appropriate when economies may have undergone significant changes, as has been the case following the recent recession. Given our view that the severe recession and financial crisis caused

[3] See *Global Insights: The natural rate of interest – Past and prospective*. Trends in population dynamics has been an important driver of the 'global savings glut' that has depressed interest rates and boosted asset prices around the world during the past 30 years. The world now faces a demographic inflection point, and that demographic support for saving, and by extension asset prices, should fade materially in the decades to come.
[4] The precise definition of a 'safe asset' can vary depending on the role that it is expected to play in any context, and we assume that it is reasonable to expect such assets to deliver very low default risk, a high degree of liquidity, and low currency risk. In applying this screen we viewed the safe asset universe as including US government debt (excluding debt held by the Federal Reserve), direct debt and asset-backed securities issued by US government-sponsored agencies, privately issued mortgage-backed securities, and public debt of large European governments.
[5] See *Demand for safe havens to remain robust, Equity Gilt Study 2013*.
[6] See "Long-term interest rates: A Survey", 2005, Council of Economic Advisors, July. Also see Bernanke, Ben S., 2013, "Long-term interest rates," Annual Monetary/Macroeconomics Conference: The Past and Future of Monetary Policy, San Francisco, March.

significant damage to output, the inflation process, and the natural rate of unemployment in developed economies, we use a business cycle framework that estimates the equilibrium real rate of interest from estimates of trend GDP and its cycle. In so doing, we focus implicitly on the link between interest rates and the business cycle. The gap between actual and potential output should contain information about the difference between actual unemployment and its long-run trend and actual interest rates and the natural rate of interest. This is not to say that we ignore the other factors that could cause the natural rate of interest to change. Government policy, demographics, and structural shifts in global capital flows are likely to influence the rate of potential growth and, in turn, alter estimates of the natural rate of interest. We make the simplifying assumption that potential growth and its changes are likely to reflect much of the information needed when forming estimates of r* and understanding the implications for the future conduct of monetary policy.

Our framework jointly estimates potential output, the natural rate of unemployment, and the equilibrium rate of interest

We apply a business cycle framework to four developed economies – Germany, Japan, the UK, and the US – and break down observed output data into its cyclical and trend components with the goal of jointly estimating potential growth, the natural rate of unemployment, and the real equilibrium interest rate. Although these variables are key inputs in the setting of monetary and fiscal policy and serve as anchors to economic models, 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, participation, and the real policy rate are used in a comprehensive framework to generate a decomposition of each variable into trend and cycle components.[7,8] The model applied to the US is described in more detail in the appendix, while the approach for the remaining countries is identical to that in *The great destruction, Equity Gilt Study 2015*.

The post-crisis landscape: Lower potential growth

Potential growth slowed markedly heading into the recession…

…and the recession further destroyed output and slowed productivity

Unsurprisingly, our findings reconfirm the results of our previous analysis that severe recessions intertwined with financial crises are associated with lost output and lower potential growth. 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.

Trend growth in the US is estimated to have fallen steadily since 1999 as the benefits of technological progress began to fade and the workforce aged (Figure 4).[9] Our findings support the conclusion that the decline in labor force participation since its peak in the early 2000s mainly reflects the ageing and retirement of the baby boom generation as opposed to purely cyclical forces. The post-recession environment has also weighed on productivity growth, likely a consequence of limited resource re-allocation from bubble-inflated sectors and slower rates of business formation as a result of tighter credit and reduced entrepreneurial risk-taking. In addition, 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

[7] 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.
[8] 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.
[9] Our US economics team has written frequently about US demographic trends and their contribution to slower potential growth. 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

part-time employment and a shorter average work week.[10] Altogether, we estimate that these factors caused US potential GDP growth to slow to 1.1% in the post-recession period. That said, our year-on-year estimates show potential edging up to 1.5% in 2015.

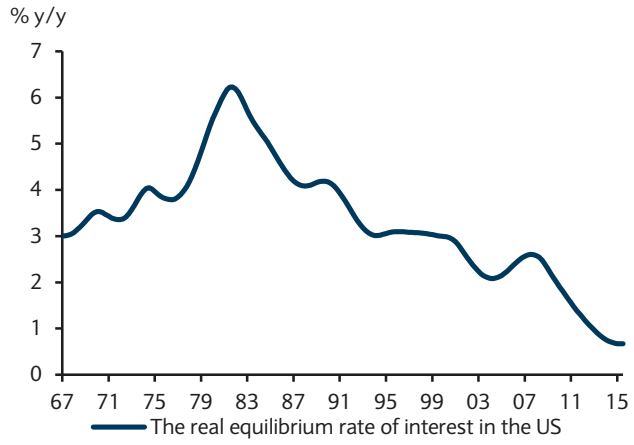
Productivity growth has slowed, but growth in total hours has mitigated the effect on potential growth

We find similar results for the UK, Germany, and Japan. The slowing of the rate of trend output in the UK is clearly related to slower trend productivity growth. However, growth in hours worked has provided an important offset to the slowing in trend productivity and the "productivity puzzle" looks less pronounced than before.[11] A slowing in trend productivity growth is also a feature of Germany and Japan, with output per hour falling to1.0% in the post-crisis period. In contrast to many of its peers, labor force participation has been on a steady upward path. Higher participation, faster growth in trend employment, and stable population growth have been important offsets to weaker productivity. In Japan, demographics, the transition to a more service-based economy, and a decelerating trend in weekly hours explain most of the fall in potential growth heading into the recession. Following the recession, potential GDP remained low as productivity growth fell further.

The natural rate of interest in developed economies has fallen

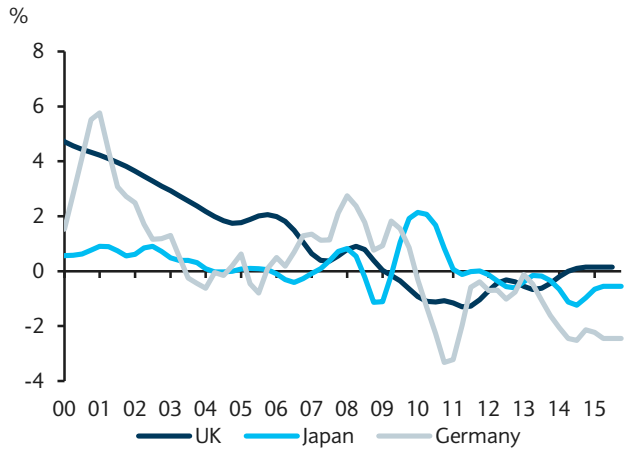
The four economies in our sample have experienced broadly similar outcomes in recent years. Following the recession, observed growth has been modest, but strong enough to boost employment and put persistent downward pressure on unemployment. However, despite the improvement in labor market conditions and narrowing of the output gap, central banks have failed to meet their inflation targets. The fear of runaway inflation early on in the recovery due to significant balance sheet expansion has given way to the expectation of sub-2% inflation for the next decade. Our business cycle framework reconciles this combination of growth, unemployment, and inflation outcomes by slowing trend growth, lowering estimates of long-term unemployment, and reducing the natural rate of interest. Put another way, near-zero interest rates have failed to generate strong activity and/or ignite inflation. The framework suggests the equilibrium interest rate must have fallen and policy was not as stimulative as previously thought. Modest growth and falling unemployment must be consistent with slower potential growth, as illustrated in the previous section.

FIGURE 5
The real equilibrium interest rate in the US



Source: Barclays Research

FIGURE 6
Real equilibrium interest rates in the UK, Japan, and Germany



Source: Barclays Research

[10] 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.

[11] The UK "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. 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.

The real equilibrium rate of interest is about 50bp in the US …
…and near zero in the UK, Germany, and Japan

As Figures 5 and 6 show, our estimate of the real equilibrium interest rate in the US has fallen to about 50bp from a range of 2-3% in the previous decade. In the case of the UK, Germany, and Japan, our estimates of the natural rate of interest vary between zero and -1%. We discount somewhat the estimates of the equilibrium rate of interest in Germany given the difficulty in estimating the model in light of reunification and the fact that our sample period ends just as the ECB has pushed its deposit rate into negative territory. The filtering procedures underlying the business cycle framework often have endpoint problems because the first and last values often receive excessive weight in model outcomes. Nevertheless, our estimate of the natural rate of interest in Germany has been below zero since 2010, suggesting that end-point problems may be minimal. That said, the direction of travel of the natural rate of interest in developed economies in recent years is clearly downward. Our estimate for the US is broadly similar to that found by Laubach and Williams (2001) and Federal Reserve Board staff as presented in a recent speech by Chair Yellen.[12]

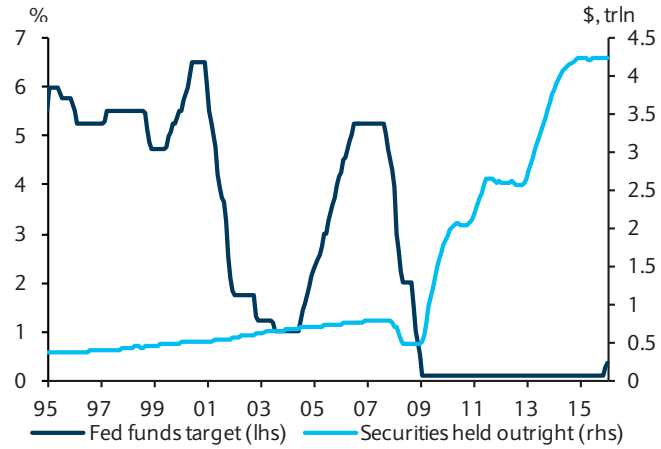
Lower r* means a slower, softer policy cycle

A lower equilibrium rate implies a lower target rate for monetary policy

A lower level of the natural rate of interest rate has immediate implications for the current policy cycle. With a lower equilibrium rate at every point, the target rate for monetary policy will also be lower. This is true in the US, where the pace of policy withdrawal is estimated by FOMC participants to be less than half as fast as previous tightening cycles, and also in Europe and Japan, where the expectation is that policy rates will be at (or below) zero for some time. Moving away from the broader context of the business cycle model, consider the classic Taylor rule, which has become the benchmark for judging the relative tightness or looseness of monetary policy. Although never intended to be prescriptive (in any case, no central bank would follow such a simple framework mechanically) the equation provides a simple framework to assess the appropriate stance of monetary policy and how that policy stance might change when potential growth and the natural rate of interest change. Here we focus on the US to illustrate these dynamics and note that the same analysis applies to the other countries in our sample.

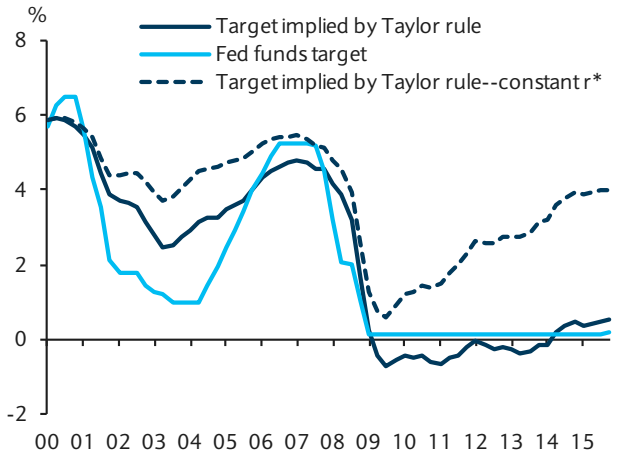
The Taylor rule states that today's policy rate, r, is determined by the natural rate, r*, the distance between inflation and the inflation target, and the distance between output and potential output. Here, the traditional view from the Taylor rule is in nominal rates and so we substitute n and n* to denote the optimal level for the central bank's target and a

FIGURE 7
The Fed's balance sheet ballooned when it hit the ZLB



Source: Federal Reserve, Haver Analytics

FIGURE 8
The Taylor rule policy rate remained below zero for an extended period



Source: Federal Reserve, Haver Analytics, Barclays Research

[12] Laubach, Thomas and John C. Williams, 2001, "Measuring the natural rate of interest." Also see Janet Yellen, "The Economic Outlook and Monetary Policy," December 2, 2015.

nominal version of r*. The Taylor rule is defined:[13]

$$n = n^* + \theta * (\pi - \pi^*) + \varphi * (y - y^*)$$

Our estimate of US r corresponds quite well to actual policy outcomes*

If we assume that both inflation and output are close to target and the Fed desires to keep them there, the Fed's policy rate should be close to r*. Should r* move lower, either permanently or temporarily, the equilibrium policy rate should also be lower. In other words, a lower level of r* and slower potential growth implies that for output and inflation to be balanced the policy rate must also be lower. It also implies that any given level of the policy rate is actually tighter than it would have been a few years ago

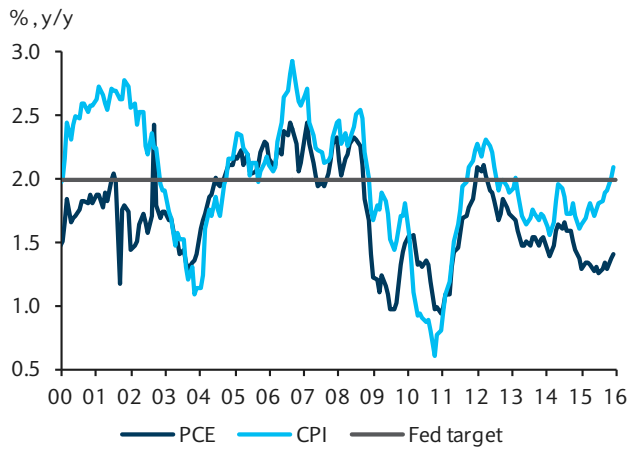
How easy is US interest rate policy?

The fed funds rate has been mired near zero for a long time, even as growth has remained quite low relative to its historical average. This combination has led some observers to conclude that monetary policy is no longer effective. However, in our framework, what matters for changing growth rates or output is not so much the level of the interest rate but the distance of the policy rate from its natural rate. From an investment perspective, an interest rate is only "low" if it is below the rate of return.

We assume that the natural rate of interest estimated below represents the required rate of return, the price that balances the supply of savings with demand for borrowing. Therefore, monetary policy is not nearly as accommodative as one might think from the level of interest rates. Of course, the level of interest rates does not fully reflect the entire stance of monetary policy, which requires understanding the effects of the expansion of central bank balance sheets. For example, as Figure 7 shows, the Fed pushed its target rate to zero in early 2009 and then launched a $3.5trn asset purchase program.

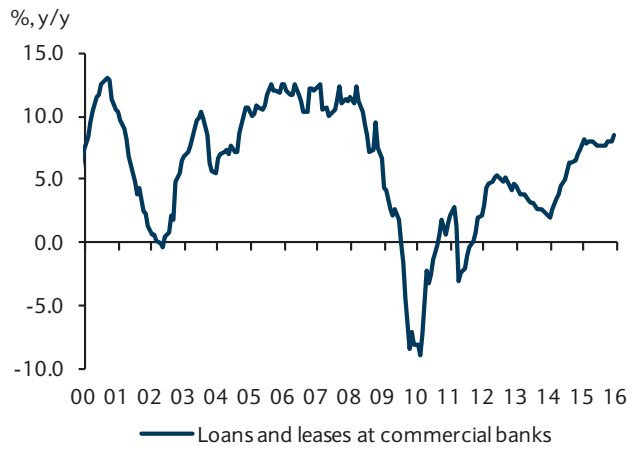
Nonetheless, and to the extent that we can safely make statements about the stance of interest rate policy separate from balance sheet policy, we use the Taylor rule in Figure 8, applying our estimates of the output gap and r* from our model. For inflation we use the four-quarter change in core PCE inflation. The solid black line shows the nominal policy rate as implied by this Taylor rule. Although a policy rate of zero seems to be very easy monetary policy, we can see from the path of the solid dark line that the zero lower bound is binding on the Fed from early 2009 until early 2014. In an unconstrained world, the Fed would have

FIGURE 9
Core inflation has remained soft, despite low rates



Note: The FOMC did not formally adopt an inflation target until 2012.
Source: BLS, Haver Analytics, Barclays Research

FIGURE 10
Credit growth was slow to rebound, despite low interest rates



Source: Federal Reserve, Haver Analytics

[13] The weights on the inflation and output gap are unknown parameters and the subject of intense debate among economists. Theory does not provide a tight guide for the relative weight of inflation and activity in conducting monetary policy. Empirical estimates are imprecisely estimated because the two gaps tend to move together. As we discussed in *Two minds are not better than one*, this lack of guidance drove some of the divergence among FOMC members last year, as those who placed more weight on activity were ready to hike rates and those who placed more weight on inflation were content to hold fast. We do not take a strong stand and simply follow early research to assume that the FOMC's objective function places equal weight on the inflation and output gaps.

moved the policy rate even lower, which of course is the reason it implemented the asset purchase program. Notably, the implied policy path rose above zero in early 2014. This is consistent with the Fed beginning to taper its asset purchases in December 2013. The movement above zero also explains why Chair Yellen began discussing liftoff in late 2014. With the implied policy rate rising, inaction in monetary policy was actually leading to "looser" policy from the perspective of a simple Taylor rule.

*Low inflation and slow loan growth in the US until 2014 are consistent with a drop in r**

The Taylor rule also sheds light on the policy path in the mid-2000s. Following the 2000 recession, the Fed cut policy aggressively, much faster than the pace implied by the Taylor rule. In 2004, the Fed began its "gradual and measured" rate hike cycle, boosting the policy rate by 25bp at each meeting. One reason for the easy credit conditions and the booming housing market was that the Fed was substantially behind on its rate hike cycle. It was not until late 2005 that the policy became neutral, and it ended up being tight by the time the recession began to emerge. Another reason that Chair Yellen was eager to begin the rate hike cycle was that she believes policy was tightened too slowly in the 2000s.

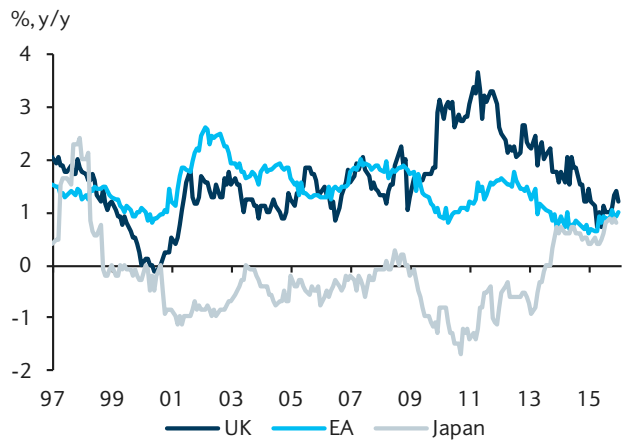
What if r* in the US did not decline

The main reason policy has been able to stay at zero for an extended period without being "too easy" is the substantial decline in r* that has occurred since 2000. The dashed line in Figure 8 shows the interest rate implied by the Taylor rule if r* is held constant at its 2000 level. With this higher level of r*, the policy rate never even falls to zero but rather falls to about the low point of the actual 2000s cycle before rising steadily from 2009. This view of the optimal policy rate likely contributed to some of the very hawkish statements by FOMC members early in the recovery. Using a constant r*, the gradual improvement in the US economy after the recession is evident. As the output gap gradually closes, the Taylor rule implies gradually higher policy rates. Without the decline in r*, the neutral policy rate would currently be close to 4% and monetary policy would be extremely accommodative.

Of course, r* is not truly observable. As a result, the consensus view that r* has fallen since 2000 might be wrong. However, if that were the case, we would expect both inflation and lending to be strong. As Figure 9 shows, when the Fed was slow to normalize rates in the 2000s, both core CPI and PCE inflation moved above 2% and remained at that level until the recession. Since 2008, inflation has remained mired stubbornly below the Fed's target rate. Even with the added expansion of the balance sheet, the Fed has managed only to just support inflation, a very strong indication that policy has not been excessively loose.

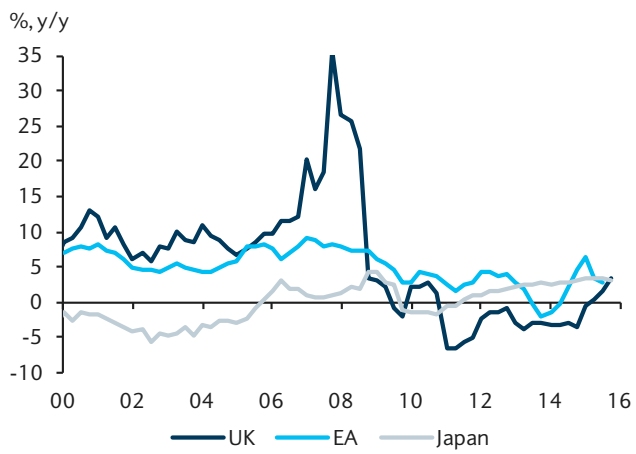
Loose policy should also lead to high credit growth. In the 2000s, for which the Taylor rule indicates loose monetary policy, total bank lending rose at a steady 12% (Figure 10). In the current recovery, with our Taylor rule showing policy as still relatively tight, loan growth is very

FIGURE 11
Global inflation remains below central bank targets



Note: Core inflation. Japanese inflation adjusted for effects of 2014 VAT increase.
Source: ONS, ECB, MIC, Haver Analytics, Barclays Research

FIGURE 12
Outside of Japan, lending growth is below pre-crisis levels



Note: Nominal bank lending growth. Source: BoE, Eurostat, BoJ, Haver Analytics

low or negative. It has become consistently positive as policy has moved toward neutral and, in early 2014, as the Taylor rule rate moved above the actual policy rate, loan growth began to accelerate. Because the Taylor rule does not take loan growth into account, the acceleration in lending serves as partial independent confirmation of the relative stance of monetary policy.

Soft lending and inflation data in the UK, Germany, and Japan are also consistent with a low natural rate of interest

A similar story can be found in the inflation and bank lending data of Europe, the UK, and Japan. In Japan, core inflation was mired below zero for much of the past decade, but inflation in Europe and the UK remained near central bank targets until the recession (Figure 11). Since 2011, inflation in these economies has drifted lower while, in Japan, unconventional balance sheet policies were successful at pushing inflation (adjusted for the effects of the 2014 VAT hike) above zero. The fact that inflation remains at or somewhat below targets is indicative of less stimulative monetary policy; a result that would occur if the equilibrium policy rate had fallen. Loan growth has also been virtually flat in these countries since 2009 (Figure 12), further indicating that interest rate policy was not sufficiently loose.

The real cost of borrowing for US firms has tracked the slowdown in potential GDP

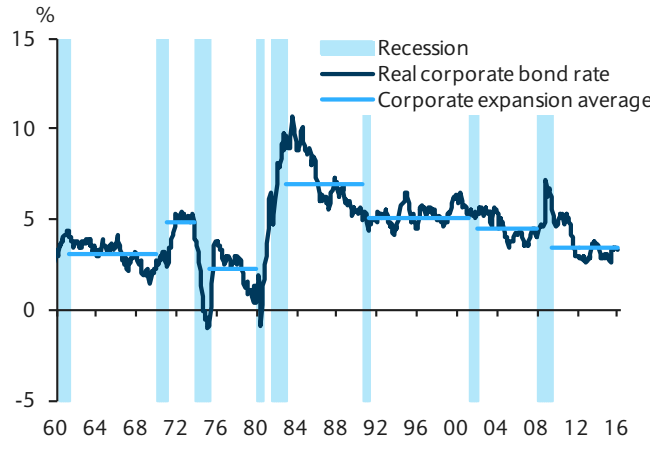
Finally, another way of thinking about the level of monetary policy accommodation is through actual costs of capital. The real cost of borrowing for US firms has declined substantially since the early 1980s (Figure 13). The blue lines in the figure indicate that corporate borrowing rates stepped down after the last recession, consistent with our step down in the r* and the decline in the real fed funds rate. If the decline in corporate borrowing owed to accommodative policy rather than to a decline in r*, we would expect a surge in capital investment.[14] Investment as a percentage of GDP (Figure 14) recovered quickly after the recession but did not boom and remains just below its pre-recession average. Altogether, we find the behavior of realized inflation, loan growth, cost of capital, and investment following the recession consistent with our estimates of a lower natural rate of interest.

With low r*, the zero lower bound is omnipresent

If current beliefs about the likely evolution of the natural rate of interest prove true, actual interest rates should remain much lower than past averages over the next decade. Furthermore, because our view on low interest rates is driven, in part, by estimates of lower potential growth, the possibility that recessions are likely to be more common than in the past may cause the lower bound to be reached more frequently. In Japan, average growth dropped from an average of 4.5% in the 1980s to 0.7% over the past 20 years. Over that period, GDP growth turned negative 17 times (on five occasions the decline was sufficient

FIGURE 13

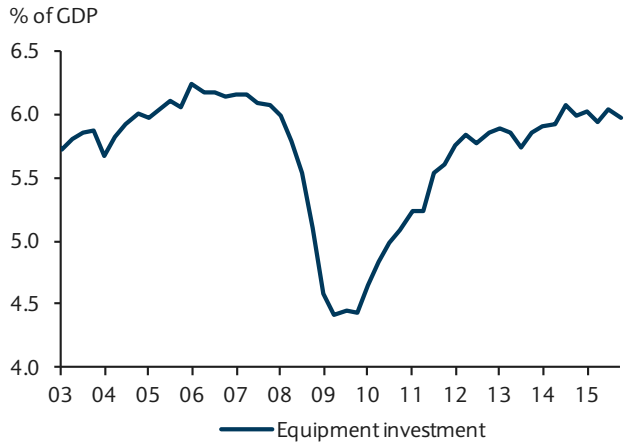
Real US corporate borrowing rates stepped down after the last recession



Note: US Baa corporate bond rate deflated by y/y core CPI inflation. Expansion average is the average rate 6 months after start of expansion to next recession.
Source: Moody's, Haver Analytics, Barclays Research

FIGURE 14

US equipment investment recovered after the recession but did not boom



Source: BEA, Haver Analytics, Barclays Research

[14] Recall, a fall in r* also reflects a fall in the marginal product of capital (MPK) or the return firms receive for investing in an extra unit of capital. If the cost of borrowing is below the MPK, firms can boost profit by borrowing to expand.

to pull the four-quarter growth rate negative). In such circumstances, either the reaction function of central banks must change or central banks will frequently find themselves at the zero lower bound.[15] However, low growth alone need not imply more recessions.

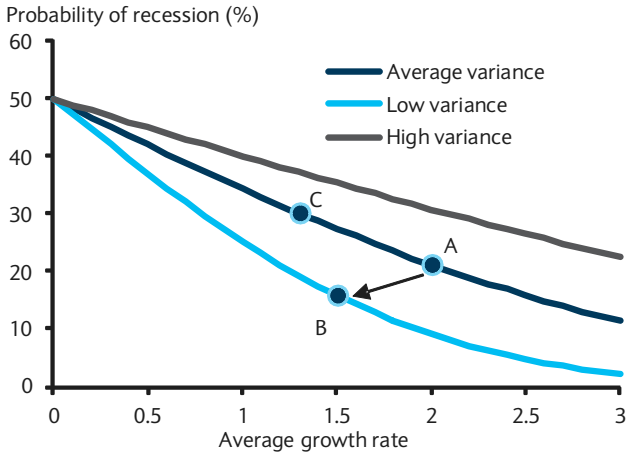
A low natural rate of interest and slow nominal output growth imply more frequent zero lower-bound episodes

How often the zero lower bound would bind is difficult to assess, with the frequency of the constraint depending on the level of inflation, interest rates, growth, the variance of growth, and the reaction function of the central bank. In 1999, predating much of the slowdown in US potential growth, David Reifschneider and John Williams[16] (now president of the San Francisco Federal Reserve) used the Federal Reserve's large-scale economic model, FRB/US, to evaluate the likelihood that monetary policy would be constrained by the zero lower bound. Following a standard Taylor rule with an inflation target of 2%, the federal funds rate would be near zero about 5% of the time and each of these episodes would last four quarters. Their results also suggested that the zero lower bound would have relatively minor effects on macroeconomic performance, although inflation often moved negative for long periods under their policy assumptions. Although this paper is widely cited, post-recession work by the San Francisco Federal Reserve finds that these early studies substantially underestimate both the probability of hitting the zero lower bound and the economic costs of having monetary policy constrained by the zero lower bound.[17]

The main difference in the two studies by the same authors generating a substantially different probability of hitting the zero lower bound has to do with the decline in the average growth rate of the economy and, of course, the level of interest rates.[18] Turning to growth first, if the variance in the economy does not change and the average growth rate declines, the probability of negative growth increases. Figure 15 shows the probability of recession as a function of the average growth rate of the economy.[19] As the growth rate

FIGURE 15

For any given level of variance, the probability of recession rises with slower rates of growth…



Note: Low variance 1.5, average variance 2.5, high variance 4. Source: Barclays Research

FIGURE 16

…but a reduction in the variance of growth may mean recession probability has actually declined (%)

Since	Average growth	Std deviation	Recession prob	Recssion prob avg variance
United States				
1947	3.2	3.9	21	10
1985	2.6	2.4	14	15
1990	2.4	2.5	16	17
2010	2.1	1.7	10	20
United Kingdom				
1955	2.5	3.9	26	19
1985	2.2	2.8	22	22
1990	2.0	2.4	20	24
2010	1.8	2.5	23	26
Japan				
1980	2.0	4.5	32	32
1985	2.0	4.5	32	32
1990	1.0	4.2	40	41
2010	0.9	4.4	42	42

Source: BEA,CAO, ONS, Barclays Research

[15] The zero lower bound does not strictly apply. Several central banks have moved their policy rate well below zero.. The ability to set the policy rate below zero derives from the costs of holding cash. These costs seem to be much larger than were generally believed before the last recession. Indeed, as late as 2010 several central banks, including the ECB, that have since implemented negative deposit rates believed that the effective zero lower bound was zero or slightly positive. Nonetheless, should interest rates move too low, banks and other deposit holders would begin to move money outside the banking system, preferring to hold cash in lieu of paying negative rates. Therefore, most economists believe there is a floor below which policy rates cannot be moved. Although we do not know the FOMC's current belief on this lower bound, in the 2016 CCAR stress tests, the Federal Reserve required banks to assume an extended period in which 3-month rates were held at -50bp, implying that Fed staff believe policy rates at that level are likely given a sufficiently adverse shock to the US economy.

[16] Reifschneider, David, and John C. Williams (1999) "Three Lessons for Monetary Policy in a Low Inflation Era," FEDS 199944 http://www.federalreserve.gov/pubs/feds/1999/199944/199944pap.pdf

[17] Chung, Hess, Jean-Philippe Laforte, David Reifschneider, and John C. Williams (2011) "Have we underestimated the likelihood and severity of zero lower bound events?" Federal Reserve Bank of san Francisco Working Paper, 2011-01 *http://w*ww.frbsf.org/economic-research/files/wp11-01bk.pdf

[18] Estimates of the unconditional variance of the economy have not changed substantially since 1999 in FRBUS. The long-run level of the fed funds rate estimated in FRBUS has only fallen slightly over time.

[19] We assume, for the purposes of this exercise, that innovations to growth are normally distributed and that therefore the mean and variance describe the full distribution of potential outcomes.

falls toward zero, the probability of recession in any year rises to 50% (think of the case of Japan). At zero growth, assuming positive and negative shocks are symmetric, the probability of negative growth in any period is 50%, independent of the variance. Effectively, Reifschnieder and Williams consider the case of an economy sliding along one of the variance curves as growth slows (say from point A to point C).

However, lower growth does not necessarily lead to a higher probability of recession. Low-variance economies have a lower probability of recession than those with high variance. As a result, if an economy undergoes a sufficiently large reduction in variance that coincides with the decrease in average growth rate, the probability of recession can decline. For example, an economy that moved from average variance and 2% growth (point A) moved to low variance and 1.5% growth (point B), the probability of recession would fall from around 20% to 15%. Falling growth and variance tends to be the US experience.

However, a shift toward service sector value added may mean growth is more stable at lower rates; slow growth need not coincide with a higher frequency of recessions

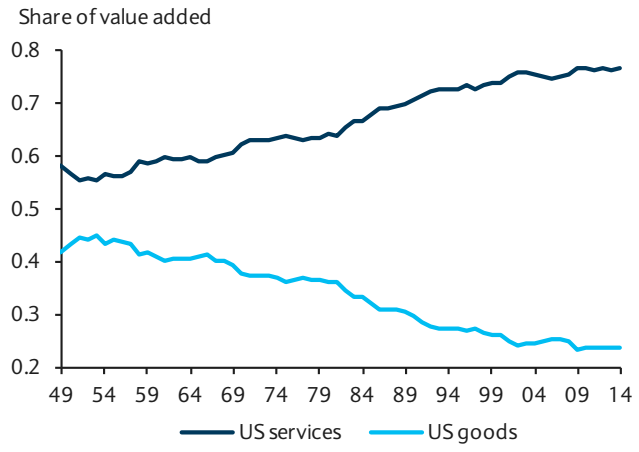
This story fits the US economy, where the average growth rate and variance output have declined over time. Figure 16 give the results of this exercise using actual GDP data. Row 1 of the table shows that the average growth rate of the economy since 1947 was 3.2% and the standard deviation of output over the same period was 3.9%. This implies an unconditional recession probability of 21%. Of course, this high frequency of recession owed to the very volatile years immediately after WWII. From 1985 to the present, a period that includes the Great Moderation, the average growth rate of the economy fell to 2.6% and the standard deviation of output growth fell from 3.9 to 2.4. Because the volatility of output also fell, the probability of recession declined from 21% to 14%. Likewise, since 2010, the average growth rate of the economy has declined further, to 2.1%, but the volatility fell even further, implying that the unconditional probability of recession declined to about 10%.

The sample since 2010 is quite short and we do not expect volatility to stay repressed for an extended period, but the data are nevertheless instructive. Should the variance of output rise, the probability of recession would increase as well. Although we see much of the decline in variance as structural, we believe the standard deviation in the last row of the table somewhat overstates the decline. If, as shown in the last column of the table, we compute recession probability using the average standard deviation since 1990, the probability of recession rises to 20%. We would estimate that the unconditional probability of recession lies somewhere between 10 and 20%, or not substantially different from previous decades.

However, even if the probability of a recession is much lower, the probability of hitting the ZLB remains elevated. Because r* is lower and the FOMC's inflation target is unchanged, the Fed has less room to lower its policy rate when recessions occur. Since the Fed has typically cut the fed funds rate by more than 4pp during recessions, the zero lower bound is very likely to

FIGURE 17

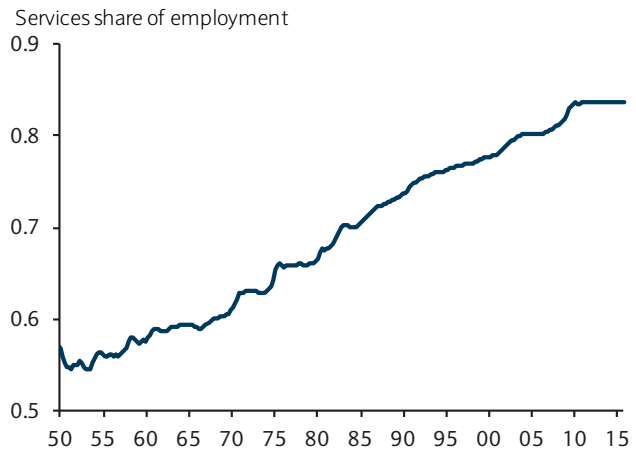
The share of services value added in US GDP has risen…



Source: BEA, Haver Analytics

FIGURE 18

…as has the share of US services employment



Source: BLS, Haver Analytics

be reached anytime r* is near 2%. Whether or not the frequent periods of hitting the ZLB are costly depends on the efficacy of the Fed's alternative tools. Reaching the ZLB requires the deployment of unconventional monetary policies, such as balance sheet expansion. If these tools are effective, the ZLB is a constraint on policy rates but not on monetary policy itself. If balance sheet expansion is less effective or if such tools are subject to diminishing returns, monetary policy itself will be constrained and economic outcomes may be less optimal.

Is slow growth, low volatility a structural shift?

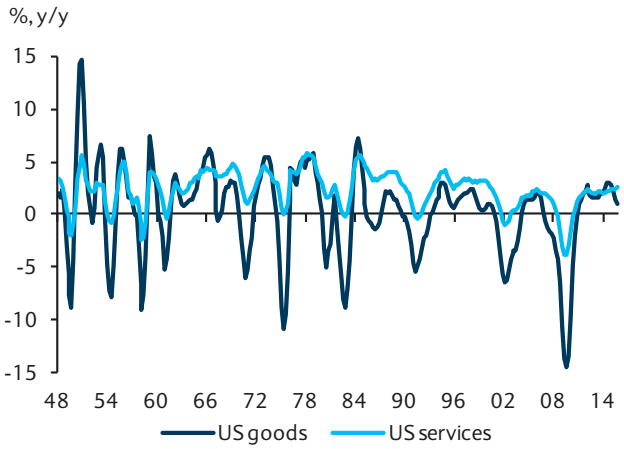
In a 2004 speech, then-Fed Governor Ben Bernanke provided three possible explanations for the overall decline in volatility: structural changes, improved macroeconomic policies, and good luck. In this section, we focus on structural changes to the economy. We believe that both luck and policy have helped reduce macroeconomic volatility; however, changes in these aspects of the economy are difficult to measure. Instead, we focus on structural changes.

We think the economic shift from manufacturing to services has substantively contributed to the decline in volatility in US output. Services rose from 55% of value added in GDP just after WWII to more than 75% of value added in 2014 (Figure 17). Value added data is available only annually for the US. To proxy for the relative output of goods and services and allow us to study within-year cyclical effects, we use employment in the two sectors. The rise in value added has coincided with a rise in the services share of employment (Figure 18). The rise in services share is not just a US phenomenon but is a common feature across developed countries.

Figure 19 shows the y/y change in both goods and services employment. Goods employment is substantially more volatile than services employment. Even before the trend decline in total goods employment, goods employment tended to have periods of rapid outright declines. Services employment growth tends to slow at those times, but rarely posts large drops. Until the late 1990s, goods employment also grew faster during expansions. As a result of these deeper lows and higher highs, the five-year rolling standard deviation of goods employment (Figure 20) averages more than 2½ times the standard deviation of services employment.

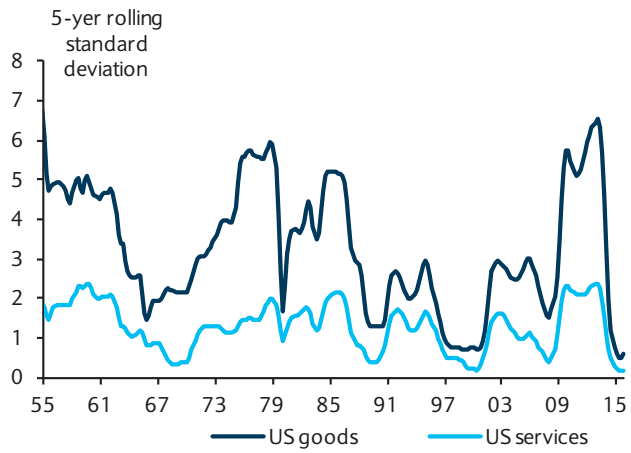
The average volatility in the economy has declined as the volatility of both series has declined slightly, but the largest driver of the overall decline was the shift in weight from goods employment to services. At present, the volatility of both series is close to an all-time low; we expect volatility to rise modestly in the near term.

FIGURE 19
Goods employment has sharp downs and fast ups



Source: BLS, Haver Analytics

FIGURE 20
The standard deviation is greater for goods employment



Source: BLS, Haver Analytics

Appendix: US business cycle framework

Potential output, the output gap, the natural rate of unemployment, and the natural rate of interest are key variables in understanding 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 and cycle estimates. The framework applied to the US in this analysis constructs estimates of the unobserved variables above using a multivariate approach; inputs on working hours, output, employment, unemployment, and the labor force are used in a multivariate framework to break down potential output growth into its components.[20] The framework is similar in structure to that in "The great destruction," *Equity Gilt Study 2015*, but we have altered the specifications of some variables and added terms to estimate the real equilibrium rate of interest.

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.[21] 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 of the inputs with contemporaneous and, in some cases, lagged effects, while each variable is permitted to have its own unique trend. In addition, we assume a partial-adjustment process that allows for rigidities or other adjustment costs that prevent variables from fully adjusting in the current period in response to cyclical shocks.

The US multivariate framework

Our 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.[22,23] The framework assumes the residuals are measurement errors that can be broken down into the sum of a common component and idiosyncratic components. Potential output and nonfarm

[20] 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.

[21] 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.

[22] 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.

[23] 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.

business output can be further broken down into component parts according to

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

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

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

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

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

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, cycle, and partial adjustment term according to

$$ENFB_t = ENFB_t^* + \gamma_{20} cyc_t + \varphi_2(ENFB_{t-1} - ENFB_{t-1}^*) + u_{5t}$$

$$WW_t = WW_t^* + \gamma_{30} cyc_t + \gamma_{31}(cyc_t - cyc_{t-1}) + \varphi_3(WW_{t-1} - WW_{t-1}^*) + u_{6t}$$

$$ER_t = ER_t^* + \gamma_{40} cyc_t + \varphi_4(ER_{t-1} - ER_{t-1}^*) + u_{7t}$$

$$LFRP_t = LFPR_t^* + \gamma_{50} cyc_t + \varphi_5(LFPR_{t-1} - LFPR_{t-1}^*) + u_{8t}$$

where the framework allows for some deviation between shocks to output and the response of employment hours and labor force participation. The idea behind the partial adjustment formulation is that the observed variable may be related to its trend, but there may also be inertia in the system such that the observed value is a compromise between its value in the previous period and the value justified by the current trend. The coefficient φ describes the speed of adjustment between periods where a value of 0 indicates no adjustment and a value of 1 indicates full adjustment from the current period. The rationale for this specification is similar to the one we used to justify including lags of the cycle; adjustment costs may mean firms find it costly to adjust the factors of production so that changes in labor market activity may lag changes in output. If present, these adjustment costs could preclude full adjustment from one period to the next.

Finally, the Phillips curve is given by

$$DPCXFE_t = \alpha_1 DPCXFE_{t-1} + (1 - \alpha_1)PTR_t + \beta_{11}(L)drpe_{t-1} + \beta_{12}(L)d85_t drpe_{t-1}$$

$$+\beta_2(L)drpi_t + \theta(\gamma_{20} cyc_t + \gamma_{21} cyc_{t-1} + \gamma_{22} cyc_{t-2}) + u_{9t}$$

where $DPCXFE$ is the change in core PCE inflation, PTR is a measure of long-run inflation expectations, $drpe$ 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. Like Roberts (2014) we constrain the sum of the coefficients on lagged inflation and PTR to be equal to one. The inflation equation also assumes cyclical deviations in output from its trend affect inflation.

Natural rate of interest

The specification for the natural rate of interest is similar to that in Laubach and Williams (2001)[24]. Since the Federal Reserve and, indeed, nearly all major central banks use a short-term interest rate as the primary tool of policy, it is useful to estimate the natural rate of

[24] Laubach, Thomas and John C. Williams, 2001, "Measuring the natural rate of interest."

interest simultaneously with estimates of potential output, trend employment rate, and inflation. The advantage of this specification is that it provides a useful metric to understand the long-run stance of monetary policy. Its chief weakness is that it abstracts from many other factors that are thought to cause variations in the natural rate of interest, including, but not limited to, demographics, the "global saving glut", the safe-asset shortage, changes in the regulatory environment, inflation risk and the term premium, deleveraging, secular stagnation, and tail risks and fundamental uncertainty.[25]

Identification of the trend real rate of interest (R*) is done by relating the output gap, or estimate of the cycle, to two lags of the real interest rate gap according to

$$cyc_t = \rho_1 cyc_{t-1} + \rho_2 cyc_{t-2} + \varphi_6(R_{t-1} - R^*_{t-1}) + \varphi_6(R_{t-2} - R^*_{t-2}) + \eta_t$$

with the imposed restriction that the coefficients on the two lags of the real rate gap are the same (Laubach and Williams (2001) makes a similar assumption). Because the output gap in most empirical studies is characterized as an AR(2) process, we specify two lags of the interest rate gap. To construct an estimate of the real policy rate (R), we subtract the measure of long-run inflation expectations (PTR) from the effective federal funds rate. The model is estimated using quarterly data from Q1 1967Q1 to Q3 2015 using maximum-likelihood techniques in the state-space model estimation framework in Eviews.

[25] See "Long-term interest rates: A Survey", 2005, Council of Economic Advisors, July. Also see Bernanke, Ben S., 2013, "Long-term interest rates," Annual Monetary/Macroeconomics Conference: The Past and Future of Monetary Policy, San Francisco, March.

CHAPTER 3

Negative ascent: Life amid negative nominal interest rates

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- **Negative nominal interest rates are more than just a passing monetary fad. In a world with persistent and pervasive negative real risk-free interest rates and "Missingflation", they may be the only tool available to central banks that can stimulate moribund economies.**
- **Three key frictions differentiate negative nominal rates from positive rates and will challenge policymakers: 1) currency as an alternative; 2) "money illusion" – an aversion to nominal losses – and its politics; and 3) long-term nominal commitments of pensions and insurers. While the former two are better known, the latter may be more determinative of the "negative lower bound" in some economies.**
- **Uncertainty over the negative lower bound, the above-mentioned frictions, and reduced wealth effects due to money illusion may dampen the impact of interest rate cuts below zero relative to similar moves in positive territory.**
- **But well designed tiering of negative rates on bank reserves can work around some of these frictions and provide powerful new tools for central banks to stimulate lending to the non-financial sector.**

In a frictionless world, there would be no difference between negative nominal interest rates and positive interest rates; only the sign would change. Negative nominal rates (NNR) would be just another number. But the world is not frictionless. The existence of nominal rigidities – including "money illusion", currency as an alternative, and long-lived nominal liabilities – means that, in practice, the impact on the economy and asset prices of NNR may differ greatly from the effect of positive interest rates.

Yet, negative nominal rates appear to be ascendant. Pervasive low or negative real interest rates, "Missingflation", and the unclear success of other "unconventional" monetary policies to address declining inflation have led several developed economy central banks to experiment with NNR as a policy tool. So far – in chronological order – the Danmarks Nationalbank (DNB), the European Central Bank (ECB), the Swedish Riksbank, the Swiss National Bank (SNB)[1], and the Bank of Japan (BoJ) have instituted some form of NNR, while the Bank of England (BoE), Bank of Canada (BoC) and Federal Reserve (Fed) all have publicly discussed NNR's potential as a policy tool should conditions merit their use.

We examine the implications of a world of NNR. We start with an exploration of why central banks are increasingly turning from other unconventional policies to NNR. Next, we look at the nominal frictions that might impair the efficacy of NNR – the existence of notes and coins, the politics of money illusion, legacy long-term nominal liabilities, and the transactions demand for money – and how those may determine the "negative lower bound" (NLB) for interest rates. Finally, we turn to what NNR and those frictions mean for monetary policy, fiscal sustainability, banking, asset management, asset pricing, and foreign exchange.

[1] Here we refer to this economic cycle. The SNB was the first to experiment with NNR in the 1970s.

The economics of negative nominal rates

The policy case for negative nominal rates

Negative rates are consequence of 'missingflation'…

The turn to NNR by a handful of central banks has its roots in recent extraordinary economic circumstances. Most developed economies are operating below capacity, with persistently below-target and falling core inflation (Figure 1, *Chapter 1: The fight to bring back inflation*). This situation has endured despite zero or near-zero nominal policy rates and a variety of unorthodox policy measures over the past eight years. With 5y risk-free real interest rates mired at or below zero since the global financial crisis (GFC) and "Missingflation" threatening to raise them, despite historically low nominal interest rates, central banks need a new weapon in their fight against disinflation and stagnation (Figure 2).

In "normal" circumstances, central banks would cut nominal short-term interest rates, which, in the presence of sticky prices, would lower real interest rates to make capital investment more attractive and stimulate economic activity to absorb excess capacity and put upward pressure on inflation. But the GFC presented central banks with an unusually difficult situation.

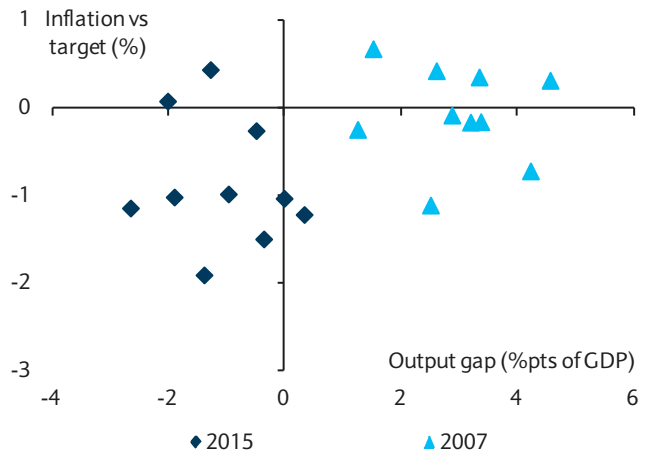
…and the need to push real rates lower

Because of the unusually large contraction in output and years of pre-GFC overinvestment, the marginal product of capital (MPK) of available investment projects fell for even long-horizon projects. At the same time, an overhang of excessive leverage, combined with the severe adverse shock to real incomes and wealth, pushed risk premia higher. Even with nominal policy rates cut to zero, central banks could not get real borrowing costs low enough to make capital investment attractive (Figure 3; for simplicity, Figures 3, 4 and 8 assume zero inflation, so nominal and real rates are equivalent).

Unconventional monetary policies: A mixed record

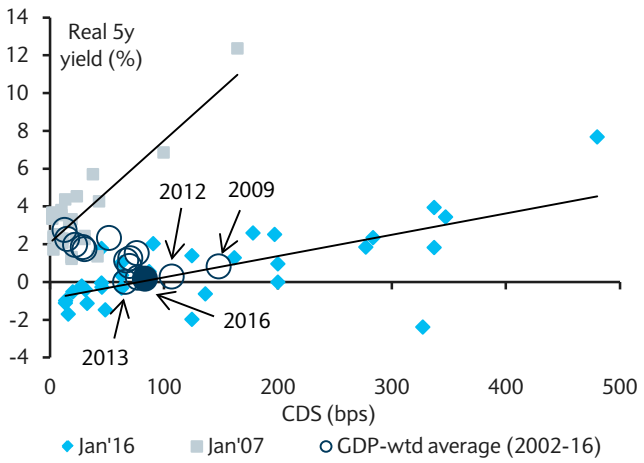
To address this problem, central banks have unveiled an inventive array of unconventional monetary policies, including verbal forward guidance, quantitative easing (QE) and funding for lending schemes (FLS). Forward guidance aimed to reduce policy rate expectations and to decrease term premia and risk premia by diminishing uncertainty about future economic outcomes. However, to be truly effective, forward guidance required a credible commitment to keep rates low even if the economy improved.[2]

FIGURE 1
G10 core-inflation deviation from target versus output gaps



Source: Haver Analytics, Barclays Research

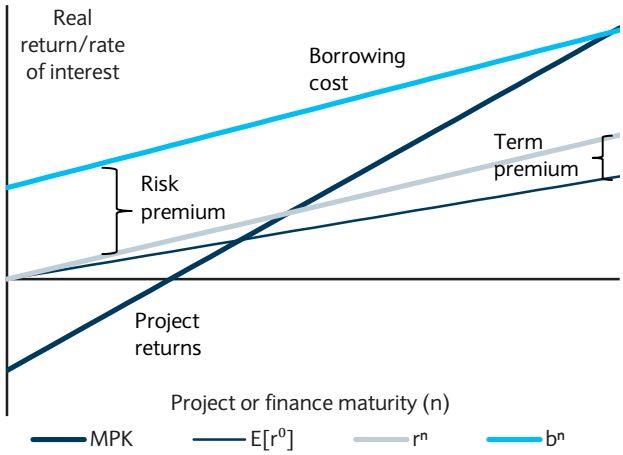
FIGURE 2
Global real interest rates versus sovereign risk premium



Source: Bloomberg, IMF, Barclays Research

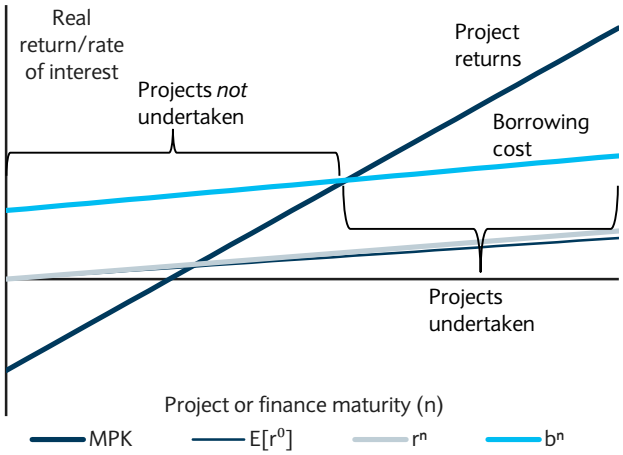
[2] The academic literature distinguishes between "Delphic" forward guidance that is based on forecasts, but reversible, and "Odyssian" forward guidance that includes a commitment not to change policy even if economic circumstances change. Since no central bank can credibly commit not to change course if the economy improves, a better example of Odyssian forward guidance is QE, as it is less easily reversible and is an effective commitment to lower for longer policy rates. See Campbell, Evans, Fisher, and Justiniano, 2012, "Macroeconomic Effects of Federal Reserve Forward Guidance," Brookings Papers on Economic Activity, vol. 44(1), pp. 1-80.

FIGURE 3
Stylized real returns and financing conditions post GFC



Note: MPK: marginal product of capital for a project with an n-year life; E[r^0]: the expected path of short-term interest rates; r^n: the yield on a default risk-free bond of maturity n years; b^n: rate of interest on a bank loan or corporate bond of maturity n years. Source: Barclays Research

FIGURE 4
With forward guidance, QE and funding for lending



Note: MPK: marginal product of capital for a project with an n-year life; E[r^0]: the expected path of short-term interest rates; r^n: the yield on a default risk-free bond of maturity n years; b^n: rate of interest on a bank loan or corporate bond of maturity n years. Source: Barclays Research

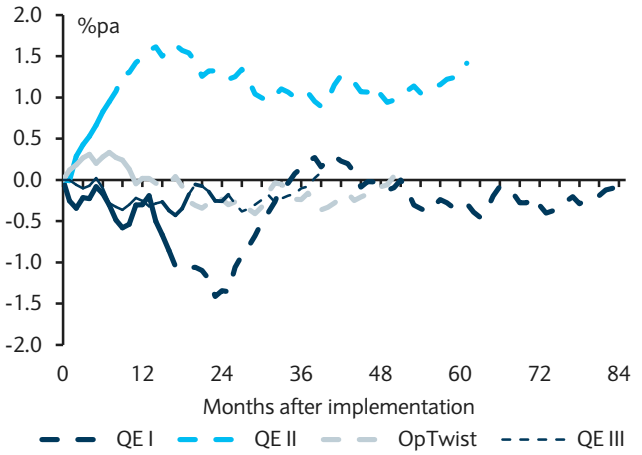
QE provided a more powerful tool for flattening yield curves and reducing risk premia. It implied an "Odyssian" commitment to a lower-for-longer path for policy rates, demonstrated a "whatever it takes" commitment to raising inflation, further reducing uncertainty, and created a portfolio balance shift to longer-duration and higher-risk securities. Academic studies validate that all of these channels worked to varying degrees, albeit they are state contingent (that is, they do not work in all situations).[3] In effect, QE flattened the term structure of sovereign interest rates and reduced risk premia.

QE policies managed to compress risk spreads and flatten yield curves

Some central banks also introduced FLS or non-sovereign bond purchase programs that put downward pressure on credit spreads in specific sectors (eg, mortgages or small business lending), or, like the ECB's, LTROs reduced banks' funding costs during periods of stress.

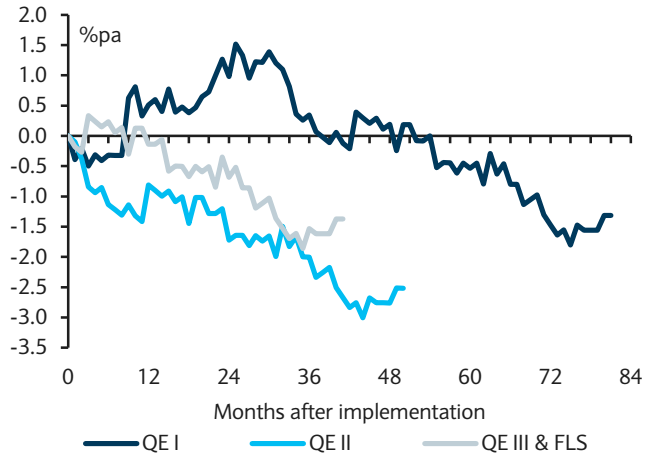
Together, these programs appear to have flattened the term structure of interest rates and compressed risk spreads, as stylized in Figure 4. The net effect was to make viable many projects that previously were not.

FIGURE 5
Change in US inflation after various policy operations



Source: Haver Analytics, Barclays Research

FIGURE 6
Change in UK inflation after various policy operations



Source: Haver Analytics, Barclays Research

[3] See M. Weale and T. Wieladek, 2016 "What are the macroeconomic effects of asset purchases?" Journal of Monetary Economics, forthcoming.

However, QE is running into limits of political and technical nature…

However, there are limits both to central banks' ability to extend these policies and their efficacy. There are technical limits on how many assets central banks can buy without distorting liquidity or giving themselves undesirable veto power in potential debt restructurings. Furthermore, in extremis, these policies may raise worries about debt monetization and undermine faith in central banks' liabilities, ie, currency (see *Three Questions: Big in Japan*, 24 February 2014). In many cases there are political limits, too. Political leaders in the US and core Europe have expressed concern about the size of central bank asset purchases. Paradoxically, if central banks buy too much government debt, they may find themselves unable to reverse their decisions if fiscal dominance threatens, or in the situation the SNB faced when Swiss voters considered forcing it to irrevocably convert a portion of its large asset holdings to gold (see *A Swiss cross of gold?* 3 November 2014).

…as central banks accumulate government debt and distort liquidity in markets…

…suggesting diminishing returns of additional QE

As these limits are approached, concerns have arisen about the policies' effectiveness, particularly on an ongoing basis. All three unconventional policies appear to have diminishing returns to scale or time. Furthermore, the academic literature suggests their impact may be state-contingent. And despite years of intense academic research, even the transmission mechanism and size of impact remain in debate.

While QE worked against financial market crisis…

…it seems less effective in creating inflation

Most important, with respect to inflation, the success of these policies has been underwhelming. In the US, QE I and QE II appear to have staved off deflation, but neither Operation Twist (the maturity extension program) nor QE III led to any sustained rise in inflation, with only a slight pick-up recently as unemployment has got to or below NAIRU (Figure 5). The UK experience was even less satisfactory: a plunge in sterling that may have been fostered by QE I fuelled a temporary rise in inflation, but QE II and the jointly undertaken QE III and FLS have been followed by persistent declines in *core* inflation (Figure 6). Only Japan's "Qualitative and Quantitative Easing" program has produced a marked improvement in subsequent inflation (Figure 7). This may be because Japan began its QQE program with a much narrower output gap, because of the program's immense size or due to the unique implied fiscal threat noted earlier. But the recent stalling of inflation and the BoJ's late turn to NNR suggest that QE has limits, even in Japan.

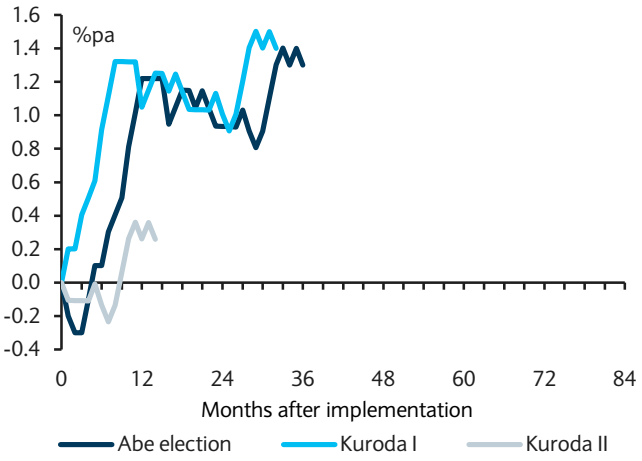
A new hope?

If equilibrium real rates are negative, nominal policy rates may need to become negative

As central banks exhaust their capacity for (or patience with) previous unconventional monetary policies, amid signs of "Missingflation" and evidence suggesting that the equilibrium real interest rate may be negative (Figure 2), NNR offers an alternative that, in theory, may solve central banks' inability to create sufficiently stimulative financial

FIGURE 7

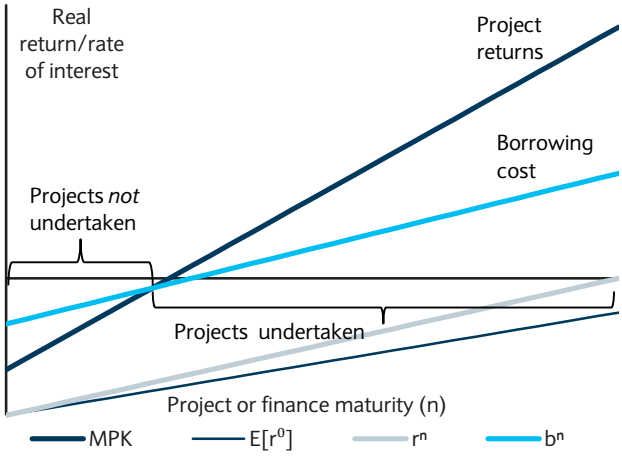
Change in Japanese inflation after various policy operations



Source: Haver Analytics, Barclays Research

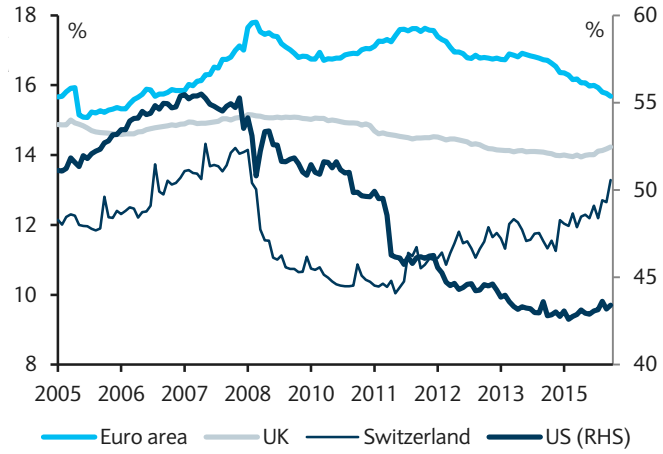
FIGURE 8

Stylized real returns and financing conditions with NNR



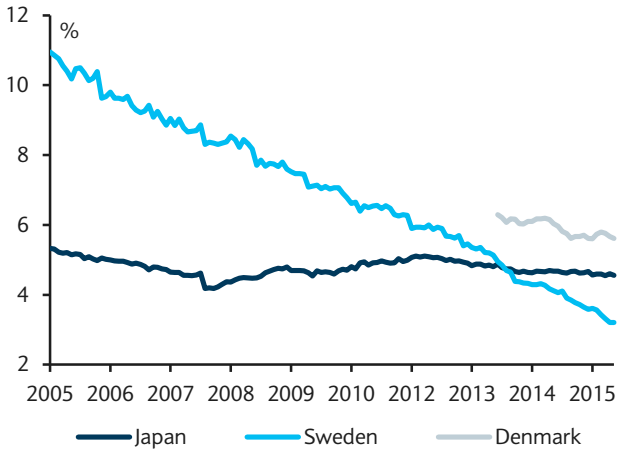
Note: MPK: marginal product of capital for a project with an n-year life; $E[r^0]$: the expected path of short-term interest rates; r^n: the yield on a default risk-free bond of maturity n years; b^n: rate of interest on a bank loan or corporate bond of maturity n years. Source: Barclays Research

FIGURE 9
Currency in circulation relative to M1 outstanding



Source: Haver Analytics, Barclays Research

FIGURE 10
Currency in circulation relative to M1 outstanding



Source: Haver Analytics, Barclays Research

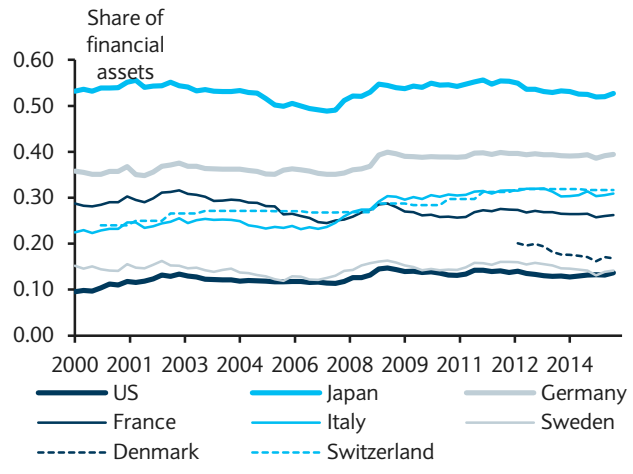
conditions to foster a more rapid return to trend growth following the GFC. By allowing the central bank to shift lower the entire structure of market rates from the front end of the curve (as they once were able to do when policy rates were significantly positive), central banks can increase the share of investment projects in the economy that are viable (Figure 8). This is the attraction of NNR.

Nominal frictions and the negative lower bound

NNRs have their own problems:
- Shift to cash holdings
- Aversion to nominal losses
- Long-term contractual nominal liabilities

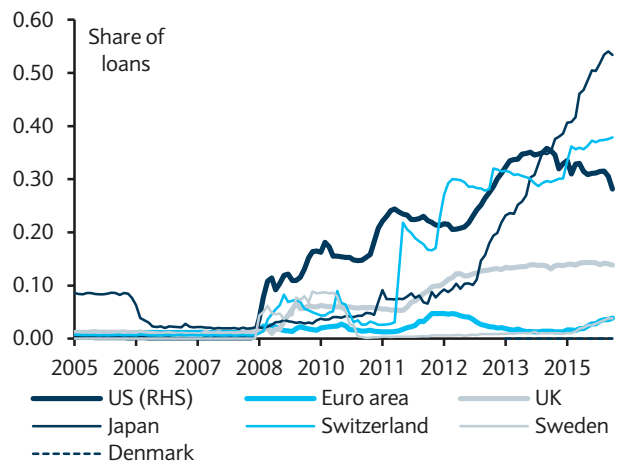
However, NNR is not without its own problems. The presence of at least three significant nominal frictions in the economy may reduce the efficacy of NNR as a policy tool and likely determine the NLB, at least initially. The first friction is the existence of pecuniary notes and coins, which offer zero nominal interest, as an alternative to costly demand deposits under NNR. The second is the politics of "money illusion", ie, an aversion to a *nominal* cost to use money even in a world of negative *real* returns. The third is the existence of long-lived nominal commitments by important economic agents, including pensions and insurers. In the long run, if NNR is to be more than a passing phenomenon, even these nominal rigidities are unlikely to determine the ultimate NLB; that likely will be determined by the real transactions value of having a multilateral medium of exchange.

FIGURE 11
Households' balance sheets: Cash share



Source: Haver Analytics, Barclays Research

FIGURE 12
Banking system deposits at central bank to total loans



Source: Haver Analytics, Barclays Research

$100 bills as zero-coupon bearer bonds

Attraction of cash in a NNR world…

The existence of paper money and coins long has underpinned the belief in a zero lower bound (ZLB) for nominal interest rates. If a central bank – or retail banks – charges interest for holding deposits, people can turn to paper money as an alternative medium of exchange without interest cost. In effect, NNR turns notes and coins into higher-yielding zero-coupon bearer bonds with a maturity of the holder's choosing. The increasing use of NNR by central banks as a policy tool has demonstrated that there is no ZLB, but the existence of notes and coins is still thought to bound NNR from below at a relatively shallow depth.

… could limit effectiveness of policy and challenges banks as intermediaries

The existence of cash as an alternative raises three potential problems for NNR. First, the impact of NNR likely would be muted as economic agents largely or entirely substituted notes and coins for deposits. Second, as depositors shifted to cash, banks may be at risk of deposit flight, which, if widespread, could lead to a collapse of the banking system. Third, even if systemic risks could be contained, the shift away from banks could lead to a breakdown in the payments system.

Empirically, there is little evidence, at least at the moderate level of NNR so far observed, that deposit flight is a significant risk. The currency share of M1 has been falling throughout the G4 and in all NNR economies except Switzerland (Figures 9 and 10). Even in Switzerland, where M1 has fallen since the imposition of NNR (and currency in circulation has risen), there does not appear to be a systemic threat, and one bank has even rolled out NNR on retail transactional deposits without significant loss of deposits.[4]

Storage costs for cash could play an important role

Although cash is an alternative to deposits, it is an imperfect substitute and its imperfections likely explain why the ZLB has proven permeable. First, cash has a storage cost, which we have estimated may be as little as 20bp but more realistically may be multiple percentage points (see *Three Questions: Quantum Evolution*, 27 January 2015). However, although fixed storage in a vault or guarded (and fire-insured) warehouse fulfils two of money's uses (a unit of account and a store of value) it fails at the third: as a medium of exchange. As transactions are increasingly carried out electronically, not just online but in "bricks-and-mortar" establishments, bank deposits as a medium of exchange are irreplaceable. Hence, although the portion of deposits that represents household savings (see below) may be withdrawn as cash, the portion that is kept for transactional balances likely will remain, even under NNR.

But withdrawing cash as savings to be stored in a vault is not as easy as it sounds, and storage costs likely are only a second- or third-order deterrent; legal restrictions are far more prohibitive. In many developed markets, large cash transactions are illegal, and in all developed countries anti-money laundering laws create serious legal risks – including indefinite asset seizure – for anyone holding or using large sums of cash.[5] Thus, withdrawing cash may not be hard, but using it or returning it to the banking system may be very difficult. For businesses, in particular, this likely means that bank deposits will remain a necessity that will support both the banking and payments systems.

It is tempting to think that storage businesses offering tradable electronic claims would arise as a result, but a business that takes cash deposits in exchange for tradable book entries sounds suspiciously like a bank and likely would run afoul of regulators. Indeed, acquiring enough cash may be difficult: there is not enough to cover M1. Aside from the US – where 50-70% of cash in circulation is abroad[6] – in no economy in Figures 9 and 10 does currency comprise more than 16% of M1, and for Japan, Denmark and Sweden it is 5% or less. Under NNR, central banks are unlikely to be incentivized to crank up the actual printing presses to fill

[4] "Swiss bank ABS plans negative interest rates for some depositors," Joshua Franklin, 16 October 2015, *Reuters*.
[5] In the US, authorities have aggressively pursued large cash users with laws that allow seizure of *any cash and bank deposits* until the accused can prove the legal sources of *all* funds, a process that can take years. See "Law Lets I.R.S. Seize Accounts on Suspicion, No Crime Required," Shaila Dewan, *The New York Times*, 25 October 2014. See also banks' legal requirements for AML reporting in "Suspicious Activity Reporting – Overview" in *Bank Secrecy Act Anti-Money Laundering Examination Manual*, Federal Financial Institutions Examination Council.
[6] "Crisis and Calm: Demand for U.S. Currency at Home and Abroad from the Fall of the Berlin Wall to 2011," Ruth Judson, November 2012, *International Finance Discussion Papers 1058*, Federal Reserve Board of Governors.

large orders for notes (as opposed to the figurative printing press for reserves). The SNB reportedly has encouraged Swiss banks *not* to accommodate cash withdrawals.[7]

Sovereign can ultimately limit avoidance-schemes (ie, flight to cash)

This last point hits upon a broader reason why the existence of notes and coins is unlikely to be the limiter of NNR, *if the sovereign backs its use by central banks*. Ultimately, the sovereign makes the rules. A determined sovereign can use myriad methods to undermine cash as an alternative, including – in the era of e-commerce – removing notes and coins from circulation altogether. While there is bound to be popular resistance to government efforts to remove cash from circulation, governments have a strong fiscal (and criminal-justice) incentive to do so as it forces the black-market economy into the light where it cannot evade taxes.

The politics of "money illusion": charging for money

Beyond whether or not sovereign peoples will support their respective central banks in restricting cash usage, a more important question determining both the future of NNR and the NLB is if they will support NNR on retail deposits, a necessary step for NNR to be effective policy at more deeply negative levels.

NNRs have not been passed on to retail depositors…

…and 'first mover ' bank could risk deposit flight

Could NNRs losses force banks to increase lending rates?

There are three key hurdles to retail NNR. First, and most important, "money illusion" – people's greater aversion to nominal losses than real losses – creates a political barrier for banks to institute NNR on retail deposits. Second, there is a "first mover" disadvantage for banks: the first bank to impose retail NNR is at risk of deposit flight (to other banks, not cash), making it difficult to initiate retail NNR in an economy. Third, and of great recent concern to markets, without retail pass-through, deeper NNR either puts banks' profitability at risk or requires them to *raise* lending rates – constricting lending – to offset the higher-than-market funding cost of deposits and negative rates incurred on liquid assets required by regulation (see Implications section for a more detailed review of the effects of NNR on banks).

Although retail depositors in most countries have in recent years faced persistent negative *real* rates of returns on their deposits, due to the "money illusion" people have a strong aversion to accepting *nominal* losses. Even low nominal interest rates – rather than negative real returns – have drawn protests against QE, particularly in high-savings countries and political constituencies. For this reason, most banks in NNR economies have resisted passing NNR on to depositors other than for institutional deposits and very large retail deposits. In several European countries, NNR is illegal on retail deposits, and some in the US Congress have questioned even the Fed's legal ability to institute negative rates on reserves of banks.[8]

Switzerland could eventually remove exemptions on retail deposits

Political constraints accentuate the "first mover" problem. Without the political problems created by money illusion, central banks as regulators could push banks to move in unison toward retail NNR. But a central bank that encourages retail banks to charge retail depositors NNR raises its political exposure and threatens its independence. Yet, events may force action. As noted above, in Switzerland the SNB has discouraged banks from providing cash to large, institutional depositors (who are exposed to NNR on deposits and market instruments). Eventually, such policies are likely to create a political debate that either will result in political legitimacy for retail NNR or lead to curtailment of the SNB's policy of NNR. Similarly, we have argued that a surge in the exchange value of the CHF may push the SNB to force banks toward retail NNR (on a largely foreign deposit base) by removing the exemptions it currently allows domestic banks from NNR on their sight deposits (reserves at the SNB).

Japanese households have very large deposit holdings

One metric of the likely political risk from NNR is the share of household financial assets that are kept in some form of deposit. Switzerland is in the middle of the pack, with about 30% of household financial assets held as bank deposits or currency, a level roughly on par with France and Italy, but significantly below the almost 40% held by German residents. However, the most politically exposed to retail NNR would appear to be the BoJ as Japanese households keep more than 50% of financial assets as currency and deposits. However, the

[7] "Negativzins: Bank verweigert Pensionskasse Bargeld-Auszahlung," Rahel Sahli, 12 March 2015, *Schweizer Radio und Fernsehen*.
[8] "Yellen Re-Examining Negative Rates; Top Lawmaker Doubts Legality," Matthew Boesler and Jana Randow, 11 February, 2016, *BloombergBusiness*.

measure is not perfect: NNR – despite not being implemented – is already attracting negative political attention in the US, the major economy with the lowest share of household financial wealth kept as deposits.

NNRs' impact on banks' net interest margins is a concern

Without the ability to pass on NNR to depositors, banks' profitability and behaviour likely will limit the depth to which NNR policy rates can fall. The compression of banks' net interest margins (NIM) by NNR is a significant concern of monetary policymakers and, more recently, of markets (see section on practical implications of NNR for banks). If banks cannot pass on NNR to their primary source of funding, depositors, not only can they not lower lending rates in line with policy rates, they may actually raise lending rates to compensate for other NNR-related costs, like the cost of their reserves at the central bank or negative yields on government securities held to meet regulatory liquidity requirements.

But there are workarounds, for policymakers and for banks, that can help extend the depth and, more important, the efficacy of NNR. For central banks, tiering of reserve deposit rates can help both to alleviate the drag on bank profits and to incentivize bank lending at lower rates. For banks, even in countries where NNR on retail deposits is illegal, increasing fees are already being instituted on retail deposits to offset the impact of policy and market NNR.

Particularly in economies where excess reserves of the banking system have been swollen by QE or other balance-sheet expansion, the drag on bank earnings from NNR can be quite significant without some form of relief. Figure 12 shows banks' deposits at central banks as a share of system-wide loans to non-financial entities. Particularly for Japan, Switzerland and the US, the shares are large and imply a huge potential drag to bank earnings in the case of NNR.

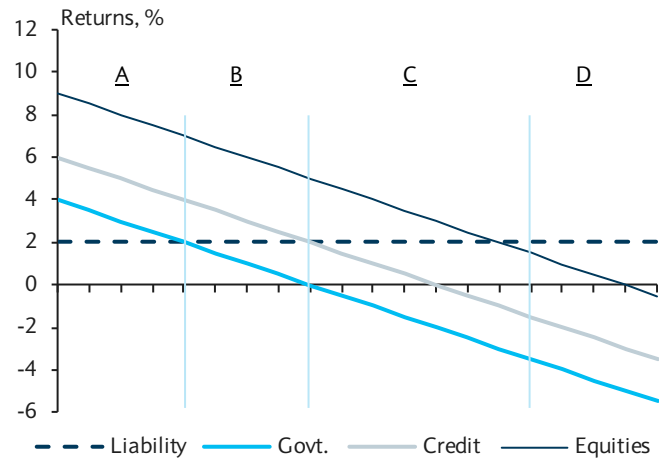
Central banks typically exempt 'excess reserves' ….

Japan's three-tier approach is another innovation

However, most central banks currently using NNR as a policy tool – the ECB being a notable exception so far – exempt a significant share of excess reserves from NNR.[9] For instance, the SNB exempts 20 times banks' required reserves as of November 2014 (the month before NNR policy began), meaning that only about a third of banks' sight deposits at the SNB are subject to NNR. The BoJ went one step further with its three-tiered approach and in the process provided an important potential tool for increasing the effectiveness of NNR for policy transmission while limiting the impact on banks' profits. An idealized version of the BoJ's three tiers might look like the following:

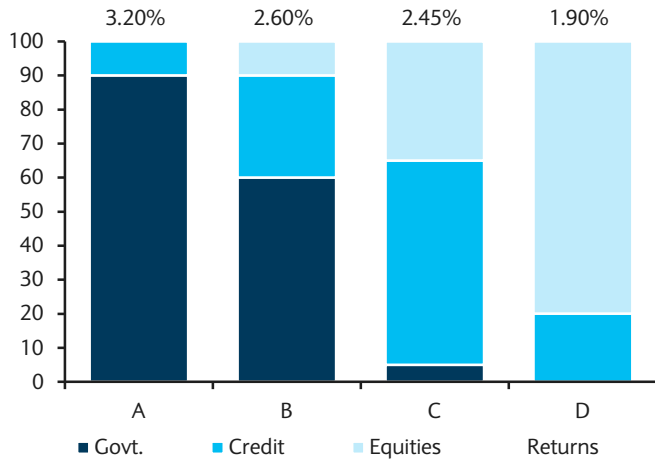
- TIER 1: An adjustable multiple of required reserves (eg, in the SNB example, 20 times) is exempted from negative deposit rates and remunerated at zero or the central bank's corresponding open market rate.

FIGURE 13
Stylized path for expected returns as NNR deepen



Source: Barclays Research

FIGURE 14
Stylized asset allocation for an asset manager with nominal liabilities under falling rates



Source: Barclays Research

[9] Required reserves, however, are exempted in all cases.

- TIER 2: An additional "macro add-on" balance tied to banks' lending activity that, like Tier 1, would be remunerated at zero or the central bank's open market policy rate.
- TIER 3: Remaining excess liquidity would be fully subject to the negative deposit rate.

Pressuring marginal but reducing average costs

So long as Tiers 1 and 2 are less than the total reserves of the system, excess liquidity will pressure *marginal* funding costs of both the banking system and financial system toward the central bank's negative deposit rate due to Tier 3 reserve treatment. But the adjustable proportion of required reserves in Tier 1 allows the central bank to exempt the majority of system reserves – even when excess reserves are large – reducing banks' *average* cost of NNR and thus reducing the overall impact on banking system profitability.

Incentivize banks to lend more

More important, the innovation of Tier 2 gives central banks an effective tool to encourage banks to lend more and to pass lower interest costs on to non-financial borrowers. An example helps to illustrate the power of such a system: under zero nominal rates and QE, banks' only incentive to lend more is the opportunity cost of returns on loans relative to government securities. But with the three-tiered system above and NNR, banks would have an additional incentive: they could reduce, dollar-for-dollar, their associated NNR costs on reserves by lending to the non-financial economy. For instance, for a central bank deposit rate of -1%, a bank could reduce NNR costs by 100pb per dollar of excess reserves for every dollar lent as this would shift Tier 3 reserves to Tier 2 reserves, an effective 100bp subsidization of lending rates.

Adjusting 'tiers' becomes part of monetary policy

This tiered mechanism gives the bank several levers to operate both on the economy and on bank profits. By adjusting the proportion of reserves included in Tier 1 and the rate of remuneration on Tier 1 reserves, the central bank can increase or decrease the relief banks receive from NNR on *average* on a system-wide basis. By adjusting the multiple of new lending for which banks can transform Tier 3 reserves into Tier 2 reserves, and by adjusting the rates of interest between those two tiers, the central bank can increase or decrease the incentive for banks to expand lending activity. This may be particularly useful for central banks that have coincident macro-prudential or financial stability mandates. Finally, by adjusting the NNR deposit rate on Tier 3 reserves and the total quantity of reserves of the system, the central bank can adjust the marginal cost of finance for the financial system as a whole, its traditional tool of monetary policy.

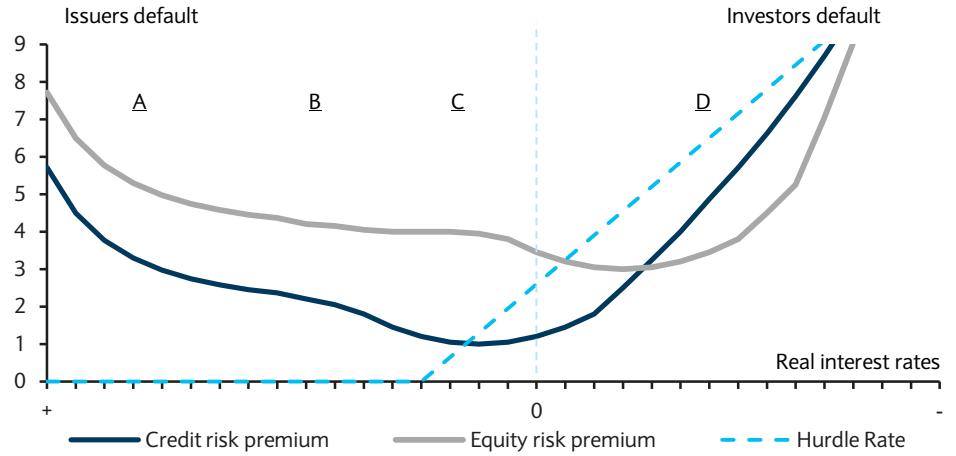
The increased ability to spur banks to lend and the reduction in effective NNR burden from reserves would give central banks extra leeway to reduce policy rates more deeply into NNR even without pass-through to retail depositors. However, there is a limit: as long as bank deposits yield zero, the further market rates descend with the Tier 3 deposit rate, the more banks will face increasing deposit inflows. To some extent, those can be deterred by increasing account fees, but it is a lagging, inefficient mechanism that likely has its own limits in a society that does not accept retail NNR.

It is worth mentioning that concerns about the viability of money market funds or oft-cited institutional constraints around those are unlikely to constrain NNR, even with retail deposits still yielding zero. Regulations that prohibit money market funds from "breaking the buck", ie, returning less than invested, as is the case in the US, can be changed if needed (not that we expect the US to move to negative rates; see *Coping with negativity*, 8 November 2012, for a fuller discussion of US institutional barriers to negative rates). Although retail deposits may leave money market funds for zero-yielding bank deposits, as has already occurred in existing NNR countries, large and institutional deposits will be forced by the bank fees or NNR pass-through to go elsewhere, and, when liquidity is important, likely to money market funds.

Long-term nominal liabilities under negative nominal rates

A firmer foundation for the NLB may be more associated with the nominal liabilities of insurers and pensions. Furthermore, the boundary created by long-term nominal commitments has important implications for risk premia, including credit spreads and the equity risk premium (ERP).

FIGURE 15
Stylized path of risk premia as nominal-liability constrained asset managers "chase yield"



Source: Barclays Research

Those with long-term nominal contractual commitment under increased pressure…

To understand this constraint and its asset price implications, think about entities with long-lived nominal liabilities and low risk tolerance, eg, pensions and insurers. Figures 13, 14 and 15 illustrate the impact of increasingly negative rates on, respectively, their return opportunities, their portfolio choices, and market risk spreads, segmented into four phases. In a "normal" world with historically observed nominal government bond yields (phase A), they invested mostly in government bonds, with some investment grade credit to meet their nominal commitments, or in the case of non-mutualised insurers to earn a small return over nominal commitments.

… as their need for yield pushes them into riskier instruments, which in turn further compresses spreads…

But as yields fall below their required rate of nominal return (phase B), they increase their risk by shifting their allocation toward credit as a *yield* investment to match their liabilities rather than as a *spread* product. This exerts downward pressure on credit spreads. Phase B is effectively what has occurred at pensions and insurers already under QE. As NNRs are introduced and go progressively deeper (phase C) the process continues until yields on investment grade credit also fall below required rates of return. At that point, any further declines in rates would require an *increase* in spread to meet insurers' and pensions' minimum yield, meaning that investment grade spreads bottom out and begin to rise as rates go even more negative. Meanwhile, insurers and pensions – subject to regulatory allowances – push even further out the risk curve to meet their nominal obligations, repeating the same process for high yield spreads, and eventually the equity risk premium.

…and at some point will no longer suffice to meet nominal obligations

But at some point (phase D), further declines in rates – and risk spreads – imply that returns, even on risky portfolios, are insufficient to meet their long-term nominal commitments, which simultaneously are rising in net present value as interest rates fall. This process is accelerated by the existence of regulatory barriers to further risk-taking. At that point, pensions and insurers are insolvent and need to turn to their regulator or the state either for capital injections or for contractual relief from their nominal liabilities (both of which have fiscal implications, as discussed below). Pensions and insurers entering regulatory protection or receivership are unlikely to be allowed to take on further risk, and likely will be forced to actively de-risk, sending credit spreads and the ERP sharply higher as the financial system's marginal buyers turn to sellers.

The ultimate NLB: the transactions value of money

But, as we noted in *Three Questions: Quantum Evolution*, 27 January 2015, it is the utility of transactions demand that likely dictates the ultimate NLB. Even once political obstacles to retail NNR are overcome and long-term nominal constraints have been dealt with, the transactions value of money is still a barrier. As noted above, although there may exist alternative stores of value and units of account, only legal tender can facilitate multilateral transactions (rather than barter) in a sovereign society that accepts NNR.

Credit card charges as lower bound for NNRs?

The convenience value of multilateral exchange likely forms the NLB. A measure of how much that transaction utility is worth to consumers and to businesses may be given by credit and debit card interchange fees, the fee that card companies charge merchants for transactions. Until recent moves to regulate interchange fees, such fees on debit cards were around 1-3 percent of transaction value, depending on the card and the merchant. Credit cards, which remain unregulated, still command fees in that range, with some reaching as high as 6%. Coincidentally, the ECB has calculated that the social welfare value of such transactions is 2.3%.[10] If these rates represent an accurate measure of transaction utility, they suggest that the ultimate NLB for interest rates likely is considerably lower than the -125bp charged on reserves deposited at the Swedish Riksbank (currently the lowest policy rate).

Swedens' -125bp deposit rate may be close to what is feasible in practice

Given the current constraints, how low can NNR reasonably go? Until retail NNR becomes politically feasible and governments establish credible plans to deal with the adverse impact on pensions and insurers, it seems unlikely that NNR would be able to fall much below the Riksbank's -125bp deposit rate in most economies, and perhaps not even that low in countries with high levels of retail bank deposits (eg, Japan) or large, contingent long-term commitments (eg, Germany). Even with tiered reserve charges, in the absence of retail NNR, the pressure on bank deposit inflows may require unrealistic (or politically infeasible) fees on deposits, and insurers and pensions are already creaking under the strain of their nominal commitments amid historically low fixed income yields.

Economic policy below the zero

Monetary policy with negative nominal rates

Theoretical elegance of NNRs are challenged by many real-life challenges

Monetary policy under NNR, at least in theory, should be more familiar and have more direct transmission than other unconventional policies as it returns central banks to their pre-crisis (positive interest rate) world of adjusting the marginal cost of short-term funding in the economy. Relative to changing interest rates above the ZLB, however, there likely are some differences in effect and nagging unknowns regarding NNR as a policy tool. Among these are: 1) if retail NNR is not politically feasible, the ZLB on retail deposits likely induces some frictions that could slow or impair the transmission of monetary policy; 2) the existence of long-term nominal commitments, as discussed above, may raise rather than lower risk spreads beyond some threshold for NNR policy rates; 3) uncertainty about the existence and depth of the NLB may reduce policy effectiveness by raising risk premia and impairing market expectations for the forward path of monetary policy; 4) conversely, if uncertainty increases FX risk premia, a move to NNR may yield a larger-than-usual depreciation of the exchange rate, improving the FX channel of transmission; 5) money illusion may reduce wealth effects usually associated with monetary policy when interest "income" becomes a payment or is amortized as a reduction in principal. Furthermore, as with any untried policy, there may well be unanticipated effects.

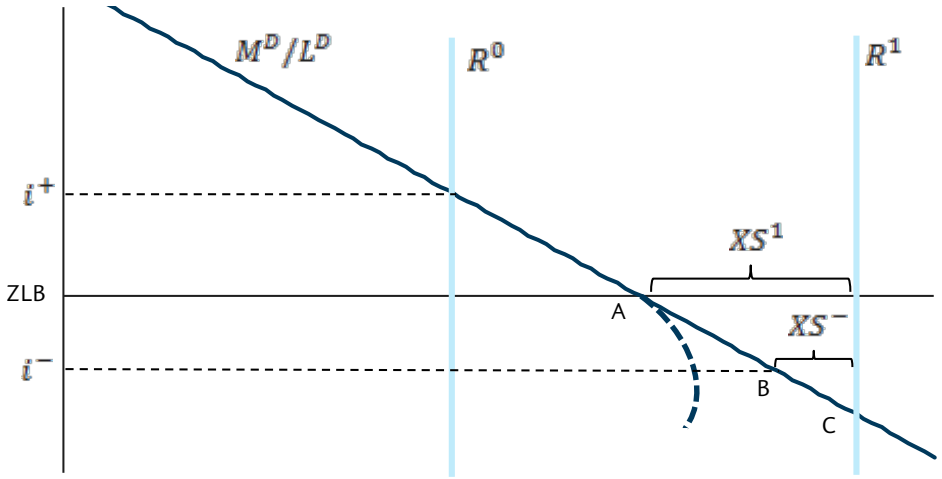
Figure 16 presents a stylized view of monetary policy as it descends below the ZLB. Above zero, the central bank adjusts the reserves of the banking system (R^0) along the money/loan demand curve of the economy (M^D/L^D)[11] to achieve the desired level of lending and economic activity at target policy rate i^+. But at the ZLB, adding more reserves to the banking system (R^1) only increases excess reserves (XS^1) because money/loan demand will not expand beyond point *A* without a further decline in interest rates. At this point, if the central bank introduces a cost to holding excess reserves – a negative deposit rate, i^- –

[10] See "Life below zero: Learning about negative interest rates," speech by Benoit Cœuré, ECB Executive Board Member, 9 September 2014, Frankfurt am Main, Germany; and "The social and private costs of retail payment instruments. A European perspective," H. Schmiedel, G. Kostova, and W. Ruttenberg, 2012, *ECB Occasional Papers Series* , No. 137.

[11] We describe this as a money/loan demand curve because the effect on measured monetary aggregates is ambiguous. Particularly in the case where retail NNRs are allowed, measures of money like M1 may contract as households reduce their savings portfolio allocation to money, reducing money balances, but begin to use remaining transactional money balances more efficiently, ie, the velocity of money increases. Thus, measured money balances may contract, but loans outstanding and economic activity increase. For economic activity and inflation, it is the product of money and velocity that matters, not the quantity of money.

FIGURE 16

A stylized view of monetary policy through the zero lower bound



Source: Barclays Research

behaviour below the ZLB depends on whether or not NNR is allowed on retail deposits, how those are handled, and the pricing power of banks.

If retail deposit rates are restricted to be non-negative and the central bank does not create an effective loan subsidy through a tiering mechanism similar to the one described above, at some point the money/loan demand curve will bend backwards as banks either raise loan rates to offset NNR charges on reserves or shrink their balance sheets to escape them (dashed line). In this case, NNR would be a contractionary policy instrument.[12]

If, instead, a mechanism exists that allows banks' funding costs to fall with policy rates – retail NNR, retail deposit fees, or a system of tiered reserve rates that subsidizes new loans – the money/loan demand curve will remain downward-sloping (at least to an extent) and interest rate cuts will stimulate loan demand and economic activity. In this case, by lowering the marginal deposit rate on reserves to i^-, lending expands to point B and excess reserves shrink to XS^-. This process can continue (subject to the unknown NLB) until point C, when the central bank will have to add more reserves to lower market rates further and boost lending.

The existence of barriers to the imposition of NNR on retail deposits creates rigidities that may impair the process described in Figure 16, or at least delay its transmission. Even with a tiering of reserve deposit rates that encourages banks to lend at lower rates as policy rates are cut, in the absence of retail NNR, banks will have to impose fees to deter deposit inflows that will result from the relatively higher rates of return available on zero-yielding deposits than on market instruments. While fees can improve bank profitability and allow a reduction in lending rates, fees are a "stickier" price than indexed interest paid (or charged) on deposits. As a result, there may be a longer lag between a cut in policy rates and reductions in lending rates as banks slowly adjust fee structures.

Even with retail NNR, a 25bp cut in NNR policy rates may have a weaker effect than a similar-sized cut above the ZLB. Because of an uncertainty premium for a novel policy and for reasons discussed in the section on implications for asset prices below, term and risk premia may rise as NNRs are taken progressively deeper, reducing some of the financial and economic benefits usually associated with monetary policy easing. In the presence of binding long-term nominal commitments, those effects may even become extreme and dominate any short-term funding cost benefits to deeper NNR, as noted previously. However, to the extent that uncertainty over NNR manifests as an FX risk premium, it may improve the exchange-rate channel of transmission as a cut in rates into NNR or deeper into NNR may induce a larger depreciation than a similar sized cut in policy rates above the ZLB.

[12] See "How far can the repo rate be cut?" Jan Alsterlind et alia, *Economic Commentaries, No. 11*, 2015, Sveriges Riksbank.

Another factor that may reduce the impact of policy rates below the ZLB is the potential for it to impair the wealth channel of transmission due to the money illusion. In positive territory, cutting interest rates raises asset prices as lower discount rates boost the net present value of generated income streams. In theory, the same should happen below the ZLB, but, because of the money illusion – the tendency to place a greater weight on nominal changes than on real changes in value – consumers may respond less positively when interest income on savings turns into a cost of holding deposits or the nominal value of principal falls on amortizing fixed income investments.

For these reasons and the unknown unknowns of NNR, policymakers are now adopting and likely will continue to adopt policy gradualism, moving rates in smaller increments as they feel their way through unfamiliar territory. Gradualism is the policy analogue of market risk premia to compensate for uncertainty about a new and untried policy.

NNRs may have been more effective if applied before extensive QE programs

Another policy consideration is the sequence of unconventional policies. Although path dependence led the ECB, BoJ and SNB to impose NNR *after* outsized balance sheet expansion, the reverse order may be more advisable. Forcing banks to carry large excess reserve balances under NNR erodes banks' profitability (though tiering can alleviate this) reducing their willingness and ability to expand lending as interest rates are cut more deeply into negative territory. Thus, if a central bank anticipates that it may ultimately have to turn to NNR, it may be best to begin with NNR, introducing just enough excess reserves into the banking system to drive marginal funding costs down to the target rate below zero, and continuing in that manner as rates progressively are cut lower. QE can then be used subsequently, if needed, to attempt to offset a rise in term or risk premia created by the uncertainty over NNR. [13]

Fiscal sustainability under negative nominal rates

For countries with persistent low inflation and high debt ratios, NNR offers a hope of relief, but it may be a mixed blessing in the presence of large long-term nominal payment commitments. Unlike inflation, which erodes the *real* value of nominal debt, NNR leads to a *contractual* decline in nominal fiscal obligations. However, if sovereigns are the backstop for pensions and insurers with unsustainable long-term nominal payment commitments, NNR may lead either to large contingent fiscal liabilities if those commitments are taken on by the sovereign or to a drop in tax revenues if the commitments are negated.

It can be shown that a sufficient condition for debt sustainability is given by:

$$pb^* = \left(\frac{r-g}{1+g}\right)d_{t-1} + cd_{t-1} \cong (r-g\ )d_{t-1} + cd_{t-1}$$

where *pb** is the primary (non-interest) fiscal balance consistent with a stable path of debt to GDP (*d*), *r* is the nominal effective interest cost of the fiscal debt, *g* is the nominal rate of growth of GDP, and *cd* are contingent liabilities that come onto the sovereign balance sheet.

The equation makes clear why inflation and real growth are so important for debt dynamics. A high rate of nominal growth, *g*, due either to high inflation or high real growth, allows a smaller or even negative primary balance with stable debt to GDP. But low *r*, or even better, negative *r*, allows for the same thing even in economies with Missingflation (see *Chapter 1: The fight to bring back inflation*) or low trend growth (see *Chapter 2: When absolute zero isn't low enough*). Indeed, sustained NNR that brings the average nominal interest on sovereign debt below zero implies a contractual decline. So long as nominal growth is not more negative, debt will shrink as a share of nominal income or larger primary fiscal deficits are allowable.

[13] Alternatively, QE or a removal of tiering can be used to force banks to move to NNR on retail deposits when it becomes politically feasible but the "first mover" problem prevents banks from doing so. See *FX Focus: SNB: From negative to nuclear?* 16 September 2015.

However, contingent liabilities may be exacerbated by NNR. Although markets recently have exhibited concerns about the impact of NNR on banks' sustainability, as noted above, this need not be a problem if retail NNR are feasible or at low levels of NNR, with tiering of central bank charges on reserves. But long-term nominal commitments of pensions and insurers likely are more difficult to deal with under NNR. With sustained NNR, many pensions and insurers likely are not viable and either will need a fiscal backstop or contractual relief from their nominal commitments. In the former case, *cd* may boost the fiscal debt by more than a decline in *r* improves long-run debt dynamics. In the latter case, the breaking of pensions' and insurers' nominal commitments implies lower future government tax revenues and perhaps increased social welfare payments, permanently raising primary fiscal deficits.

Financial stability concerns

An oft cited concern with respect to NNR and other unconventional monetary policies is their impact on financial stability and their potential to create asset bubbles. However, these concerns are not unique to unconventional policies or NNR. Rather, they are a general critique of the risks of pursuing excessively easy monetary policy, whether above the ZLB or below.

Key economic policymakers have expressed concerns that NNR and other unconventional monetary policies have depressed real interest rates below the "Wicksellian natural rate" that equates savings with investment.[14] However, such assessments do not accord well with the data. In most developed economies, saving rates are rising and investment growth has remained stubbornly below expected rates despite historically low rates of interest. An unusually large cohort of high-earning middle-aged workers nearing retirement appears to be more the problem as their savings are increasing faster than their demand for goods and services (see *Chapter 4: Population dynamics and global imbalances*).

High asset prices are a consequence of low real interest rates, not monetary policy "leaking" into asset price rather than consumer price inflation. If central banks had successfully reduced real interest rates below their Wicksellian natural level, investment activity would be much stronger, generating production bottlenecks and goods and services inflation. Widespread resource slack and lack of inflation suggest this is not a common problem.

Concluding thoughts

Negative nominal rates have the potential to be a powerful new tool in central banks' arsenal in a world where real risk-free interest rates appear to have slipped below zero and Missingflation plagues a wide spectrum of economies. There still are significant hurdles to NNRs realizing their full potential. Most important, central banks will need to confront the politics of money illusion and of passing NNR on to retail depositors if it is to be as effective a tool in practice as it promises in theory. Tiering of reserve balances provides a powerful workaround to resistance to retail NNR, but can only allow rates to descend so far. A greater problem, particularly in economies with large legacy long-term nominal commitments at pension funds and insurers, may be the social and fiscal costs of those institutions' insolvency. However, with no end to negative real rates or Missingflation in sight, negative nominal rates have – excuse the pun – a very positive future, in our assessment.

[14] See "World faces wave of epic debt defaults, fears central bank veteran," Ambrose Evans-Pritchard, The Telegraph, 19 January 2016; or "Ultra-low or negative interest rates: what they mean for financial stability and growth" Hervé Hannoun, Deputy General Manager, Bank for International Settlements, remarks at Eurofi High-Level Seminar, Riga, 22 April 2015.

CHAPTER 4

Population dynamics and global imbalances

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- **Concerns about large and persistent current account imbalances (and the net capital flows underlying them) have been displaced by more pressing issues associated with the global financial crisis. But the imbalances have persisted and have recently begun to expand again. We think these longstanding imbalances are associated with structural (as opposed to cyclical) influences on national propensities to save, and that demographic developments are a key driver of these propensities. We find a strong positive correlation between average external imbalances over the past 20 years and a measure of demographic support for saving.**

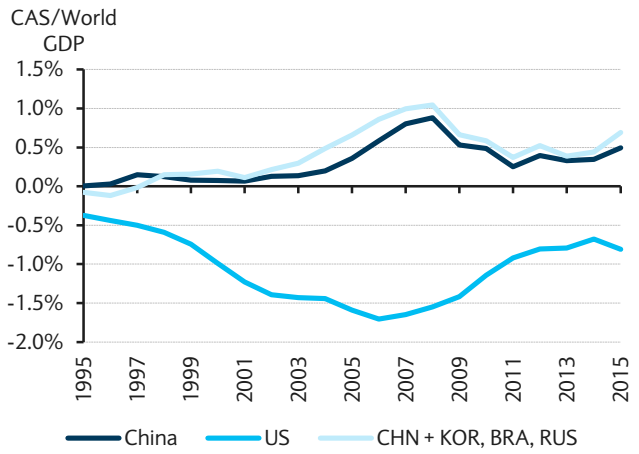
We find a strong positive correlation between average external imbalances over the past 20 years and a measure of demographic support for saving

- **Last year, we presented evidence that the three-decade slide in the world real interest rate was largely attributable to population dynamics in those economies comprising the bulk of global economic activity, savings, and investment, and that the extended period of support for asset prices was on the cusp of a slow but sizeable reversal. Building on that research, we now extend our framework to explore linkages between prospective population dynamics and external imbalances, focusing on how demographic developments are likely to affect imbalances.**

- **For the world's largest economies, we find that prospective demographic developments do not suggest a large change in the pattern of net capital flows and current account imbalances because the shifts in national demographic trends are reasonably well synchronized. In particular, population dynamics suggest that China and the European Union will likely remain capital exporters in the coming 10-15 years, while the US and UK are likely to remain net capital importers. In some smaller countries, including Korea, Russia, and Latin America, we project more substantial effects on net capital flows and current account imbalances.**

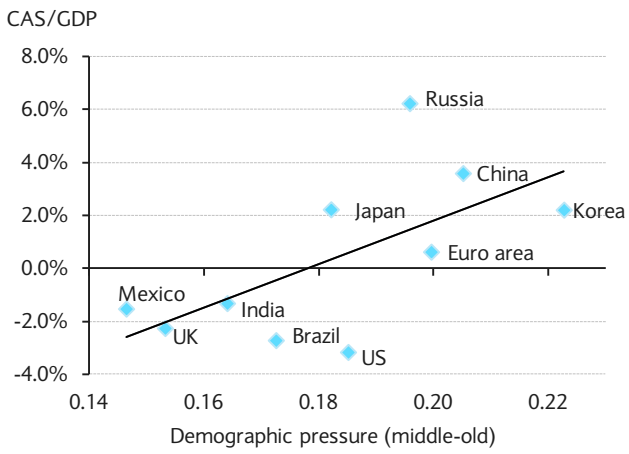
In last year's *Study*, we suggested that global population dynamics provide a coherent explanation for the 'global savings glut' that, in our view, lies behind the 30-year decline in the 'natural' rate of interest and, more generally, the secular updraft in asset values over the same period. In a follow-up *note*, we quantified the impact of demographic pressure for saving on the 'natural' rate of interest, and suggested that demographic trends could explain most of the secular decline in the real interest rate since the mid-1980s. We also argued that the ongoing global demographic transition is likely to be accompanied by a secular rise in interest rates and downward pressure on asset prices in the decades ahead.

FIGURE 1
The US and China are, quantitatively, the most important drivers of 'global imbalances'…



Source: Haver Analytics, Barclays Research

FIGURE 2
… but in 1995-2014, current accounts have been large where demographic support for saving has been strong



Source: Haver Analytics, Barclays Research

If these population dynamics were evolving uniformly around the world, we would not have much more to say. However, a key aspect of the demographic transition is that it is not proceeding at the same pace across regions, thereby placing disparate pressures on saving and investment in different parts of the world. This suggests that population dynamics are a plausible driver of the current account imbalances that have puzzled analysts and vexed policymakers in recent decades. In this section, we extend our framework to explore linkages between demographics and external imbalances, with a specific focus on how demographic developments are likely to affect these relationships.

Global imbalances – Trend and cycle

In the run-up to the global financial crisis and subsequent recession, a key preoccupation of policymakers and source of uncertainty for investors was the growth of 'global imbalances'. Quantitatively, the most important of these were the US current account deficit, which expanded to a peak of roughly 6% of GDP (1.5% of world GDP) in 2006, and the Chinese current account surplus, which peaked at *c.*10% of GDP (nearly 1% of world GDP) in 2007.

Global current account imbalances have been strongly affected by short-term 'cyclical' influences…

Although other, mainly smaller, economies have, individually, been less significant drivers of global current account flows, they have collectively played a significant role. For example, between 1996-97 (before the Asian financial crisis) and 2005-06, the combined current account balances of Korea, Russia, and Brazil rose by nearly 0.5% of world GDP, mainly because of the capital outflows that followed that crisis. These outflows were particularly large and persistent in Russia, where a subsequent strong recovery in energy prices also bolstered exports and the current account.

As this very brief account of the historical backdrop shows, global current account imbalances have been strongly affected by short-term, broadly defined 'cyclical' influences, particularly the impact on desired international capital flows of economic and financial crises, major fluctuations in energy and other commodity prices, and the turbo-charged financial environment that led up to the 2007 global financial crisis. We do not focus on these here, largely because they are hard to forecast, even if they are fully understood.

…but persistent 'structural' influences are also clearly at work

However, persistent 'structural' influences are also clearly at work. On the one hand, apart from a two-quarter blip in the early 1990s, the US has not run a quarterly current account surplus since the early 1980s. Of smaller systemic significance, Brazil, India, Mexico and the UK have also tended persistently to run current account deficits. On the other hand, since its emergence as a systemically important economy, China has consistently generated current account surpluses, and, although the unusually high surpluses of the mid-2000s have given way to more normal levels, the Chinese surplus remains at a significant 0.5% of world GDP. In the past several years, Germany and Korea have also emerged as chronic surplus economies, for reasons that are difficult to explain as transitory 'cyclical' factors, while Japan's tendency to generate moderate current account surpluses has vanished in the past half-decade.

One potential driver of these persistent, apparently 'structural,' current account imbalances is saving, particularly demographic influences on the propensity to save. It is natural to consider saving as a determinant of the current account balance because the current account is, as a matter of national income accounting, equal to the difference between domestic saving and investment. Thus, a fundamental driver that raises domestic saving will generate a current account surplus, unless it also spurs correspondingly higher investment.

In last year's *Study*, we presented evidence (consistent with previous studies of national saving) that demographic structure is an important driver of national saving. Specifically, national saving tends to be higher in countries whose population has a large share of mature, typically high-saving workers (measured in our analysis as the share of the population between the ages of 40 and 64), and it tends to be lower in economies with a high share of elderly people (measured as the share of the population aged 65 and older).

As a summary measure of demographic pressure on saving, we use the difference between the population shares of high-saving mature workers and of the elderly.[1]

Figure 2 provides some evidence that demographic structure has in fact been correlated with longer-run current account developments. The vertical axis plots the average current account balance, measured as a share of GDP, in 1995-2014; the horizontal axis plots the measure of demographic pressure on saving described above.

There is a strong positive correlation between demographic fundamentals and current accounts, though this does not completely explain cross-country current account dynamics

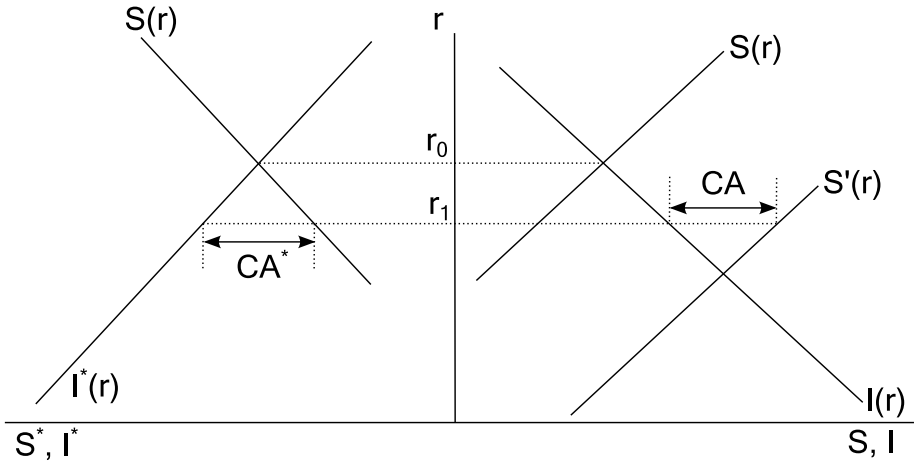
There is a strong positive correlation between demographic fundamentals and current accounts. Of course, this measure of demographic pressure does not provide a complete explanation of cross-country current account dynamics. The biggest outlier is Russia, where the extraordinarily large capital outflows that followed the 1998 economic crisis skew the average higher, for reasons that are not captured by an analysis that focuses on demographic or other fundamentals.

A framework

We use a simple Fisherian model of the natural rate of interest, with two financially integrated economies, to illustrate some of the points we have explored (Figure 3). In each economy investment demand is a decreasing function of the real interest rate. The investment demand schedule for the home country is drawn in the right section as I(r), and the rest of the world's investment demand is drawn in the left panel as $I^*(r)$, with an increase in ROW investment represented by a move to the left, away from the origin of the axes.

FIGURE 3

An increase in domestic saving, with international spillovers



Source: Barclays Research

Similarly, the supplies of domestic and foreign savings are drawn as the upward-sloping curves S(r) and $S^*(r)$, respectively. The equilibrium rate of interest is determined by the condition that world saving equals world investment, or, equivalently, that the home country's current account surplus equals the rest of the world's deficit.

In Figure 3, we have drawn a hypothetical equilibrium where the current account is equal to zero in both countries. We then consider some shift in fundamentals that increases the home country's propensity to save. As a result of this shift, the world interest rate falls, and world investment therefore rises. Domestic saving rises and the current account moves into surplus, but foreign saving falls, with the resulting ROW current account deficit (CA^*) matching the surplus in the home country (CA).

[1] In our more formal statistical work, we estimated the separate effects of the two demographic variables on saving. On the basis of our finding that one variable has approximately the same effect as the other, but with the opposite sign, we feel comfortable using the difference between the variables as a summary measure, as in Figure 2.

Simplistic though the framework may be, it highlights that a relationship between one country's demographic fundamentals and its current account, as in Figure 3, is not a simple, fixed relationship because the current account (and therefore domestic saving and investment) is also determined by demographic fundamentals in the rest of the world. To calibrate the potential impact of demographic drivers on external imbalances requires that we account for these international spillovers. This is particularly germane in the present context, in which demographic support for saving is set to fade in most of the world in the decades to come. As it does so, every economy's current account cannot deteriorate simultaneously.

Looking ahead

It is not difficult to quantify a multi-national application of this two-country theoretical framework and, given projections of populations' age structures, to estimate the impact of demographic developments on equilibrium current account imbalances in the years ahead. As noted, current account imbalances are determined by many factors besides the demographic developments we focus on here. The projections we make should be viewed as estimated effects of prospective demographic changes on 'structural' current accounts, not precise forecasts of future imbalances, which will be affected by factors beyond the ones we quantify here.

Our approach is as follows:

- We begin with the assumption that 2015 current account imbalances were more or less consistent with demographic and other structural drivers. This assumption is not particularly important, so long as it is understood that differences between the projected current account balances and the 2015 level represent an estimate of future changes attributable to changes in the age composition of populations in the 10 economic regions included in our analysis.
- We make assumptions about the slope of the saving and investment schedules in Figure 3 and the magnitude of the shift in the schedules that may be attributed to changes in demographic pressure on saving as we have quantified it.[2]
- For each country, in each year of the projection period, we compute the gap between saving and investment that would result for some arbitrary world interest rate, given the projected demographic structure of each country in that year.
- We then adjust the world interest rate as required to set the aggregate current account to zero.[3]

The effect of demographic change is small but not negligible

The results of this exercise are summarized in Figure 4. For the world's largest economies, the impact of demography on projected imbalances is modest in the decade ahead, and only slightly larger in the subsequent decade. This reflects the fact that all of these large economies are facing a gradual decline in demographic support for saving, as we have noted in past publications. This means that the most marked effect of the coming demographic transition is likely to be on world interest rates and asset prices, with smaller consequences for global imbalances.

The effect of demographic change is small, but not negligible. For example, our projections suggest that the US and the UK will likely remain capital-importing economies for the foreseeable future and, indeed, that prospective demographic forces will likely intensify this

[2] In particular, we assume that a 1pp increase in the real interest rate would increase net saving (the difference between desired supply of saving and the demand for domestic investment) by 0.5% of GDP. This is roughly in line with the assumption made in our previous discussions of this issue. For our current purposes, it is not very important, because it affects only the magnitude of the increase in the interest rate that is required to match world saving and investment; that was our focus in the previous notes, but not this one. We also assume that a 1pp increase in our measure of demographic pressure on saving would boost net saving by 0.5% of GDP, at any constant rate of interest.
[3] More precisely, recognizing that the 10 economies that we analyze here do not comprise the entire world, we maintain the aggregated current account balance at its 2015 level, which was roughly 0.4% of world GDP.

longstanding tendency. China is likely to remain a capital exporter, but with no strong rise or fall in demographic support for net capital exports for another 15-20 years. The same seems to be true of the euro area.

The same is not true of the smaller countries that we consider. The most striking example is Korea, where a very abrupt demographic transition to an elderly population is projected to put substantial downward pressure on the country's 'structural' current balance, beginning in a few years and amounting to nearly 5.5% of GDP in the 15 years after 2020. In India, Brazil, and Mexico, on the other hand, our projections suggest a substantial rise in current account balances. In India, this shift from 'structural' deficit to surplus results from an absolute increase in demographic support for saving, as the country's very young population matures and enters the higher-saving years. In Brazil and Mexico, demographic support for saving is projected to decline slightly in coming decades, but by much less than in the rest of the world. In our framework, the growing scarcity of global saving pushes up world interest rates and thereby promotes net saving in Brazil and Mexico.

FIGURE 4

Projected effect of demographics on imbalances – Modest in the largest economies

	2015	2020	2025	2030	2035
US	-2.7%	-3.4%	-4.3%	-4.7%	-3.9%
China	2.7%	2.3%	2.6%	2.9%	1.9%
Euro area	3.0%	3.5%	3.3%	2.6%	2.0%
Japan	3.3%	3.4%	4.3%	4.0%	3.3%
UK	-4.1%	-3.8%	-3.8%	-4.2%	-4.5%
India	-1.0%	0.1%	1.1%	2.2%	3.3%
Korea	7.8%	7.9%	6.3%	4.1%	2.5%
Brazil	-3.7%	-2.7%	-1.9%	-1.8%	-1.6%
Mexico	-3.1%	-2.0%	-1.3%	-0.8%	-0.4%
Russia	5.5%	5.4%	5.4%	6.2%	7.5%

Source: Barclays Research

The demographic transition is best viewed as a global shock with substantial implications for interest rates and asset prices and relatively modest implications for net capital flows and 'global imbalances'

The limited effect of the ongoing demographic transition on global imbalances in the larger economies is not the result of weak linkages between population structure, saving, and net capital flows. Our reading of the past several decades is that these relationships are significant, and reasonably strong linkages are built into the projections summarized by Figure 4. Rather, it underscores the global and broadly synchronized nature of the projected demographic transition, the salient feature of which is the looming withdrawal from the workforce of a large portion of the population in its mature, high-saving years and its replacement by a generational cohort that has been reduced in size by the strong decline in fertility rates and family size in much of the world. The details of this historical process differ across countries with, for example, China's one-child policy affecting population dynamics there and the post-WWII 'baby boom' affecting them in the US and parts of Western Europe. However, the overall result is a decline in demographic support for saving in virtually every large economy. The demographic transition is, therefore, best viewed as a global shock with substantial implications for world interest rates and asset prices, while having relatively modest implications for net capital flows and 'global imbalances' in the coming decades.

CHAPTER 5

UK asset returns since 1899

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We analyse returns on equities, gilts and cash from end-1899 to end-2015. 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	2015	10 years	20 years	50 years	116 years*
Equities	-0.1	2.3	3.7	5.6	5.0
Gilts	-0.6	3.0	4.3	2.9	1.3
Corporate Bonds	-0.5	1.8			
Index-Linked	-3.4	2.5	3.8		
Cash	-0.7	-1.1	0.9	1.4	0.8
Inflation	1.2	3.0	2.8	5.9	3.9

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.

It was a disappointing year for UK assets across the board as real total returns were negative for equities and fixed income products. UK equities underperformed many other developed market indices in 2015. UK nominal price returns were -2.5%, compared with +6.8% for the Eurostoxx 600 and 9.9% for the TOPIX. European stocks received a boost in the first half of 2015 as investors pursued the ECB QE trade. The ECB announced QE in January and implemented the policy in March, leading to a 16% rally in the Eurostoxx 600 in the first quarter. The FTSE All Share only managed a 3.7% capital return over the same period. Global market shockwaves, including the sudden devaluation of the Chinese yuan, were partly to blame for last year's weak returns. However, UK stocks were also heavily influenced by the continued decline in commodity prices. Much of the performance drag on UK equities was driven by the exposure to oil and mining related sectors, which declined about 20% and 50%, respectively.

Fixed income and credit both reported negative real total returns in 2015, in sharp contrast to strong performances seen the previous year. Over the course of 2014, investors pricing out rate hikes from the MPC, combined with broader deflationary pressures, led to a sharp rally in Gilts. However, this was followed by a correction in the first half of 2015 and, despite the safe-haven rally that came in the wake of the China devaluation, Gilts ended the year with a marginally negative real total return. Inflation-linked gilts proved to be the worst-performing asset with a real total return of just -3.4% as the continued deflationary environment drove breakeven inflation and total returns lower. Credit spreads widened in the UK as sterling credit closely tracked US markets. US corporate credit faced a number of headwinds including a sharp increase in issuance and underperformance of the investment grade energy sector. Cash returns remained weak in the low yield environment.

FIGURE 2

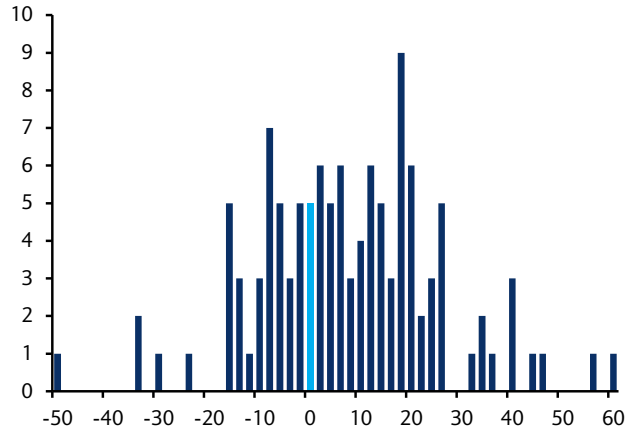
Real investment returns (% pa)

	Equities	Gilts	Index-linked	Cash
1905-1915	-0.2	-2.2		-0.5
1915-25	3.9	-1.1		0.8
1925-35	8.7	10.8		4.7
1935-45	2.4	0.3		-2.3
1945-55	5.3	-5.4		-3.0
1955-65	7.3	-1.0		1.8
1965-75	0.1	-5.4		-1.4
1975-85	11.0	5.2		1.5
1985-95	9.9	6.8		5.2
1995-2005	5.0	5.6	5.2	2.9
2005-2015	2.3	3.0	2.5	-1.1

Source: Barclays Research

FIGURE 3

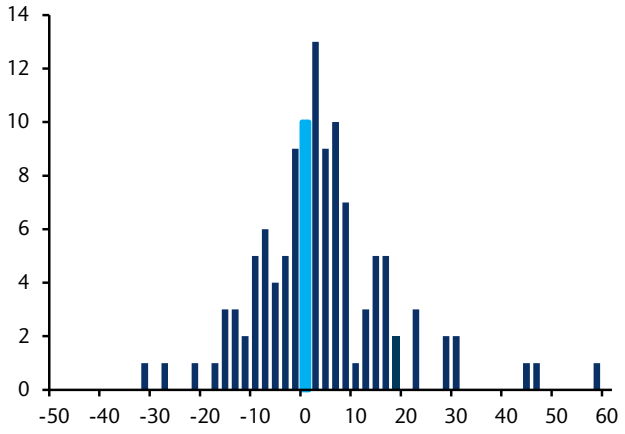
Distribution of real annual equity returns



Source: Barclays Research

FIGURE 4

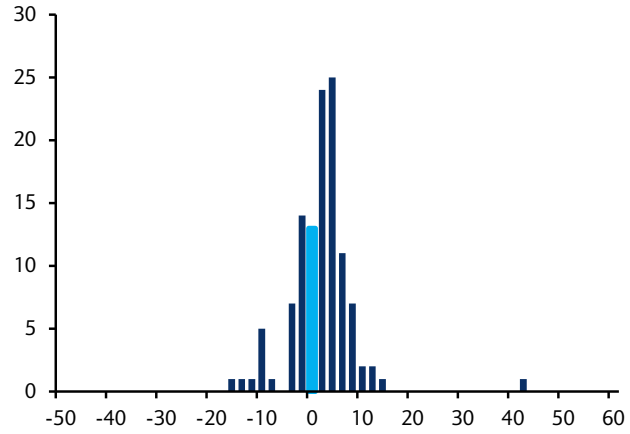
Distribution of real annual gilt returns



Source: Barclays Research

FIGURE 5

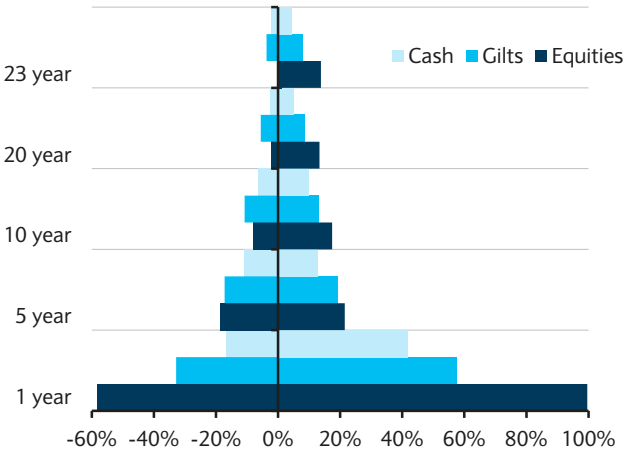
Distribution of real annual cash returns



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. Gilts have outperformed equities over the past decade, with an average annualised return of 3% since 2005, compared with an equity return of just 2.3%. 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 2015 are shown in Figure 7. The equity portfolio is ranked in the seventh-best decile since 1899; Gilts and linkers are ranked in the sixth and ninth declines, a sharp drop in performance compared with last year when they were ranked in the 1st and 2nd deciles, respectively. Cash remained weak, in the seventh decile, as yields were held near zero.

FIGURE 7

2015 performance ranked by decile (1899-2015)

	Decile
Equities	7
Gilts	6
Index-Linked	9
Cash	7

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 116 years. 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 about 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 decades, the real returns to cash have been relatively stable, with the move towards 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 or 20 years and 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 comprise of 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 outperformed cash in 78 out of 115 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

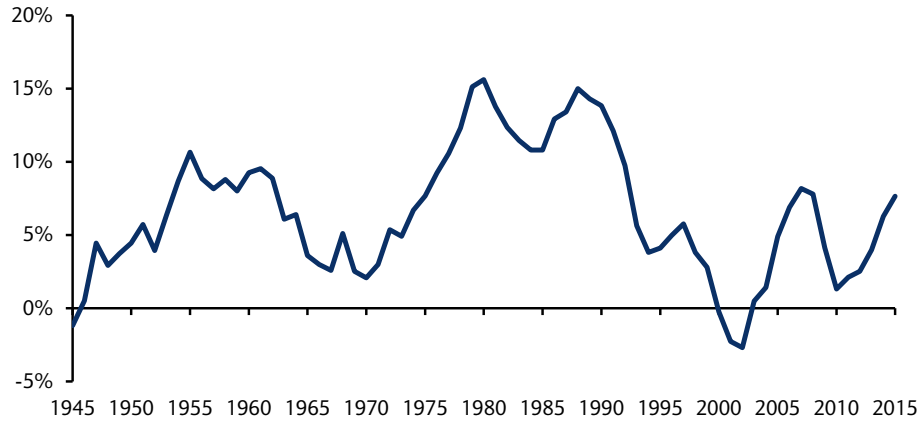
	Number of consecutive years					
	2	3	4	5	10	18
Outperform cash	78	80	82	84	97	98
Underperform cash	37	34	31	28	10	1
Total number of years	115	114	113	112	107	99
Probability of Equity Outperformance	68%	70%	73%	75%	91%	99%
Outperform Gilts	78	85	85	81	84	85
Underperform Gilts	37	29	28	31	23	14
Total number of years	115	114	113	112	107	99
Probability of Equity Outperformance	68%	75%	75%	72%	79%	86%

Source: Barclays Research

The importance of reinvestment

Figures 10 and 11 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 £28,232. The effect upon the gilt portfolio is less in absolute terms, but the ratio of the reinvested to non-reinvested portfolio is over 600 in real terms.

FIGURE 9
Five-year average dividend growth rates



Source: Barclays Research

FIGURE 10
Today's value of £100 invested at the end of 1899 without reinvesting income

	Nominal	Real
Equities	£14,231	£177
Gilts	£58	£0.72

Source: Barclays Research

FIGURE 11
Today's value of £100 invested at the end of 1899, income reinvested gross

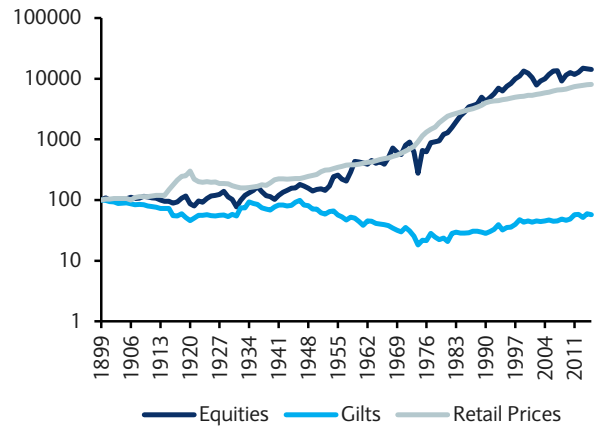
	Nominal	Real
Equities	£2,265,437	£28,232
Gilts	£36,395	£454
Cash	£20,535	£256

Source: Barclays Research

Turning to the dividend growth ratio, the FTSE All-Share dividend rose 7% in 2015, an improvement from 2014, when it grew just 0.6%. Figure 9 shows that the five-year average growth rate picked up in 2010 following the steady declines of recent years after corporates began cutting dividends in 2008. In 1997-2001, dividend income fell 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.

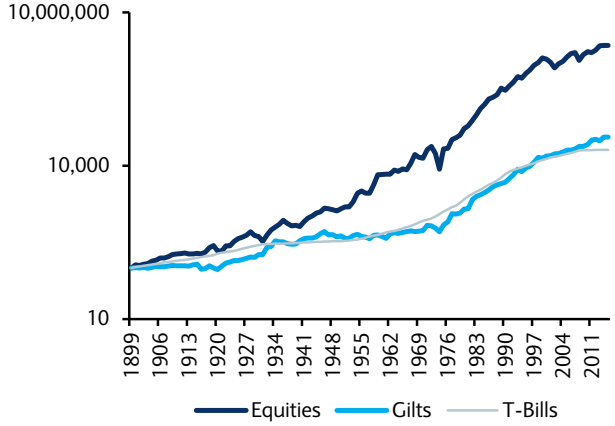
Figures 12 and 13 illustrate the time series of price indices and total return indices for equities, gilts and cash over the entire series. These returns are in nominal terms and are shown with the use of a logarithmic scale.

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	£8,919	£251
Gilts	£63	£2

Source: Barclays Research

FIGURE 15
Today's value of £100 invested at the end of 1945, gross income reinvested

	Nominal	Real
Equities	£181,676	£5,113
Gilts	£7,815	£220
Cash	£6,289	£177

Source: Barclays Research

FIGURE 16
Today's value of £100 invested at the end of 1990, gross income reinvested

	Nominal	Real
Equities	£759	£378
Gilts	£768	£383
Index-Linked Gilts	£564	£281
Treasury Bills	£301	£150

Source: Barclays Research

CHAPTER 6

US asset returns since 1925

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We analyse returns on equities, government bonds and cash. The total sample includes 90 annual return observations. The construction of the series is explained in more detail in Chapter 7 ("Barclays Indices"). The 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	2015	10 years	20 years	50 years	90 years*
Equities	-2.4	4.9	5.8	5.3	6.6
Government Bond	-1.2	4.6	4.8	3.4	2.6
TIPS	-8.7	2.9			
Corporate Bond	-5.3	4.2	4.4		
Cash	-0.7	-0.7	0.2	0.8	0.5
Inflation	0.7	1.9	2.2	4.1	2.9

Note: * Entire sample. Source: Centre for Research into Security Prices (CRSP), Barclays Research

Figure 1 provides real annualized returns over various time horizons. 2015 was a difficult year for US assets, with negative real returns across the board. The US growth backdrop weakened relative to 2014, while actual and expected inflation trended lower. Oil continued to play a key role in driving asset prices, and the Fed finally tightened monetary policy in December following months of speculation. US equity returns collapsed relative to 2014. Real total returns were just -2.4% in 2015, in contrast to 9.7% the prior year. US 2015 growth expectations were steadily downgraded over the year. Expectations for real GDP had started the year close to 3% y/y before being derated gradually to close to 2% y/y as activity data in the first half of the year proved weaker than initially expected. Global shocks, such as the China yuan depreciation, actually hit European equities harder initially given the greater exposure to Asian trade. However, European equities still managed to outperform US and UK over the year as the ECB's announcement of QE in January provided European stocks with a headstart.

Fixed income markets followed the trends in the UK: nominal bond real returns collapsed from 23% in 2014 to -1.2% in 2015, while inflation-linked bonds were the worst-performing asset in the US as well as the UK. Weak 2015 returns dragged the 10-year annualised average return for TIPS sharply lower, from 4% last year to 2.9%. Investment grade corporate credit returns were almost as poor as in 2008 and 2013 in nominal terms. US credit markets faced a number of headwinds last year. Increased M&A-related issuance weighed on returns, while the decline in commodity prices led to underperformance of the investment grade energy credits as investors feared downgrades.

FIGURE 2

Real investment returns (% pa)

	Equities	Government Bond	Corporate Bond	Cash
1925-35	6.7	7.7		4.6
1935-45	6.0	1.6		-2.6
1945-55	10.6	-2.4		-2.7
1955-65	9.5	0.0		1.0
1965-75	-2.8	-2.5		-0.1
1975-85	8.0	2.2		2.0
1985-95	10.1	7.9	7.7	2.0
1995-2005	6.6	5.0	4.6	1.0
2005-15	4.9	4.6	4.2	-0.7

Source: CRSP, Barclays Research

Equities outperformed Treasuries and corporate bonds in the most recent decade. A total real return of 4.9% is far below the average performance since 1925 of 6.6%. Equities' best decades were in the immediate aftermath of World War Two 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. Figure 2 highlights that the interwar decade 1925-35 also proved to be a good decade for government bonds.

Figure 3 ranks the relative performance of 2015 returns by deciles to get a clearer indication of their historical significance. The US equity ranking has fallen from the 6th decile in 2014 to the 8th decile in 2015 as performance faltered. Bonds moved from the best decile in 2014 to the 7th decile in 2015 as investors focused on the timing of the Fed's first policy rate hike in over a decade. Cash returns remained weak, with negative real returns placing them in the 7th decile.

FIGURE 3

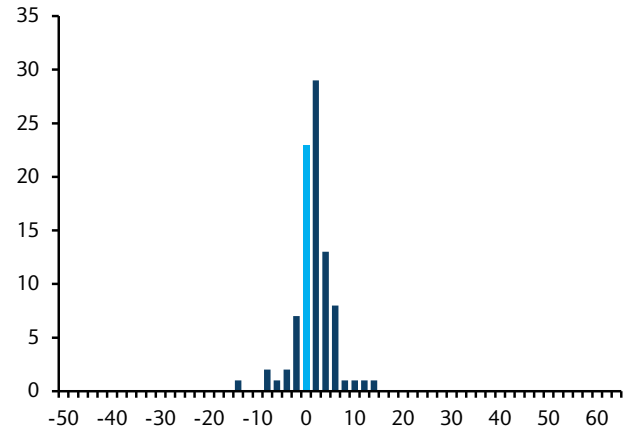
Comparison of 2013 real returns with historical performance ranked by decile

	Decile
Equities	8
Govt Bond	7
Cash	7

Note: Deciles ranking - 1 signifies the best 10% of the history, 10 the worst 10%. Source: CRSP, Barclays Research

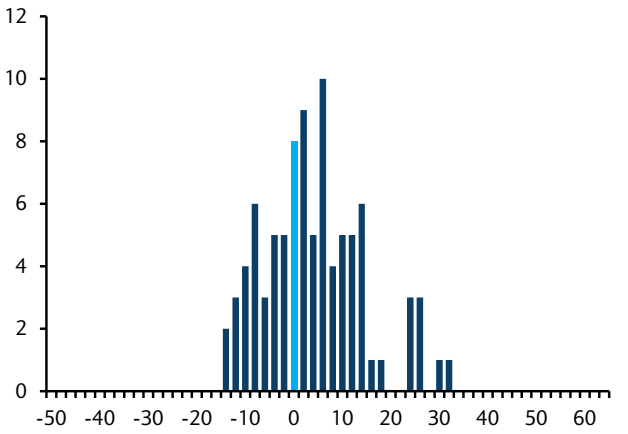
Figures 4-6 plot the sample distributions with identical maximum and minimum categories across each. These charts are useful in that they allow the reader to appreciate the volatility of each asset class while gaining an understanding of the distribution of the annual return observations. Clearly, overall, cash exhibits 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



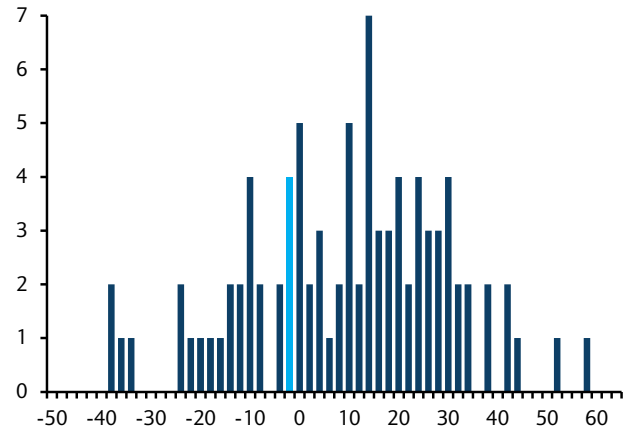
Source: CRSP, Barclays Research

FIGURE 5
Distribution of real annual bond returns



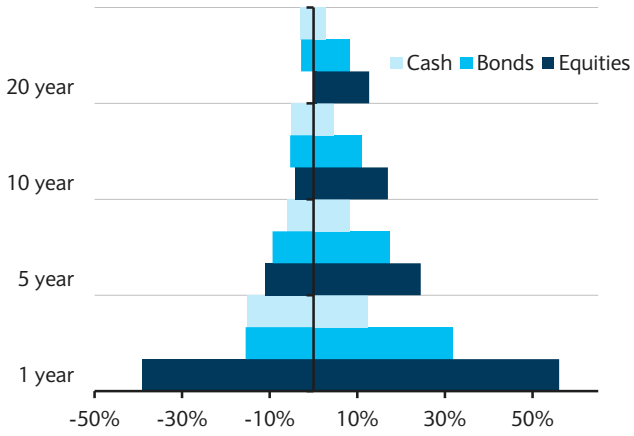
Source: CRSP, Barclays Research

FIGURE 6
Distribution of real annual equity returns



Source: CRSP, Barclays Research

FIGURE 7
Maximum and minimum real returns over different periods



Source: CRSP, Barclays Research

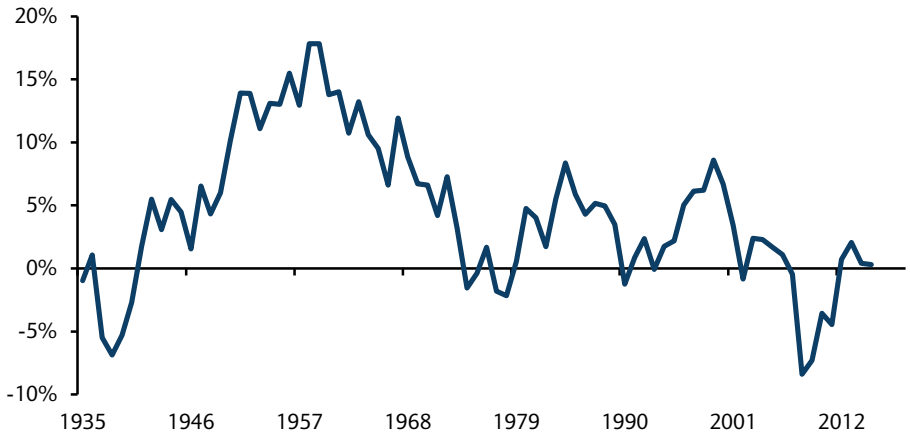
Figure 7 shows the extremes of the return distribution for various holding periods. The volatility of equities over very short horizons is clearly demonstrated in the maximum and minimum distribution of one-year returns. As we extend the holding period, the distribution begins to narrow. Over the past 90 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 merely highlights that such an occurrence seems unlikely, given equities' performance over the past 90 years.

In addition, over the long term, we would expect the ex-ante equity risk premium to provide a cushion against uncertainty. Bonds and cash have experienced negative returns over a 20-year investment horizon, reflecting unexpected jumps in inflation at various points in the past century.

Figure 8 plots the US equity risk premium and shows that the 10-year annualized excess return of equities over bonds has recovered from the lows of 2008 and remains only slightly in positive territory at 0.3%.

FIGURE 8

Equity-risk premium – excess return of equities relative to bonds (10y annualized)



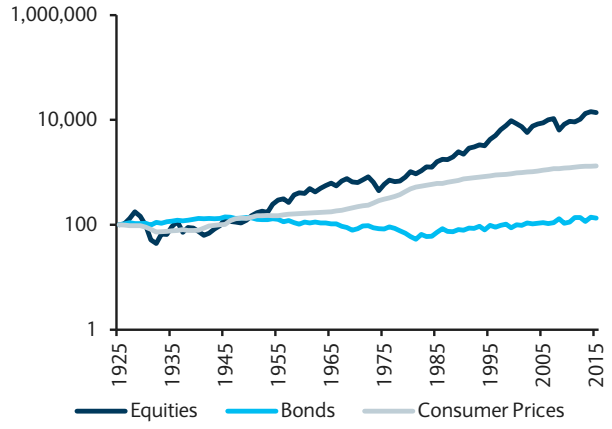
Source: CRSP, Barclays Research

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

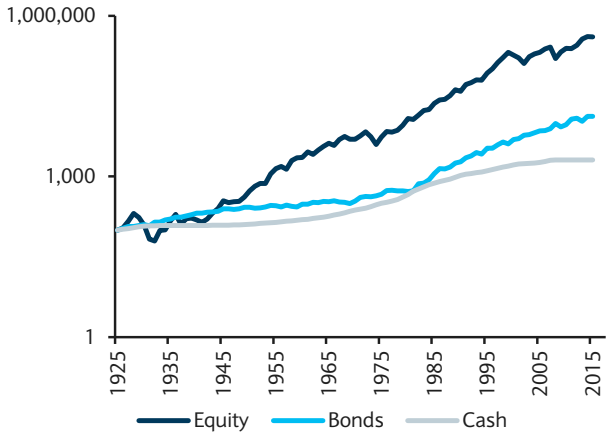
Barclays US price indices in nominal terms



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	$13,785	$1044
Bonds	$134	$10

Source: CRSP, Barclays Research

FIGURE 12

Value of $100 invested at the end of 1925 with income reinvested gross

	Nominal	Real
Equities	$401,488	$30,393
Bonds	$13,254	$1003
Cash	$2,043	$155

Source: CRSP, Barclays Research

CHAPTER 7

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 PropietaryMines 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 TstLtd	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 JagersfonteinMining & 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 £530bn (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

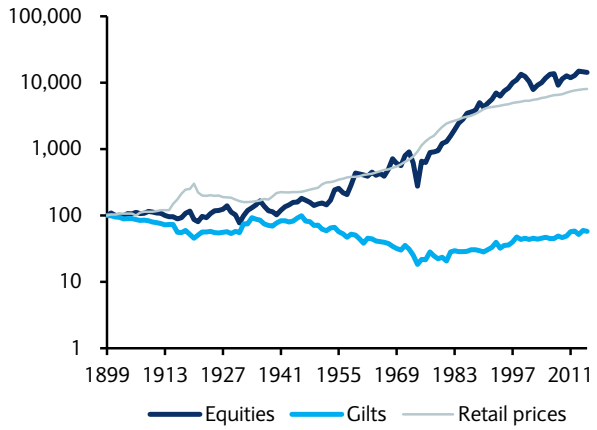
The indices in Figure 2 show the nominal capital value of £100 invested in equities and gilts at the end of 1899. The chart also plots the Barclays Cost of Living Index. Note how the equity index has correlated with increases in the cost of living versus a similar investment in gilts. The index values at the end of 2015 were 14,231 for equities, 57.6 for gilts, and 8024 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-2015 real equity price index at 177 with the real gilt price index at 0.72.

Total return indices

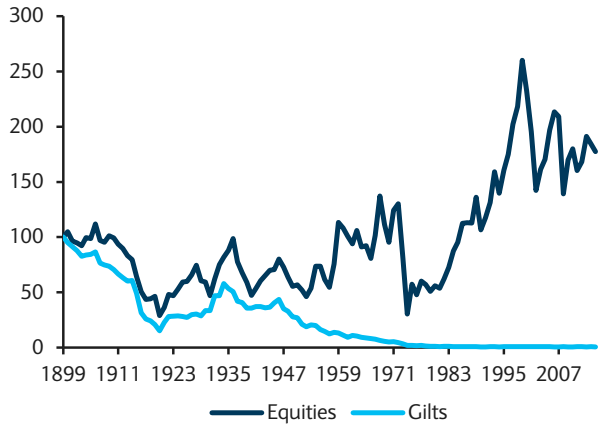
The next two charts show the nominal and real value of the equity, gilt and cash funds with gross income received reinvested at the end of each year since 1899. Figure 4 shows that the nominal worth of £100 invested in equities at the end of 1899 was £2,265,437. The same investment in gilts was worth £36,395 and in T-Bills £20,535. When adjusted for inflation, the equity fund is worth £28,232, the gilt £454 and the cash fund £256.

FIGURE 2
Barclays price indices in nominal terms



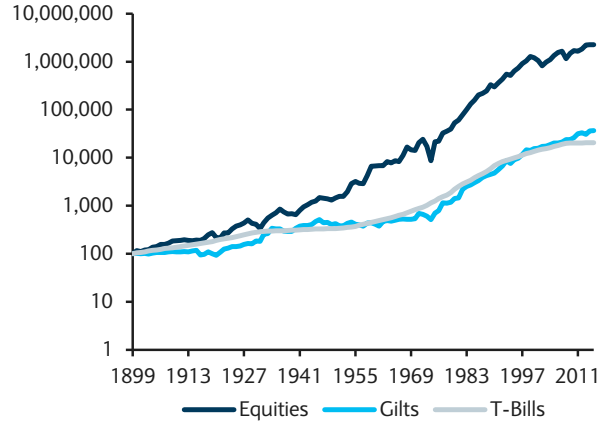
Source: Barclays Research

FIGURE 3
Barclays price indices in real terms



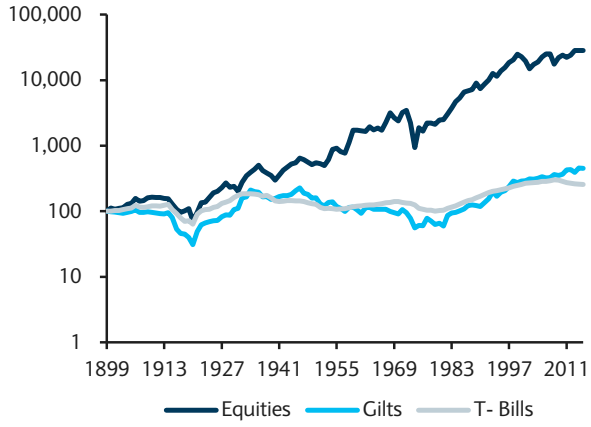
Source: Barclays Research

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

		Change %				Change %	
Year	December (1899=100)	In year	5y average	Year	December	In year	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	2015	8024.3	1.2	2.7

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%

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	
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%
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%
2015	14231	-2.5%	7675	+7.0%	3.7	177	-3.7%	99	+5.8%

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%
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%

Year	Gilt Price Index December		Yield %	Gilt Price Index Adjusted for Cost of Living	
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%
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%
2015	57.6	-2.8%	2.3	0.7	-4.0%

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%
2015	20535	+0.4%	256	-0.7%

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%
2015	400.1	-2.3%	-0.6	0.6	126.7	-3.5%

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%
2015	181676	+1.1%	5113	-0.1%	7815	+0.5%	220	-0.6%	6289	+0.4%	177	-0.7%

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	**2015**	0.45	0.25	20.00
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%
2015	933	-2.2%	296	-3.4%

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%	122	+21.7%
1928	177	+33.7%	132	+11.3%	4.2	185	+35.3%	137	+12.7%
1929	144	-18.2%	98	-26.3%	3.8	150	-18.7%	101	-26.7%
1930	98	-32.1%	80	-17.7%	4.6	109	-27.5%	88	-12.1%
1931	51	-47.7%	54	-32.6%	5.9	63	-42.3%	66	-25.7%
1932	44	-14.1%	55	+1.7%	7.0	60	-4.2%	74	+13.3%
1933	66	+50.9%	53	-4.4%	4.4	90	+49.8%	71	-5.1%
1934	66	-1.0%	50	-5.7%	4.2	88	-2.4%	66	-7.1%
1935	92	+39.6%	71	+42.2%	4.3	119	+35.6%	91	+38.1%
1936	116	+26.7%	95	+34.1%	4.5	149	+24.9%	120	+32.2%
1937	72	-38.1%	69	-27.4%	5.3	90	-39.8%	85	-29.4%
1938	89	+23.0%	70	+1.6%	4.4	113	+26.5%	88	+4.5%
1939	86	-2.9%	75	+7.1%	4.8	110	-2.9%	95	+7.1%
1940	75	-12.8%	79	+5.7%	5.9	95	-13.4%	99	+5.0%
1941	63	-16.1%	81	+1.9%	7.1	73	-23.7%	92	-7.3%
1942	69	+9.1%	87	+8.3%	7.1	73	+0.0%	91	-0.7%
1943	84	+21.6%	80	-8.6%	5.3	86	+18.1%	81	-11.2%
1944	96	+15.5%	90	+12.7%	5.2	97	+12.9%	89	+10.2%
1945	129	+33.5%	98	+9.0%	4.2	127	+30.6%	95	+6.6%
1946	116	-10.2%	86	-12.6%	4.1	96	-24.0%	71	-26.0%
1947	113	-2.3%	115	+34.5%	5.7	87	-10.2%	87	+23.6%
1948	108	-4.1%	125	+8.1%	6.4	81	-6.9%	92	+5.0%
1949	122	+12.1%	156	+25.6%	7.2	92	+14.5%	117	+28.2%
1950	148	+21.7%	194	+24.3%	7.3	106	+14.9%	138	+17.3%
1951	169	+14.3%	178	-8.3%	5.9	114	+7.8%	119	-13.5%
1952	182	+7.4%	182	+2.2%	5.6	122	+6.6%	121	+1.4%
1953	173	-5.0%	175	-3.8%	5.7	115	-5.7%	115	-4.5%
1954	247	+43.4%	225	+28.5%	5.1	166	+44.4%	149	+29.4%
1955	298	+20.4%	228	+1.1%	4.3	199	+20.0%	150	+0.7%
1956	311	+4.4%	225	-1.4%	4.0	202	+1.3%	144	-4.2%
1957	267	-14.1%	205	-8.6%	4.3	168	-16.5%	128	-11.2%
1958	372	+39.3%	270	+31.6%	4.0	231	+36.9%	165	+29.3%
1959	406	+9.1%	240	-11.1%	3.3	247	+7.2%	145	-12.6%
1960	397	-2.2%	251	+4.5%	3.5	238	-3.5%	149	+3.1%
1961	490	+23.3%	266	+5.9%	3.0	292	+22.5%	157	+5.2%
1962	425	-13.3%	262	-1.3%	3.4	250	-14.4%	153	-2.6%
1963	497	+17.1%	291	+11.0%	3.3	288	+15.2%	167	+9.2%
1964	561	+12.8%	310	+6.6%	3.1	322	+11.8%	176	+5.5%
1965	623	+11.0%	343	+10.6%	3.1	350	+8.9%	191	+8.5%
1966	550	-11.7%	327	-4.7%	3.3	299	-14.6%	176	-7.9%
1967	686	+24.7%	381	+16.5%	3.1	362	+21.0%	199	+13.0%
1968	761	+10.9%	404	+6.1%	3.0	384	+5.9%	201	+1.3%
1969	658	-13.5%	361	-10.5%	3.1	312	-18.6%	170	-15.8%
1970	636	-3.4%	413	+14.4%	3.6	286	-8.5%	184	+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	-8.9%
1972	819	+14.3%	405	+4.0%	2.8	345	+10.5%	168	+0.6%
1973	646	-21.2%	344	-15.0%	3.0	250	-27.5%	132	-21.8%
1974	445	-31.1%	348	+1.1%	4.4	154	-38.6%	119	-10.0%
1975	587	+31.8%	453	+30.3%	4.3	189	+23.3%	145	+21.9%
1976	715	+21.9%	515	+13.7%	4.0	220	+16.3%	157	+8.4%
1977	663	-7.3%	553	+7.3%	4.6	191	-13.1%	158	+0.5%
1978	685	+3.3%	629	+13.8%	5.1	181	-5.3%	164	+4.4%
1979	810	+18.3%	764	+21.4%	5.2	189	+4.4%	176	+7.2%
1980	1030	+27.1%	910	+19.2%	4.9	214	+13.0%	187	+5.9%
1981	944	-8.4%	804	-11.7%	4.7	180	-15.9%	151	-18.9%
1982	1078	+14.2%	1059	+31.7%	5.5	198	+10.0%	192	+26.9%
1983	1271	+17.9%	936	-11.6%	4.1	225	+13.6%	163	-14.9%
1984	1257	-1.1%	985	+5.3%	4.4	214	-4.9%	166	+1.3%
1985	1589	+26.5%	1141	+15.8%	4.0	260	+21.8%	185	+11.6%
1986	1777	+11.8%	1096	-3.9%	3.4	288	+10.6%	176	-5.0%
1987	1753	-1.4%	1012	-7.6%	3.2	272	-5.5%	155	-11.6%
1988	1980	+13.0%	1452	+43.5%	4.1	294	+8.2%	213	+37.4%
1989	2456	+24.0%	1594	+9.8%	3.6	349	+18.5%	224	+4.9%
1990	2225	-9.4%	1454	-8.8%	3.6	298	-14.6%	192	-14.0%
1991	2885	+29.6%	1640	+12.8%	3.2	374	+25.8%	210	+9.4%
1992	3061	+6.1%	1533	-6.5%	2.8	386	+3.1%	191	-9.2%
1993	3330	+8.8%	1547	+0.9%	2.6	409	+5.9%	188	-1.8%
1994	3221	-3.3%	1502	-2.9%	2.6	385	-5.8%	178	-5.4%
1995	4268	+32.5%	1876	+24.9%	2.4	498	+29.2%	216	+21.8%
1996	5069	+18.8%	1876	+0.0%	2.1	572	+15.0%	209	-3.2%
1997	6498	+28.2%	2011	+7.2%	1.7	721	+26.0%	221	+5.4%
1998	7831	+20.5%	2082	+3.5%	1.5	855	+18.6%	225	+1.9%
1999	9682	+23.6%	2308	+10.9%	1.3	1030	+20.4%	243	+8.0%
2000	8507	-12.1%	1688	-26.9%	1.1	875	-15.0%	172	-29.3%
2001	7448	-12.4%	1779	+5.4%	1.3	754	-13.8%	178	+3.8%
2002	5801	-22.1%	1660	-6.7%	1.6	574	-23.9%	162	-8.8%
2003	7587	+30.8%	2511	+51.2%	1.8	737	+28.4%	241	+48.5%
2004	8410	+10.8%	2970	+18.3%	2.0	791	+7.3%	276	+14.6%
2005	8862	+5.4%	2930	-1.4%	1.8	806	+1.9%	263	-4.6%
2006	10107	+14.0%	3474	+18.6%	1.9	896	+11.2%	305	+15.6%
2007	10638	+5.3%	3674	+5.7%	1.9	907	+1.1%	310	+1.6%
2008	6420	-39.65%	2639	-28.18%	2.3	547	-39.71%	222	-28.24%
2009	8223	+28.08%	3767	+42.76%	2.6	682	+24.69%	309	+38.98%
2010	9475	+15.23%	3691	-2.00%	2.2	774	+13.54%	298	-3.45%
2011	9181	-3.11%	3438	-6.88%	2.1	728	-5.89%	270	-9.56%
2012	10367	+12.92%	4719	+37.29%	2.5	808	+10.99%	364	+34.94%
2013	13237	+27.68%	5233	+10.89%	2.2	1017	+25.79%	397	+9.25%
2014	14327	+8.24%	5443	+4.01%	2.1	1092	+7.42%	410	+3.23%
2015	13785	-3.79%	5396	-0.86%	2.2	1044	-4.46%	404	-1.55%

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%
2015	134	-4.0%	2.7	10	-4.7%

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%	101	-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	1045	+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	1557	+4.6%	166	+1.8%
2000	1647	+5.8%	169	+2.3%
2001	1709	+3.8%	173	+2.2%
2002	1737	+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	2035	+1.5%	173	+1.4%
2009	2037	+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	2042	+0.03%	157	-1.5%
2014	2043	+0.02%	156	-0.7%
2015	2043	+0.01%	155	-0.7%

CHAPTER 8

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 of years 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 7.

1960-2015

- Equities – income gross
- Gilts – income gross
- Treasury Bills – income gross
- Building Society Shares – income gross
- Index-linked gilts

UK: 1899-2015
US: 1925-2015

- 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	2014
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)																																					
2015	5.2	5.4	5.5	5.3	5.6	5.6	5.9	5.4	4.8	5.3	5.6	5.1	5.0	6.2	8.6	7.0	7.5	6.9	7.1	7.5	7.2	7.4	7.0	6.5	6.0	5.7	5.2	5.2	5.2	4.5	5.5	5.1	4.6	3.7	4.4	3.7	3.2	2.4	1.9	0.8	1.4	2.6	5.1	4.1	3.7	2.3	1.4	1.4	7.0	4.1	3.2	6.1	5.3	(0.3)	(0.1)																																					

The dates along the top (and bottom) 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 2015 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	2014
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	228	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																											
2015	1634	1677	1715	1458	1615	1515	1636	1248	893	1061	1186	882	816	1255	2996	1501	1689	1274	1272	1337	1142	1127	924	756	601	528	430	411	393	313	378	327	280	224	245	205	182	152	138	113	124	144	190	163	150	126	113	112	161	127	117	127	117	99	99																											

The dates along the top (and bottom) 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 2015 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	2014
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)	(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																																						
2015	2.7	3.0	2.7	2.7	2.9	2.9	3.0	3.0	3.3	3.5	3.6	3.3	3.7	4.3	5.2	5.1	5.3	4.7	5.2	5.6	5.7	6.1	5.2	5.0	5.1	5.1	5.1	4.8	4.9	5.2	5.5	5.2	4.8	3.9	4.8	4.3	4.3	3.7	2.7	3.2	3.0	3.2	3.0	3.3	3.3	3.0	3.9	4.2	3.2	4.3	4.2	1.5	1.5	7.6	(0.6)

The dates along the top (and bottom) 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 2015 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	2014
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																									
2015	430	488	402	395	423	424	421	421	457	477	497	425	476	578	812	742	750	581	642	723	688	758	528	480	470	447	418	373	364	370	383	337	292	231	268	232	221	192	158	166	157	156	146	148	143	134	141	139	124	129	123	106	105	116	99																									

The dates along the top (and bottom) 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 2015 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	2014
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	1.7	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)																																					
2015	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.4	1.5	1.6	1.8	2.1	2.3	2.4	2.5	2.6	2.7	2.7	2.6	2.5	2.4	2.3	2.2	2.0	2.0	1.8	1.6	1.4	1.2	1.1	1.0	0.9	0.8	0.6	0.4	0.2	(0.0)	(0.3)	(0.5)	(0.6)	(0.7)	(1.1)	(1.2)	(1.6)	(2.4)	(2.5)	(2.2)	(1.7)	(1.4)	(1.0)	(0.7)																																					

The dates along the top (and bottom) 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 2015 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	2014
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																									
2015	430	488	402	395	423	424	421	421	457	477	497	425	476	578	812	742	750	581	642	723	688	758	528	480	470	447	418	373	364	370	383	337	292	231	268	232	221	192	158	166	157	156	146	148	143	134	141	139	124	129	123	106	105	116	99																									

The dates along the top (and bottom) 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 2015 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	2014
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	3.2	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)																																					
2015	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.8	1.1	1.2	1.3	1.3	1.5	1.5	1.5	1.4	1.3	1.2	1.1	0.9	0.7	0.7	0.6	0.5	0.4	0.1	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)	(0.3)	(0.5)	(0.7)	(1.1)	(1.2)	(1.3)	(1.5)	(1.8)	(2.0)	(2.3)	(2.6)	(2.7)	(2.4)	(1.9)	(1.6)	(1.1)	(0.9)																																					

The dates along the top (and bottom) 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 2015 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	2014
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	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	
2015	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	100	99	99	98	99	95	92	90	86	86	85	85	83	83	83	83	85	89	93	95	98	99

The dates along the top (and bottom) 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 2015 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	2014
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	
2015	3.3	3.6	3.6	4.0	4.0	4.1	4.0	3.9	4.2	4.4	4.0	3.3	4.1	3.8	3.8	3.5	2.8	2.8	2.9	3.3	3.1	3.1	2.9	2.5	3.0	3.2	4.0	4.2	4.0	1.5	1.9	5.0	(3.4)

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	2014
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	
2015	296	309	303	321	314	304	286	269	281	279	245	206	230	212	204	187	159	155	154	157	149	144	137	128	131	129	132	128	121	106	106	110	97

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