11 April 2019

Equity Gilt Study 2019

BARCLAYS

Completed: 11-Apr-19, 01:16 GMT Released: 11-Apr-19, 04:00 GMT Restricted - External

This is a Special Report that is not a debt research report under US FINRA Rule 2242. Barclays makes its debt research reports available to eligible institutional investors only. **Please see analyst certifications and important disclosures beginning on page 154.**

“Free competition is worth more to society than it costs.”
Oliver Wendell Holmes

“Concentrated power is not rendered harmless by the good intentions of those who create it.”
Milton Friedman

“When it is obvious that the goals cannot be reached, don’t adjust the goals, adjust the action steps.”
Confucius

“A little humility never hurts.”
Ben Bernanke

“I don’t mind going back to daylight saving time. With inflation, the hour will be the only thing I’ve saved all year.”
Victor Borge

FOREWORD

Equity Gilt Study 64th Edition

Over the past several decades of its publication, the Equity Gilt Study (EGS) has always endeavored to look beyond the here and now, to explore themes and trends affecting global economies and markets for years to come. This year, we have an especially wide variety of topics and themes to explore.

Chapter 1 looks at how the concentration of market power in corporate America is re-shaping the US economy, in ways large and small. While this phenomenon is most visible in the rise of large technology platforms, concentration has increased in most of the US economy since the turn of the millennium. More worryingly, the report suggests that higher concentration leads not just to reduced competition, but also a decline in investment, labor share of profits, and business dynamism. Society has pushed back against previous instances of market power through regulation and government intervention; instead, this report suggests policies designed to explicitly revive competition as an alternative.

Chapter 2 highlights the challenge faced by central banks in generating inflation over the past decade. While the 'inflation targeting' framework has worked well in lowering high inflation, its shortcomings have become more evident as central banks struggle to lift very low rates up to a 2% target. Several factors have driven this inflation underperformance, including demographics, technology, globalization and the constraints posed by the zero lower bound. This report concludes that the existing toolkit might simply not be sufficient: new approaches, including closer co-operation between fiscal and monetary policy, might be needed in the event of a serious economic downturn and an outbreak of deflation.

In Chapter 3, we challenge the conventional wisdom that emerging markets are where returns are to be found over the long term. EM's advantages of population growth and expected productivity convergence might be significantly exaggerated. A more realistic assessment that accounts for actual demography and the effects of recent technological progress implies that the trend underperformance of EM assets and currencies that began in 2013 might have a significant amount of room to run. Even when EM economies have sharply outperformed developed countries in the past, that has often not been reflected in EM financial assets.

In Chapter 4, we look at the implications of the US march to energy independence and how it has shifted energy markets from a mode of scarcity to abundance. We find that the US energy revolution has structurally boosted the US dollar and reshaped global capital flows. The effects on the US trade balance are significantly positive, but more modest for the overall US economy. Finally, we look at how energy abundance is likely to transform US foreign policy, with less involvement in the Middle East and a harder line with oil-exporting adversaries.

The Equity Gilt Study has been published continuously 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 University of Chicago) begin in 1925. We hope this year's effort lives up to the publication's rich history.

Jeffrey Meli
Head of Research

Ajay Rajadhyaksha
Head of Macro Research

CONTENTS

Chapter 1

The rise of market power 4

We use the new Barclays Competitiveness Indicator (BCI) to provide deeper insights into the relationship between increased concentration and market power. One possible fallout from higher concentration is an intensification of market power and a corresponding reduction in competition. We consider whether decreased competition is threatening the US economy or whether current competitive pressures are beneficial to industries, investors and consumers.

Chapter 2

Beyond inflation targeting: Reconsidering tools, targets and theories 30

Monetary policy makers are under pressure. Inflation targeting, the common policy framework that had worked so well since the early 1990s to rein in price gains, is struggling to lift inflation toward (a 2%) target. Still, the most commonly discussed alternatives seem to promise only limited help, while more radical proposals come with much larger risk. Hence, for investors the future monetary policy could be a future with fatter tails.

Chapter 3

Rethinking Emerging Markets: Fables of the Reconstruction 55

Contrary to conventional wisdom, we expect a trend relative decline of EM asset prices and exchange rates over a multi-year horizon as technological progress flips from supporting faster EM growth through globalisation to undermining it. The silver lining for unbenchmarked EM managers is that dispersion and volatility likely will increase.

Chapter 4

From scarcity to abundance: Implications of the new US energy economy 75

US tight oil growth has shifted energy markets from a mode of scarcity to abundance over the past decade. The US transition from a giant net importer of energy towards becoming a net exporter has boosted the economy, up-ended oil markets, influenced global currencies and capital flows, and dislodged geopolitical alignments. Increased energy production has spurred US growth through trade as well as investment and employment. The shift to net energy exporter should boost the USD's fair value, while muted oil price levels and higher oil price volatility are likely to constrain global capital flows, particularly to emerging markets. Finally, the US energy revolution has also recast US energy diplomacy and reshaped traditional bilateral relationships.

Chapter 5

UK asset returns since 1899 98

2018 proved to be a challenging year for investors, as negative real returns were seen across most assets. Global equities posted the weakest performance since the Great Financial Crisis, as trade tensions combined with global growth concerns to culminate in a sharp sell-off into year-end. UK assets broadly followed global trends; however, UK equities and IG credit managed to outperform Europe, while the performance of Gilts into year-end proved more volatile given increased Brexit concerns.

Chapter 6

US asset returns since 1925 **104**

Following two years of double-digit returns, US risk assets delivered weak performance in 2018. Despite this, for long-term investors, both equities and corporate bonds enjoyed a strong decade. For those who invested at the end of 2008, equities returned an average of 10% per annum, well above the long-run average performance. Negative bond returns in 2018 reflect the backdrop of rate hikes and the hawkish tone maintained by the Fed last year, with the year-end risk off sentiment partially reversing the effect of rising yields.

Chapter 7

Barclays Indices **108**

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. 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.

Chapter 8

Total investment returns **136**

This chapter presents a series of tables showing the performance of equity and fixed-interest investments over any period of years since December 1899.

Pullout Tables

CHAPTER 1

The rise of market power

Jeffrey Meli
+1 212 412 2127
jeff.meli@barclays.com
BCI, US

Jonathan Millar
+1 212 526 4876
jonathan.millar@barclays.com
BCI, US

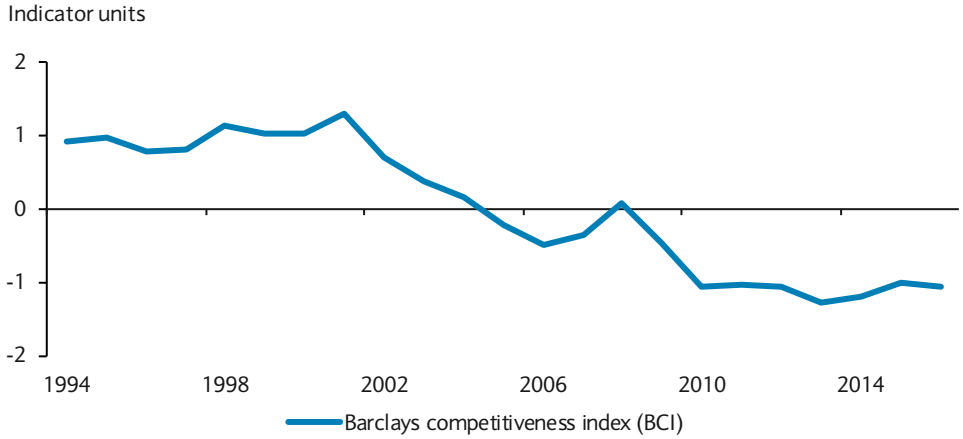
Adam Kelleher
+1 212 526 5697
adam.kelleher@barclays.com
BCI, US

We use the new Barclays Competitiveness Indicator (BCI) to provide deeper insights into the relationship between increased concentration and market power. One possible fallout from higher concentration is an intensification of market power and a corresponding reduction in competition. We consider whether decreased competition is threatening the US economy or whether current competitive pressures are beneficial to industries, investors and consumers.

Our key findings

- **Aggregate and industry-level measures of market concentration have risen sharply in the US since the turn of the millennium.** While this is most visible in technology, we found increased concentration in 75% of the sectors we examined.
- **One possible fallout from higher concentration is an intensification of market power and a corresponding reduction in competition**. Companies with market power can extract additional profits by raising prices, suppressing wage growth, and discouraging market entrants. However, competition has not fallen in every sector where concentration has increased. Rising concentration may also be consistent with a winner-take-all narrative, where new technologies enable the most productive firms to capture market share. This highlights one of the dangers of relying too heavily on concentration to measure market power.
- **We introduce the new Barclays Competitiveness Indicator (BCI), which provides a more nuanced view of whether increased concentration is hindering competition within industries.** We document an aggregate decline in competition in the US starting around 2000 (Figure 1). Our metric uses three inputs: investment, labor share, and business dynamism. Each has declined since 2000, in sync with the rise in concentration. Sectors with higher concentration have experienced sharper declines.

FIGURE 1
The Barclays Competitiveness Indicator shows a decline in competition since 2000



Note: Principal components are estimated after standardising each data series after removing industry means. Sample includes 38 industries, 1993-2016. Source: Barclays Research, using data from the BLS, the BEA and Compustat

- **Rising market power presents a binary risk to equity markets.** On the one hand, it is supportive of equity valuations: it leads to elevated and resilient margins. Left unchecked, companies with market power should continue to outperform. However, concerns about competition have become more prominent among policy makers and politicians recently, raising the risks of intervention. This poses a real risk to companies whose profitability is buoyed by low competition.

- **We believe that policies designed explicitly to revive competition would be more effective at mitigating the ill effects of market power.** We see risks that approaches designed to limit the ability of dominant firms to utilize their position might solidify the position of incumbents. The BCI can distinguish between industries that warrant intervention from those where increased concentration has not led to reduced competition.

US market concentration: Competing narratives

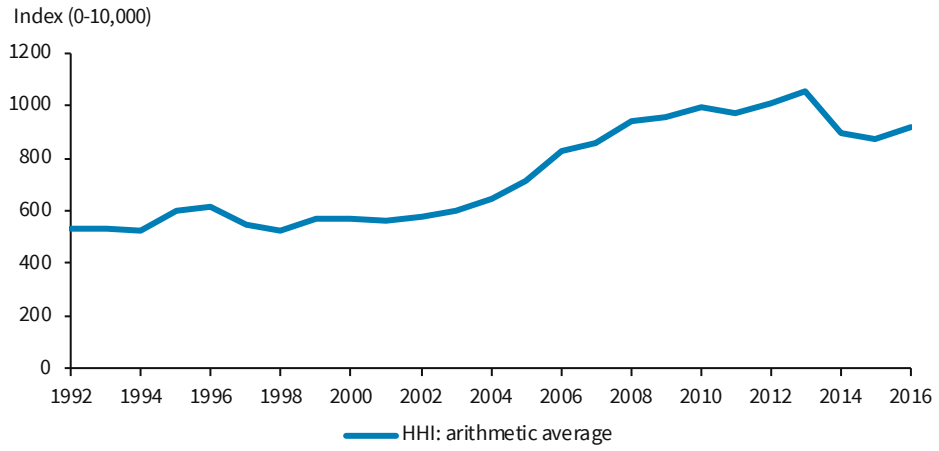
The US economy began to change in a number of ways around the turn of the millennium. One such trend, a gradual and material rise in industrial concentration, has garnered significant attention from academics and policy makers. Concentration is measured in terms of market shares, and across the economy, a smaller and smaller number of firms has come to control larger and larger portions of markets.[1]

This concentration is not limited to the dominant positions enjoyed by a few titans in the technology industry: similar consolidation has occurred across broad swathes of the economy. Since 2000, concentration has increased in nearly 75% of the non-financial sectors we examine. The magnitude of the changes is material; the standard measure of concentration, the Herfindahl–Hirschman Index (HHI), has risen over 60% over the past two decades (Figure 2). For a detailed explanation of how we measure the HHI for a particular industry, see page 7.

Higher concentration is often associated with a less competitive economy. For example, various US antitrust authorities – the Department of Justice (DoJ), the Federal Trade Commission (FTC), and the Federal Reserve – use measures of concentration to evaluate

FIGURE 2

US industries have become more concentrated, on balance



Source: Barclays Research calculations using company-level Compustat data.

[1] Our calculations use domestic data from public companies. This is a limited view of concentration, which should also include private companies and international firms. Several academic papers have shown that the conclusions are robust to adjusting for those factors. See, for example, "Investmentless Growth: An Empirical Investigation," Germán Gutiérrez and Thomas Philippon, *Brookings Papers on Economic Activity*, Fall 2017, pp. 89-174.

the implications of proposed mergers. If the association between concentration and diminishing competitiveness is true, these shifts would present a disturbing take on the prevailing direction of the US economy: one in which the private sector is accumulating significant market power. A company with market power has the ability to manipulate prices, including those for the products and services it sells, as well as those that it pays its suppliers and employees.[2] Companies can exploit market power in ways that undermine overall well-being, extracting additional profits by raising consumer prices, price discriminating, suppressing wages, discouraging entry by competitors, or using their influence to tilt regulations and government incentives in their favor.

However, an alternative hypothesis is that the rise in concentration might reflect an *increase* in competition. According to this winner-take-all narrative, increased concentration is a side effect of intensifying price competition, which forces less efficient firms out of the market. In this view, something (such as heightened price transparency from the internet) has tilted the playing field toward more efficient firms, allowing the most productive firms within a given industry to capture sales from their less efficient rivals.[3]

Macroeconomic and market implications differ sharply

Elevated market power would imply a bleak future for the US, in which crony capitalism at its worst would weigh on the economy's dynamism, innovation and investment in ways that would tend to undermine longer-run growth. With wealth flowing into fewer hands, intensifying concentration would also serve as a significant structural impediment to addressing the problems posed by rising income inequality. Indeed, with companies retaining the power to set product prices, their owners might be able to capture an outsized portion of productivity gains that otherwise would be spread more widely among consumers, wage earners, and other (smaller) producers. Those who benefit from this situation would have incentives to devote resources to sustain the status quo, even if doing so is wasteful from a broader perspective. These and other associated trends would tend to persist absent some effort to check rising market power, such as a major shift in the government's stance towards large dominant firms.

The market power narrative would also pose a binary risk for equity markets. Increases in corporate profits have helped propel significant equity gains over the past decade. If market power is elevated and continues to grow unchecked, profitability and market valuations of incumbent firms will likely continue to grow. At the same time, with the adverse effects of market power attracting greater attention, there are risks that policymakers could take action to limit or reduce this power. Such an outcome could pose risks to equity valuations, especially in sectors where market power has driven gains. While appropriate policy actions to address market power could benefit the economy in the long run, these benefits would take time to materialize, whereas potential fallout on equity prices could be abrupt, particularly for some of the more far-reaching proposals.

By contrast, implications of the "winner-take-all" narrative are seemingly more benign, and perhaps even positive. According to this thesis, the economy is benefiting from super-charged competition, yielding clear gains in terms of efficiency and productivity. Government intervention would not be needed or warranted: with "the invisible hand" disciplining costs and margins, the benefits of innovation would be distributed broadly among consumers, wage earners, and other producers. Moreover, with heightened returns to productivity, incentives to innovate and invest would remain strong and may even intensify. This is because the current crop of "winners" would feel continual pressure to

[2] Technically, a firm can have market power in either or both of the product market or input markets. Power in these markets would not necessarily go hand in hand, but both would generically be related to higher concentration.
[3] For example, see "The Fall of the Labor Share and the Rise of Superstar Firms," Autor *et al.*, NBER Working Paper #23396, May 2017 and "Concentrating on the Fall in the Labor Share", Autor *et al.*, *American Economic Review: Papers and Proceedings* 2017, 107(5), 180-185.

provide better and cheaper products for fear of having their dominant position supplanted by others. Presumably, aggregate data on investment, productivity, and growth would eventually adjust to reflect this new reality.

Introducing the Barclays Competiveness Indicator

Research approach

We examine rising US concentration, and a variety of its potential economic ramifications that have been highlighted in the literature, using an industry-level panel that encompasses 25 years of data on capital growth, Tobin's Q, labor's share of income, concentration, and business dynamism. Part of our approach is to use this dataset to run panel regressions that examine testable implications that distinguish the two theories. Figure 3 summarizes these regression results, listing a number of trends that have been noted by previous literature, the period when each trend began, and how each correlates with movements in market concentration within industries.[4] The findings corroborate the literature by documenting strong relationships between rising concentration on the one hand and higher corporate profitability, a falling labor share of income, diminished business dynamism, and reduced investment on the other. The timing of these trends appears remarkably consistent: our analysis suggests that the year 2000 represents a structural break for many economic trends, not just industrial concentration. In addition, declines in the labor share, investment, and dynamism were more severe in industries with higher concentration.

Defining the BCI: A new metric of competition

Our new metric of competitiveness – the Barclays Competiveness Indicator (BCI) – moves away from the common interpretation of concentration as a direct proxy for market power. There is a good reason why concentration is commonly used as a metric of competitiveness: it can be estimated for a highly specified market.

However, as the discussion above highlights, from a theoretical standpoint, higher concentration could arise in environments where competitive pressures are very high or very low. Although our analysis provides evidence linking higher concentration with heightened market power, on aggregate, it does not dispel the possibility (or even likelihood) that, in some markets, higher concentration may be a symptom of elevated competition. In other words, one cannot extrapolate conclusions for the overall economy to each sub-sector of the economy where concentration has increased.

Although other measures of competitive pressures – such as the mark-up of prices relative to marginal costs – are cleaner from a theoretical perspective, they are difficult, if not impossible, to measure at a more granular level because companies do not report marginal costs. While a great deal of ongoing work in the economic literature has shown that it is possible to generate plausible aggregate measures of the mark-up, these methodologies are less useful when assessing sub-sectors or specific markets, where appropriate data are difficult to form.[5] This presents a dilemma when working at a more granular market level: clean metrics of competitiveness cannot be readily computed using available data, while the feasible metric (concentration) is theoretically flawed.

[4] The panel regressions that inform the relationships described in Figure 3 all control for industry fixed effects. In other words, for any given variable, we abstract from level differences across industries that persist through time.
[5] These difficulties are apparent when one considers the lack of robustness in measuring firm-level markups highlighted by a comparison of the papers "The Rise of Market Power and the Macroeconomic Implications," Jan De Loecker and Jan Eeckhout, NBER Working Paper #23687, August 2017; "Is Aggregate Market Power Increasing? Production Trends using Financial Statements," James Traina, University of Chicago-Booth New Working Paper Series No. 17, February 2018; and "New Evidence on the Markup of Prices of Marginal Costs and the Role of Mega-Firms in the US Economy," Robert E. Hall, NBER Working Paper #24574, May 2018.

FIGURE 3
Industry panel regressions link important changes in the US economy to rising concentration

Variable	Trend	Relationship to Concentration	Narrative
Corporate profitability	Sharp rise starting in 2000		Both
Labor Share	Decline starting in 2000	More severe in industries with high concentration	Both
Business dynamism	Decline starting in 2000	More severe in industries with high concentration	Market Power
Investment	Decline starting in 2000	More severe in industries with high concentration	Market Power

Labor's share of overall business output has been trending down since the 1970s, but the pace accelerated notably around 2000. Source: Barclays Research

As a remedy, we develop a new measure of competition that employs principal components analysis (PCA). Our PCA explores whether there are common factors that help explain the joint evolution of investment, business dynamism, and labor's share of income. We find that the first unobserved principal component exhibits economic effects consistent with heightened competitive pressures, as it is positively correlated with variables that should be high when market power is low – such as the investment rate, labor's share of income, and business dynamism.[6] Hence, we interpret this component as a new metric of competitive intensity. The BCI methodology paints a picture of aggregate trends in competitiveness that is consistent with the market power narrative (Figure 1). It has declined through time in almost all the broad industry categories we examine. Since the inputs used to construct this factor are generally available at the company level, we can use this approach to create competitiveness metrics for markets composed of a custom basket of companies. In turn, we can use such customized baskets to assess the intensity of competition in market segments that cut across traditional definitions. Unlike concentration-based measures, this metric does not require comprehensive data on the entire set of competitors in a market; the influence of any excluded firms will be felt in data for the firms that we do include. In related research, *Retail & Media: Assessing the elephants in the room*, we examine how the competitive landscape has evolved in different directions across retail and media, despite both sectors showing an increase in concentration. Competition appears to be healthy in retail, but is more likely impaired in media, where we find evidence of increased market power.

A comprehensive industry-level dataset for the US economy

To explore these trends in detail, we collected a comprehensive industry panel dataset using macroeconomic and corporate data from a variety of sources. Figure 4 shows the main variables included in our dataset, the source for each measure, and some information about our underlying calculations (see Appendix A for more details).

Industry definitions differ somewhat across data sources: industry segments used by the Bureau of Economic Analysis (BEA) are somewhat more consolidated than the standard three-digit NAICS classifications used in the Bureau of Labor Statistics (BLS) and Compustat datasets. To impose a consistent sector view, we map from the three-digit NAICS into BEA industry segments.[7] To focus analysis on industries in the nonfinancial, nonfarm business sector with good data coverage, our mapping excludes the financial and utilities sectors, as well as a small number of BEA sectors with insufficient representation in Compustat. Given available annual estimates, the result is a full dataset with 38 industry sectors, with coverage from 1992 to 2016.

[6] We find that this measure is robust when we expand the set of variables in the PCA to include other measurable variables such as productivity growth, Tobin's Q, and the HHI.
[7] More specifically, we borrow the mapping scheme utilized in "Investmentless Growth: An Empirical Investigation," Germán Gutiérrez and Thomas Philippon, *Brookings Papers on Economic Activity*, Fall 2017, pp. 89-174.

FIGURE 4
US industry-level panel dataset, 1992-2016

Variable	Source	Series	Calculations	Level of aggregation
Concentration	Compustat	Sales by segment	Compute market share for each company Compute HHI as sum of squared market shares across companies in each industry	NAICS-3
Tobin's Q	Compustat	Market value of equity Book value of equity Preferred stock Total Debt	Ratio of market value to sum of book value of equity, total debt, and preferred stock	Publicly traded companies
Investment rate	BEA	Growth rate in capital stock	Adjusted for inflation	BEA segments
Labor share	BLS		Nominal labor compensation within industry divided by industry GDP	BEA segments
Business dynamism	BLS	Net jobs added at new or expanding establishments Net jobs lost at closing or contracting establishments	Sum of net jobs added and net jobs lost, divided by total employment	NAICS-3

Source: Barclays Research

Constructing the Herfindahl–Hirschman Index for a particular industry

Throughout our analysis, we measure market concentration using a simple version of the HHI, which is the standard measure of the intensity of competition in the industrial organization literature and is the main measure for merger analysis by the antitrust authorities. (That said, for reasons explained below, we believe it is at best an imperfect indicator of competition.)

We form the HHI for a particular industry by summing squared market shares of all the public firms operating within it. Thus, for a monopolist, the index is 10000, whereas for an industry with only atomistic firms, the index would approach zero. Annual sales shares for each firm are formed using sales data reported in Compustat. Figure 2 shows the average sales share across the 38 industries in our panel. According to this measure, concentration was relatively stable through the 1990s, began increasing in 2000, and levelled over the past several years. All told, the cross-industry averages show that the average HHI increased 60% between 1992 and 2016, with all of the rise occurring after 2000. Qualitatively, this uptrend is also apparent within the vast majority of sectors: 75% of the sectors we examine were more concentrated in 2016 than in 1992.

We make several simplifying assumptions in our HHI calculation. First, we include only domestic firms, leading us to overestimate concentration in domestic industries with significant import penetration (and/or less significant export content). Since the post-millennial period includes the emergence of China as a major manufacturing center, it is likely that import penetration increased for some industries (mostly within manufacturing) even as some domestic firms exited. In principle, this could cause our dataset to overstate the intensification of measured concentration, after accounting for competition from overseas competitors.[8] Second, since Compustat includes only publicly traded firms, our

[8] There are some attempts in the economic literature to adjust for import penetration (such as "Globalization, markups and U.S. welfare," R.C. Feenstra, and D. E. Weinstein. *Journal of Political Economy*, 2017), but such approaches are complex and require several ambitious assumptions. Despite the possibility that our approach biases our results, our conclusions are qualitatively similar to those that make these adjustments.

measure accounts for public companies only and therefore may skew the evolution of concentration. Despite these potential sources of bias, we find that our measure is qualitatively similar to those from other studies that attempt to adjust for such influences.[9]

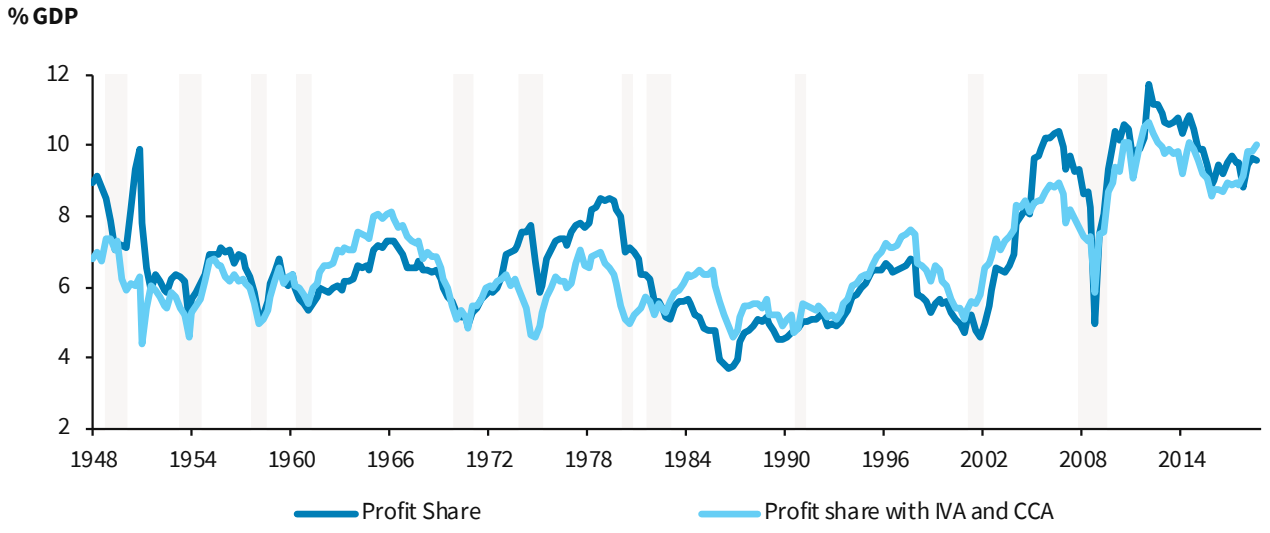
A final note of caution in interpreting our HHIs – and measures of concentration more generally – is that they are computed for a specific market or sector and therefore depend both on an accurate definition of what constitutes a market and an accurate categorization of firms within that market. Defining markets can be difficult because the business and consumer landscape evolves rapidly. For example, not long ago, very few would have anticipated that Netflix and Amazon would venture outside of their traditional online business segments to compete with movie studios in producing content. It is almost certain that the BEA segments used in our analysis do not fully reflect this blurring of lines within and between relevant markets.

The link between concentration and market power

There is a sound theoretical basis underpinning economists' focus on increased concentration as a sign of decreased competition. With a limited number of competitors, a company is more likely to be able to dictate terms; the lack of alternatives disrupts the normal disciplining effect of market forces. A company can have power over its product market, its input markets, or both; in the limiting cases with a single seller or buyer, the former is called a monopolist and the latter a monopsonist. Economic analyses usually perceive low concentration as a sign that companies lack market power. That is, as the number and scale of competitors faced by a company increases, it loses the ability to influence prices: if it charges too much for its products, its customers move to a competitor, and if it pays its suppliers or workers too little, they will tend to move to competitors. In other words, the supposition is that with low levels of concentration, market forces will dictate terms, rather than the company itself.

FIGURE 5

After-tax corporate profits have risen as a share of GDP since 2000



Source: Bureau of Economic Analysis, Haver Analytics, Barclays Research

[9] In particular, our measures are similar to those shown in "Investmentless Growth: An Empirical Investigation," Germán Gutiérrez and Thomas Philippon, *Brookings Papers on Economic Activity*, Fall 2017, pp. 89-174.

All else equal, one would expect companies with market power to be more profitable. By boosting prices relative to competitive levels, companies raise their margins, even if doing so means somewhat lower sales volumes. Profitability can also derive from market power in input markets, which allows firms to pay their suppliers less for inputs, pay workers less, or both. Large companies may also use their influence to tilt the regulatory environment in their favor or to gain tax incentives from local jurisdictions. The ability of large firms to pull such levers may help explain why corporate profits have risen sharply as a share of income since 2000, just as concentration began to increase (Figure 5).

However, while concentration is consistent with a rise in market power, elevated corporate profitability is hardly conclusive evidence; in fact, a number of critiques have challenged the claim that market power has risen. Here, we address three: the apparent disparity between supposed pricing power and subdued inflation; the perception that many of the largest and most dominant firms are also the most innovative and dynamic; and the claim that the linkage between concentration and competition may actually go in the opposite direction. Of these critiques, we believe only the third poses a meaningful challenge that warrants deeper exploration.

Lack of inflation

It seems natural to reason that inflation would be a consequence of elevated market power. Dominant firms can take advantage of their position by charging higher prices, which, if widespread enough, ought to show up in aggregate price statistics. Yet inflation has remained subdued, despite years of accommodative monetary policy.

This critique ignores at least two factors. First, aggregate inflation statistics are affected by a number of confounding influences. Particularly important among these are effects from productivity growth and low-cost import penetration, which tend to reduce costs over time. These pressures differ substantially across sectors, often in ways that may be unrelated to market power. For example, cross-sector differences in productivity growth and import penetration are a key reason why consumer goods inflation is generally very low (or even negative) while services inflation is positive. Despite this discrepancy, it is quite possible that firms in both sectors have market power and are able to sustain sizeable margins after taking account of differences in the evolution of their costs of inputs and production. To assess the role of market power, a careful analysis would need to account for these influences.

Second, exercising market power brings risks – chiefly regarding antitrust enforcement – since abusing a dominant position is illegal in the US.[10] The principal lens that antitrust authorities look through when investigating potential antitrust abuses is consumer prices; specifically, a rise in prices is potential evidence of an abuse of market power. As a result, entities have incentives to exercise power through other means. For example, they can utilize their leverage on suppliers and workers to limit cost increases, thereby allowing them to sustain – or even raise – mark-ups without drawing the ire of the authorities. Indeed, given the emphasis that antitrust authorities place on prices, rather than margins, it is no surprise that dominant firms have found alternative ways to profit from their power.

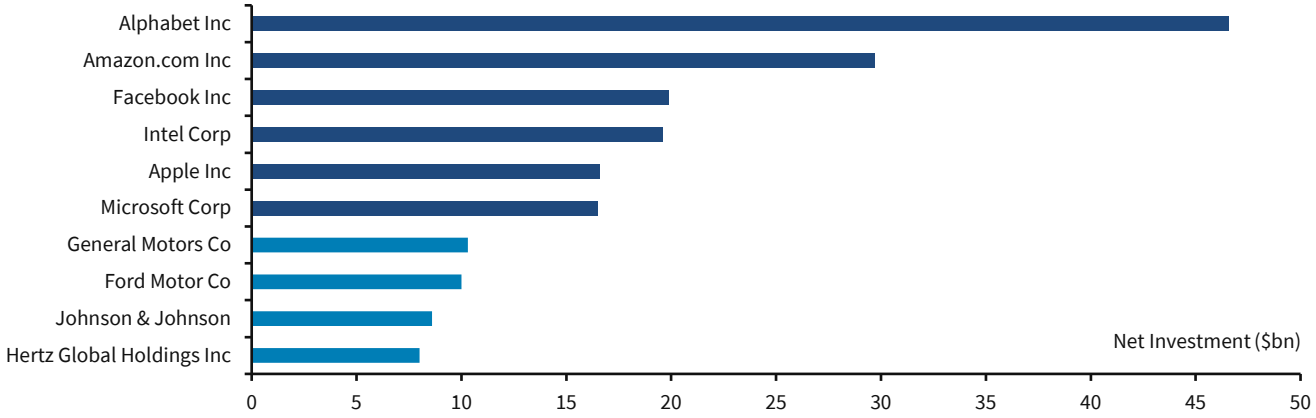
Dominant firms tend to be the most innovative and dynamic

Another critique of the market power narrative is that the most obvious firms that may have dominant positions – the biggest technology companies – are also the most dynamic and innovative. In fact, among the ten companies in the S&P 500 with the highest absolute levels of capital expenditures, the top six are high-tech (Figure 6). It seems natural to question how companies driving the most impressive technological advancements could be responsible for undermining competitiveness and efficiency.

[10] Amazon's Antitrust Paradox, Lina M. Khan, *The Yale Law Journal*, January 2017.

FIGURE 6

Tech giants dominate the list of the top 10 S&P companies in terms of capital expenditures



Note: Net of depreciation and amortization, includes outlays on research and development. Source: Compustat, Barclays Research

Our response is that one cannot assess the overall economy's dynamism using just a handful of firms, as the effects of market dominance are likely felt more broadly. In other words, if dominance by several large firms is depressing aggregate investment and technological innovation, the magnitude of investment and innovation by those large firms is beside the point. Indeed, these dominant firms may be investing and innovating just enough to keep at bay prospective competitors that would otherwise enter, invest, and innovate. To assess the broader consequences of market dominance, we must rely on larger industry trends, rather than outputs of individual companies.

Winner take all: A heightened competition alternative

The most credible critique of the claim that market power has intensified is that it usually proceeds from observed measures of concentration, which is a flawed proxy for the intensity of competition. This flaw exists, in part, because a market must be contestable in order to reap the benefits of competition, regardless of its concentration. Indeed, even if a firm has no competitors, it may still lack power if the threat of entrants prevents it from abusing its position.

The idea that market concentration need not entail market power is closely associated with the winner-take-all narrative. In this view, concentration is a symptom of heightened competition, which is driving out the least efficient firms in many industries.[11] This theory relies on differences in productivity and profitability across firms, which is a well-established fact in many industries.[12] Customers tend to migrate to firms that can provide similar products and services at lower prices. Moreover, once a winner-take-all dynamic takes shape, it can become entrenched by other self-reinforcing advantages that can accompany size and scope, such as scale economies, network externalities, and enhanced ability to collect and exploit customer data.

[11] For example, see "The Fall of the Labor Share and the Rise of Superstar Firms," David Autor *et al*., NBER Working Paper #23396, as well as "Concentrating on the Fall in the Labor Share," David Autor *et al*., *American Economic Review*, 2017, 107(5), 180-185.

[12] For example, see "Firming Up Inequality," J. Song *et al., The Quarterly Journal of Economics*, 134(1), February 2018 and "The Best versus the Rest: The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy." D. Andrews *et al*., OECD Productivity Working Papers No. 5, 2016.

The key insight of the winner-take-all narrative is that markets may be becoming more contestable precisely because potential gains from even small advantages have increased. These gains may owe to greater price transparency, which unleashes a dynamic that allows firms to better exploit their advantages, regardless of source.

One example of scale economies is the effect that online shopping has had on the retail landscape. In a world with greater price transparency, smaller electronics stores compete on an even weaker footing with the likes of Amazon and Best Buy, which benefit from various scale economies such as the ability to buy in bulk, exploit loss leaders, and draw upon national shipping capabilities. However, firms could also gain dominance by making process innovations, developing more efficient supply chains, and using new forms of technology. Regardless of how these advantages are derived, the outcome of this dynamic would be both an increase in concentration – as the less efficient firms lose market share – and enhanced incentives to invest and innovate. Ideally, the pernicious effects of low competition would not manifest, as firms in even the most concentrated markets must constantly guard against prospective new entrants.

This narrative seems consistent with at least some of the macro phenomena discussed above. Among other things, corporate profitability would tend to rise in a winner-take-all economy because the largest and most profitable firms capture greater market share, while the persistence of low inflation could indicate that at least some efficiency gains are being passed on to consumers through prices.

The two narratives may not be mutually exclusive

Although these narratives have very different macro and market implications, differentiating between them is difficult, in part because they both appear to contain elements of truth. Recent debates, such as well-publicized concerns about the privacy of data for customers in the technology sector, have highlighted the omnipresent nature of the largest companies in our lives. While the expanding footprint of dominant companies may be less obvious in other sectors, such concerns are not limited to big tech. Indeed, they are all the more obvious when one considers the limited options available to consumers in some markets and the anecdotal evidence that dominant companies are using (or abusing) their position to disadvantage competitors or suppliers.

At the same time, the trend toward price transparency and heightened price competition emphasized by "winner take all" is evident in a number of sectors where competitive dynamics appear to have intensified. Signs of heightened price competition in these sectors – readily apparent to anyone who shops online – are difficult to square with traditional notions of how firms wield market power. Indeed, in some sectors – such as ride sharing – large firms have risen to prominence precisely because they have been able to disrupt entrenched interests.

It is important to recognize that these two narratives need not be mutually exclusive. Companies are not born with market power; they have to acquire it. Shocks to the competitive landscape may reward the most productive firms, which then find themselves in a dominant position that they may subsequently seek to defend and exploit in ways that undermine collective well-being. At any given time, different industries may be in different stages of this transition, meaning that both phenomena could be occurring simultaneously.

Concentration, labor share, dynamism, and investment

To help differentiate between these narratives, we examine the relationship between concentration and three important economic trends of the past 20 years: the decline in labor's share of aggregate income, the decline in business dynamism, and the decline in the investment rate (or rate of increase in the capital stock).

We choose these trends for several reasons. First, they are of concern to the US economy, suggestive of an environment with more limited opportunity and innovation. Second, they can all be linked to rising market power on theoretical grounds – each is a characteristic we would expect in industries composed of increasingly dominant firms. Finally, they are measurable at multiple levels of granularity; that is, we can measure them (reasonably) cleanly across the entire US economy, at the industry level, and even at the company level. The industry level is particularly important in the current context, as it allows us to sidestep aforementioned problems in interpreting concentration measures for specific markets by examining the cross-sectoral relationship between these trends and changes in concentration. The fact that these variables can be measured at the company level is important for assessing competitive pressures at the sub-sector level, something we do in our companion report, *Retail & Media: Assessing the elephants in the room.*

Both narratives speak to declines in labor's share of total income

In the market power case, labor share tends to decline, for two reasons. The first is that firms with power in product markets can charge prices above marginal costs and, thus, earn excess profits. The second is that firms with pricing power in a given input market (including the labor market) can pay less for that input than it will contribute to marginal revenue.[13] In both scenarios, a greater share of a firm's income would flow to shareholders, on aggregate. In the winner-take-all case, a greater proportion of overall activity shifts to more efficient firms, which, empirically, tend to distribute more of their income to shareholders. The outcome of this compositional shift is a decline in labor's share of aggregate income, albeit for different reasons.

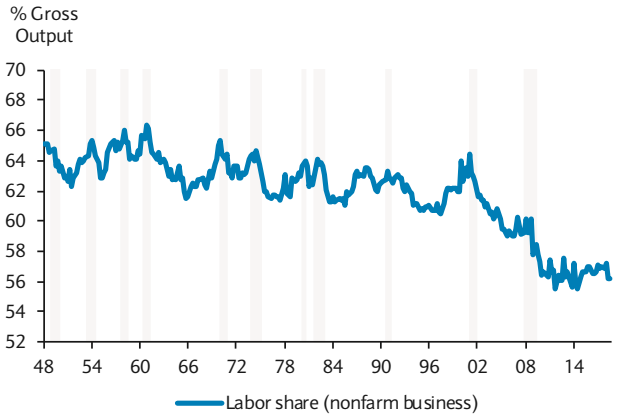
Figure 7 shows trends in the labor's share of aggregate income (GDP) in the nonfarm business sector.[14] To form this share, we use the measure of labor compensation from BEA industry data for the nonfarm business sector, which includes overall wages and salaries as well as bonuses and employer-provided benefits.[15] It is apparent from these aggregate data that the labor share began to fall after 2000, from a peak of 64% in 2000 to just 56% in 2016. This sharp decline is well outside the bounds of available experience: prior to that decline, the share had never fallen below 60% of income since the 1940s. Most of the recent decrease occurred between 2000 and 2010, whereas over the past several years, the trend has flattened. A similar trend is evident across most of the industries in our panel: two-thirds of the industries had a lower labor share in 2016 than in 1993.

Figure 8 examines how the trend in the labor share relates to the trend in concentration. We run panel regressions of this share on our measure of concentration (the HHI), with additional controls for industry fixed effects (which account for unobserved effects from fixed industry variables).

[13] It is not obvious that a dominant position in product markets necessarily leads to monopsony power in labor markets. However, some studies document declines in the number of employers in various labor markets (by industry, region or commuting area), indicating that both types of market power may be occurring.
[14] The portion of pretax income that does not flow to labor includes returns to capital, economic profits, and indirect taxes. Economic profits are defined somewhat differently than accounting profits: the latter include all returns to capital, whereas the former are returns over and above the market cost of capital ("rents"). While accounting profits have clearly risen, there is debate in the literature about whether this reflects higher rents.
[15] Among other things, this would incorporate higher benefit costs, such as the increased cost of employer-provided healthcare.

FIGURE 7

Labor's share of nonfarm business income has been consistently lower since the early 2000s



Source: Bureau of Labor Statistics, Haver Analytics, Barclays Research
:

FIGURE 8

Regression of labor share against lagged concentration and fixed industry effects

Dependent Variable: Labor Share of Income			
Variable	**Coefficient**	**Std Error**	**t-value**
Post 2000	-0.034	0.003	-9.78*
HHI	-0.051	0.026	-1.94*
HHI	0.029	0.029	0.99
Post 2000	-0.033	0.004	-9.08*

Note: All regressions control for industry fixed effects. HHI is lagged when included as an explanatory variable. For t-values, * signifies statistical significance of at least10%. Sample includes 38 industries, 1993-2016. Shaded rows separate different specifications.
Source: Barclays Research, using data from the BEA and Compustat:

The results show that higher concentration has been associated with declines in the labor share and confirm that the latter intensified around 2000. When we run this regression with only the HHI and industry fixed effects, the estimated coefficient on concentration is negative and statistically significant, indicating that higher concentration tends to be associated with a lower labor share. When we add a post-2000 dummy to the regression, the estimated coefficient on concentration is not significant. This suggests that there is insufficient independent variation in concentration within industries to disentangle it from other aggregate influences on the labor share after 2000. Indeed, many economists suspect that other influences contributed to declines in the labor share over this period, such as waning unionization, the penetration of Chinese manufactured imports, cyclical influences in the aftermath of the Global Financial Crisis (GFC), and various technological advances (robotics, machine learning, big data) that substitute for labor.[16]

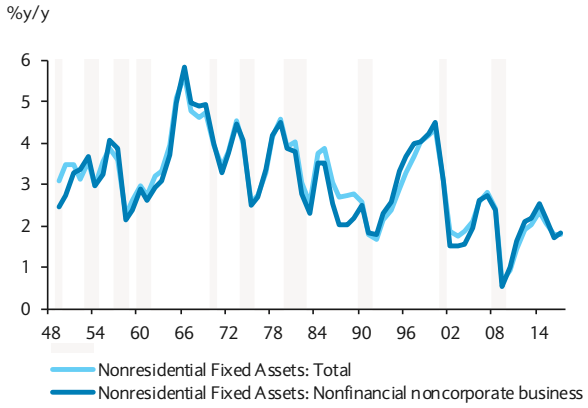
Slower investment rates are consistent with the market power narrative

The two narratives diverge in their implications for investment. Under market power, investment rates should fall as concentration increases: since dominant firms hold back production, they have less incentive to invest.[17] Firms in markets with less intensive competitive pressures also do not need to spend as much on R&D and other types of investment because they are unlikely to lose share if their products or processes grow stale. On the other hand, the heightened competition in a winner-take-all environment should boost investment because even the most productive firms need to defend their advantage against remaining competitors and prospective entrants.

[16] For the last example, see *Macroeconomics of the Machines* from our 2018 Equity Gilt Study.
[17] Although most models of market power imply a negative relationship between market power and investment, this is not true of all of them. Some models suggest firms with market power actually invest more, in order to retain their dominant position, much like in the winner-take-all hypothesis. Empirical work suggests that the standard implication is more likely.

FIGURE 9

Capital accumulation has slowed…



Source: Bureau of Economic Analysis, Haver Analytics, Barclays Research

FIGURE 10

…even though Q is elevated by historical standards.

Source: Flow of Funds Accounts, Bureau of Economic Analysis, Haver Analytics, Barclays Research

Figure 9 shows that capital growth has slowed in the US business sector over the past two decades. To be sure, aggregate growth rates should vary over time, rising when companies perceive that there are many potentially profitable opportunities to exploit and declining when they do not. The standard measurement of the investment opportunities available to a company is Tobin's Q, which is effectively the ratio of market value of a company's existing capital to its replacement cost (Figure 10).[18] The logic is that investors should expect a company with a high ratio of market-to-replacement value to have significant investment opportunities, as otherwise it would not generate sufficient earnings growth to trade at such a premium. At an economy-wide level, it is clear from Figure 10 that even though Q fell following the stock market bust in 2000-01, it has remained elevated by historical terms. Indeed, Q has ascended to levels since the GFC that should, according to the standard theory, be consistent with robust capital accumulation.

This combination of low aggregate investment and high aggregate Q makes sense in the context of market power, as firms that can exploit their power to sustain outsized profits should have both elevated market values and little incentive to expand aggressively. It is harder to reconcile with the heightened competitive pressures envisioned by the winner-take-all narrative.

Figure 11 shows the results of a number of panel regressions that explore the relationship between investment, Q, and concentration across industries. We start with a simple specification on the post-millennium dummy, which shows that there was a clear slowing of net investment (that is, the growth rate of capital) at the turn of the millennium: versus the 1990s, the net investment rate in the typical industry fell 2pp from 2001 onwards.[19] This is a substantial decline: net investment averaged 3.5-4% during the 1990s, so the rate of capital growth fell by about one-half.[20] The second specification is a standard regression of the net investment rate on Tobin's Q in each industry, with controls for industry effects.[21] The slope on Q is positive, as expected: industries with higher Q invest more. To assess whether investment has been low relative to fundamentals, the third specification regresses

[18] As we outline in the appendix, we measure this replacement cost using book values.

[19] Investment declined sharply in 2009, in the aftermath of the financial crisis. As a robustness check, we ran both regressions with data for 2009 omitted and obtained qualitatively equivalent results.

[20] We also document that controlling for industry concentration does not diminish the magnitude of the post-2000 dummy, either with or without controls for Tobin's Q.

[21] We measure the net investment rate by dividing investment by the previous period's capital stock, then deducting the rate of depreciation. This is equivalent to the rate of increase in the capital stock.

net investment rates against Q, industry effects, and a dummy for the post-2000 period.[22] These estimates continue to show a marked decline in investment within industries starting in 2000, even after controlling for Q.

FIGURE 11

The post-2000 slowing of capital growth seems to be linked to the rise in concentration

Dependent Variable: Capital stock growth			
Variable	**Coefficient**	**Std Error**	**t-value**
Post 2000	-0.019	0.002	-8.88*
Q	0.026	0.003	8.75*
Q	0.025	0.003	8.84*
Post 2000	-0.019	0.002	-8.82*
HHI	-0.081	0.021	-3.94*
Q	0.025	0.003	8.41*
HHI	-0.066	0.020	-3.29*
Q	0.025	0.003	8.7*
Post 2000	-0.019	0.002	-8.14*
HHI	-0.021	0.021	-1.00

Note: All regressions control for industry fixed effects. HHI and Q are lagged when included as explanatory variables. For t-values, * signifies statistical significance of at least10%. Sample includes 38 industries, 1993-2016. Shaded rows separate different specifications. Source: Barclays Research, using data from the BEA and Compustat

The final two specifications in the table consider the role industry concentration has played in the slowdown of capital formation. As shown in the fourth specification, capital growth within industries is negatively associated with intensifying industry concentration. The effect is economically meaningful as well, implying that we would expect capital growth in industries with the largest increases in concentration to decline nearly 2pp – again, a substantial drop relative to average capital growth during the 1990s. When we include concentration as an explanatory variable alongside Q, the coefficient on concentration remains negative and significant. When we also add the post-2000 dummy as an explanatory variable, the coefficient on concentration remains negative, but loses its significance and a good portion of its magnitude, suggesting that other aggregate influences may be playing a role in the broad slowdown of capital growth.

An alternative explanation for the decline in investment is that companies are investing in intangibles, which may not be well reflected in official estimates of capital growth. As the US economy has migrated away from manufacturing and towards services, it is possible that the nature of investment has shifted away from factories and equipment, and into IT, intellectual capital and management skill. This is one reason why we use BEA investment data, rather than a measure that aggregates capital expenditures across firms: BEA estimates ostensibly include many categories of intangibles, whereas capital expenditures reported in Compustat have more variation in scope.[23] To be sure, investments in intangibles are hard to measure, so it is possible that even the BEA investment estimates are biasing downward over time.

[22] This regression is based on a "Investmentless Growth: An Empirical Investigation," Germán Gutiérrez and Thomas Philippon, *Brookings Papers on Economic Activity*, Fall 2017, pp. 89-174. We use lagged Q and lagged HHI in all regressions. The industry dummy variables strip out the substantial inter-industry variation in many of these variables. We omit reporting of fixed effect coefficients throughout. Gutiérrez-Philippon use year dummies and report that these change from positive to negative after 2000. We replicate this result using year dummies and then collapse to the post-2000 variable for ease of exposition.

[23] Another rationale is to capture investment across the entire sector, rather than just the publicly traded firms reported in Compustat. Although we compute Q by taking weighted averages across Compustat firms, we implicitly assume it is a good proxy of sector Q.

Declines in business dynamism are also suggestive of market power

The US has historically been a dynamic economy, with an entrepreneurial streak and a flexible and mobile workforce. While it may remain dynamic relative to other parts of the developed world, measures suggest that it has become less dynamic relative to its own history. There is no standard measure of economic dynamism; instead, economists focus on a broad-based decline in a wide set of metrics that captures aspects of how an economy responds to opportunities and challenges. These include the rate of new business formation, the geographic mobility of workers, the quantity of IPOs, and the rate of employee churn. While none of these is a perfect measure, each indicates that the US is becoming less dynamic: fewer new businesses are being started, people are moving across geographic regions less frequently, fewer companies are being taken public, and workers are switching jobs less frequently.

Heightened market power tends to reduce dynamism through its effects on new business formation and workers. Dominant firms can utilize their power in a number of ways to keep emerging competitors at bay. One example is predatory pricing, where incumbents temporarily undercut new competitors' prices of goods and services to induce operating losses that force them out of business. While this may imply short-term pain for the dominant firm, predators likely retain sufficient resources to withstand even extended periods of losses, so long as they expect to return to a highly profitable position once competition has receded.

Dominant firms could also use market power in one product market to steer customers toward their other products. While this type of behavior is not isolated to technology firms, a number of examples are noteworthy from this industry. For instance, Microsoft was accused in the 1990s of using its dominant position in the operating system market to direct PC users to Internet Explorer. More recently, the EU accused Google of something similar – using its dominant position in internet search to steer customers towards its shopping services, thereby gaining an advantage over other on-line vendors.[24] Finally, even if a start-up does gain traction and begins to challenge a dominant firm, the sheer profitability and scale of the latter can allow it to buy out its competition. In the tech sector, Google's purchase of YouTube and Facebook's buyout of WhatsApp just two of many examples. At the end of the day, all of these behaviors – indeed, even the threat of them – would have the effect of discouraging entrants.

The implications of market power on job switching are obvious. With fewer firms competing, workers in industries with dominant firms have less choice of where to work, and fewer firms compete for them. This tends to result in less job churn. These effects can manifest in obvious ways – such as a one-factory town where the workers have no other options – or less obvious ones, such as non-compete agreements in which franchisees for a given fast-food brand agree not to poach each other's workers.[25] The latter effectively reduces the set of all operators into one large employer, thereby substantially reducing employment options for existing workers. And this phenomenon does not apply just to lower skill workers. In 2010, the DoJ brought an action against five technology and internet companies for agreeing not to poach each other's employees.

[24] Although the theoretical viability of predatory pricing is debatable, there is at least anecdotal evidence that it occurs. The "Chicago School" argues that this is not a viable long-term strategy and that the examples we see areexplained by economies of scale.

[25] Among other places, the trend toward non-compete agreements has been documented in, "A Proposal for Protecting Low-Income Workers from Monopsony and Collusion" by Alan B. Krueger and Eric A. Posner, Policy Proposal 2018-06, The Hamilton Project (Brookings Institute), February 2018.

By contrast, the winner-take-all narrative is likely to result in higher dynamism, at least temporarily. For example, industries experiencing this effect would be characterized by elevated job churn, from both the winners expanding as they take share, and lesser competitors shrinking or exiting the market.

We focus on job churn as a measure of business dynamism. Churn data are available at the sector level from the BLS's Business Employment Dynamics. In our measure, churn in a given industry is defined as the sum of gross job gains in new or expanding establishments plus gross job losses in closing or contracting establishments, divided by total employment.[26] In a more dynamic sector, many businesses will be expanding and contracting, consistent with high rates of churn.

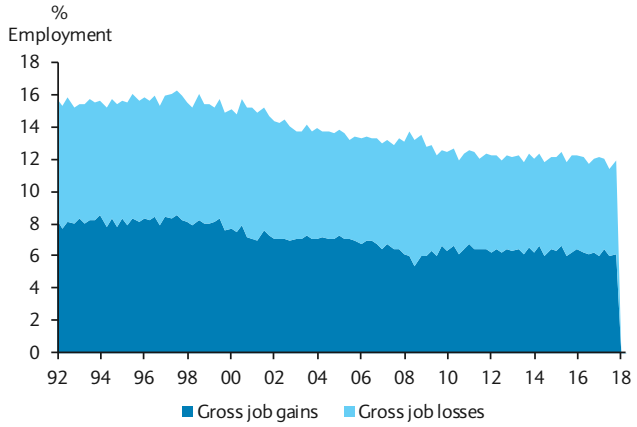
As with investment, job churn has fallen sharply, beginning around 2000 (Figure 12). In this case, the decline is smooth and clearly starts then. The quarterly churn rate was stable at about 15% throughout the 1990s, and is currently about 12% – a decline of over 20%. To be sure, there was a one-time increase in job losses around the time of the GFC that momentarily interrupted the downward trend. However, churn quickly fell back to trend and resumed its steady decline.

All of the 38 industries in our panel had lower churn rates in 2016 than in 1992. However, the extent of these declines varies. As with labor share and investment, panel regressions (Figure 13) link the decline in dynamism to concentration: industries with higher concentration had particularly sharp reductions in job churn. Although this cannot explain all of the post-2000 reduction in churn (the post-2000 indicator retains explanatory power even after including concentration), its effect remains significant.

As with the other economic trends we document, we must be careful not to over-emphasize the potential role that increased concentration is playing on dynamism. This phenomenon likely has other causes as well, particularly since every industry in our panel experienced a decline in churn. An important factor is demographics. One would expect an economy with an aging population to have lower churn, as older workers are less likely to change industries or move regions. In fact, some researchers have argued that demographics could be responsible for the majority of the reduction in job churn and have played an important role in lower new-business formation and declining labor share[27].

FIGURE 12

Job churn has steadily diminished



Source: Census Bureau, Haver Analytics

FIGURE 13

Higher concentration is associated with diminished dynamism

Dependent Variable: Labor churn rate			
Variable	**Coefficient**	**Std Error**	**t-value**
HHI	-0.840	0.074	-11.40*
Post 2000	-0.209	0.006	-32.12*
HHI	-0.357	0.051	-6.97*
Post 2000	-0.199	0.007	-30.35*

Note: All regressions control for industry fixed effects. HHI and Q are lagged when included as explanatory variables. For t-values, * signifies statistical significance of at least10%. Sample includes 38 industries, 1993-2016. Shaded rows separate different specifications. Source: Barclays Research

[26] We choose this metric because it is available from the BLS at the NAICS three-digit level. These data are disaggregated into separate rates of job gains and job losses, which we sum to compute our overall proxy for job churn. An alternative measure, also from the BLS, is the rate of establishment creation and destruction, which yields similar results.

[27] "From Population Growth to Firm Demographics: Implications for Concentration, Entrepreneurship, and Labor Share", Hopenhayn, Neira, Singhania, NBER Working Paper No. 25382, December 2018.

Other influences could include the effect that skills gaps and the rise of two-income households have had on regional mobility. IPOs may have declined because of certain regulatory reforms, such as Sarbanes-Oxley, that made going public less attractive.[28] Although the trend in the churn measure could easily reflect these and other influences, results of our panel regressions indicate that effects from concentration are also at play.

The Barclays Competitiveness Index in action

Although the results above indicate that concentration is linked to several troubling economic trends, they are hardly conclusive regarding a decline in competition, given all the other factors likely at play. An attribution of these trends to reduced competition would be more compelling if the same industries were responsible for each trend, rather than if the trends were more disparately spread through the economy. To address this, we develop the Barclays Competitiveness Indicator, which is premised on measuring the ill effects of competition: we examine the joint evolution of slowing investment, diminished dynamism, and low labor shares across the industries in our sample. We extract this information using a PCA analysis of our industry panel.

Figure 14 shows factor loadings and explained variation from a PCA that includes our industry data for net investment (after accounting for Tobin's Q), job churn, and the labor share.[29] The loadings for the first of these three components line up well with what one would expect from a "competitiveness" metric. That is, holding other factors constant, an increase in such a metric should be associated with increases in all three variables in our system. Stated in terms consistent with an intensification of market power, a reduction in such a metric for any given industry should be associated with diminished job churn, a lower labor share, and a slower capital growth in that industry.

We name this first factor the BCI. Qualitatively, the BCI allows us to examine the trend in competition over time, either in aggregate or for specific industries[30]. We compute it by applying the factor loadings from Figure 14 to the (standardized) investment, churn, and labor share for a given industry. A decline in the BCI over time suggests that the level of competition has decreased, and vice versa.

Aggregate patterns in the BCI are broadly consistent with the market power narratives. Figure 15 shows a time series of the first and second principal components, averaged in each year across the 38 industries in our panel. The first "competitiveness" component – that is, the BCI – follows a clear downward trajectory similar to those of the underlying variables discussed earlier: it was steady until about 2000, dropped rapidly through 2013, then stabilized. Figure 16 compares the distribution of the BCI across industry segments in 1994 to the distribution in 2016. This shows a clear leftward shift in the BCI from 1994 to 2016, with values for the more competitive segments in 2016 generally coinciding with those of the least competitive segments in 1994.[31]

[28] For example, see "The Sarbanes-Oxley Act and Exit Strategies of Private Firms" by F. Bova et al, *Contemporary Accounting Research*, 31(3), July 2013.

[29] Prior to computing our principal components, we standardized each variable after removing industry fixed effects because we are not specifically interested in explaining differences in the relative magnitude of variation in each of our data series. On the contrary, we do not want our PCA to overemphasize variations in these more volatile series. Similarly, we remove fixed effects because our focus is on time trends in the data series, not relative differences across industries that persist through time.

[30] Quantitatively, if the BCI for a given industry goes from 1 to 0.5, the effect on all three of the variables for that industry (labor share, capital growth, dynamism) is half its initial magnitude.

[31] As a robustness check, we ran separate PCAs with the set of variables in our baseline specification expanded to include concentration (HHI), industry Q, and capital growth (as opposed to the residual of capital growth after accounting for Q). The results are similar to those above, both qualitatively and quantitatively, with a first principal component that can be reasonably interpreted as a measure of competitiveness, and that declines over time (Figure 15). Also as in our basic specification, the second component has loadings for investment and the labor share with opposite signs, and therefore can be interpreted as a winner-take-all factor. We prefer our more parsimonious system discussed above, in part because one can easily compute these three variables for individual companies, which makes it feasible to use microdata to compute competition metrics for more narrowly defined markets or even ad hoc groups of companies.

FIGURE 14

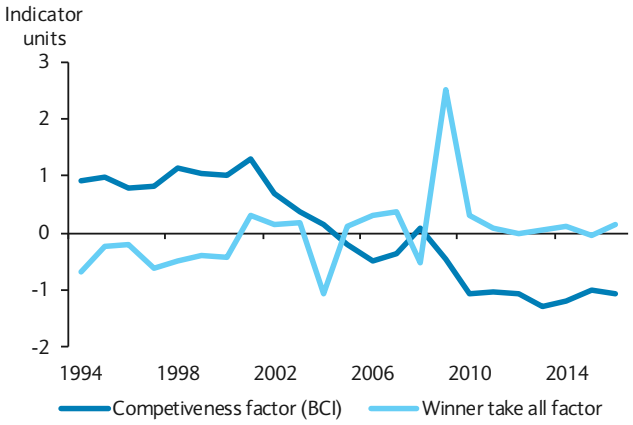
PCA of net investment, churn, and labor share

Variable	Loading for component		
	1	2	3
Job churn	0.71	0.05	0.70
Labor share	0.68	-0.29	-0.67
Net investment	0.17	0.96	-0.24
% of overall variance explained	45	34	21

Note: Principal components are estimated after removing industry means from each data series and standardizing. Sample includes 38 industries, 1993-2016. Source: Barclays Research, using data from the BLS, the BEA and Compustat

FIGURE 15

Our measure of competition has declined since 2000



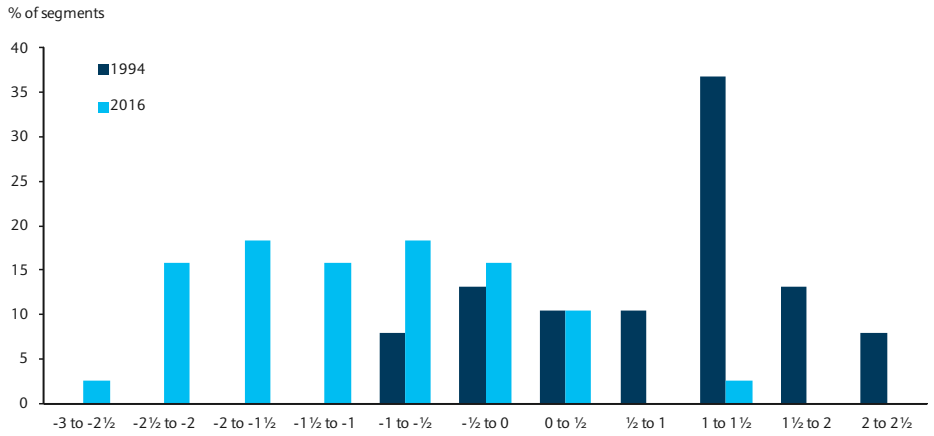
Note: Principal components are estimated after removing industry means from each data series and standardising. Sample includes 38 industries, 1993-2016. Source: Barclays Research, using data from the BLS, the BEA and Compustat

By comparison, loadings for a "winner-take-all" measurement would affect net investment and the labor share in opposite directions. This is the case for the second component in Figure 14, which has a large positive loading for investment, a negative loading for the labor share, and almost no loading for churn. The second winner take all component trends up gradually until the eve of the GFC, spikes upward with the surge of investment in the initial stages of the recovery, then moves sideways (Figure 15).

These results support the view that market power has increased in aggregate in the US economy. The first factor is aligned with the indirect effects of competition; the decline in this factor, therefore, in sync with the rise in concentration, is further evidence that the ill effects of reduced competition are weighing on the economy. However, we cannot extrapolate this to every industry, nor even to every industry that has experienced a rise in concentration. By applying the BCI to specific markets, we can distinguish between cases where concentration is leading to either diminished or elevated competition.

FIGURE 16

Distribution of competiveness metric across segments



Note: Principal components are estimated after removing industry means from each data series and standardising. Sample includes 38 industries, 1993-2016. Source: Barclays Research, using data from the BLS, the BEA and Compustat

Macroeconomic and policy implications

Intensifying market power could help shed light on a number of economic puzzles in the US. Among these is the still-sluggish rate of wage inflation despite data that point to historically tight labor markets. Without hindsight from recent experience, many economists and policy makers would have expected wages to be accelerating much more rapidly at present, given the low unemployment rate. Indeed, in late 2010, estimates of the natural unemployment rate by most FOMC participants varied from 5% to 6%, which the economy has overshot since late 2015. For nearly a year now, the unemployment rate has been at or below 4%, yet wage growth remains close to 3% y/y.

To be sure, economists have offered many possible explanations to explain this lack of acceleration. Among the simplest is that the natural unemployment rate had been overestimated, with more recent estimates placing it closer to 4.5%. Another is nominal wage rigidities, which may have kept real wages higher than otherwise in the earlier stages of the recovery, thereby discouraging some wage gains later on. Yet even after accounting for these possibilities, many view the acceleration of wages to date as surprisingly modest. This opens the door more to structural influences, such as limited union membership, competition from foreign or outsourced workers, and capital-biased technological change.[32]

Increased market power should be included in this list of potential structural explanations, our analysis shows. This would gradually boost employers' bargaining power at the expense of workers. With fewer alternatives, workers – especially less-skilled ones – would have little choice but to accept lower wage gains, which could plausibly help explain why real wage gains have failed to keep pace with productivity, on aggregate. This hypothesis suggests that wage gains may continue to underwhelm despite strong payroll gains.

Market power may also help explain other puzzles, such as why profit margins for many companies have been so durable in the face of cost pressures from tariffs, currency movements, and other factors. Companies with market power would have greater scope to pass at least some of these pressures onto consumers and workers through higher prices and slower wage increases. Although such an environment would clearly have negative implications for the well-being of consumers and workers, this may also help us understand why profits (and economic activity more broadly) appear to be more insulated from cyclical pressures than in the past.

Policy responses and potential ramifications for equity markets

Policy makers may begin to respond to the threat of intensifying market power. In fact, a number of proposals have recently been floated.

We believe that proposals – both macro and industry specific – that are explicitly designed to promote competition are more likely to be effective. On the macro side, these include policies to address some of the ill effects of market power, such as reduced job churn, as well as enhanced scrutiny of mergers.

Although some industry-specific approaches are pro-competitive, we see risks that proposals designed to limit the ability of dominant firms to exploit their position could solidify the position of incumbent firms, by raising fixed costs and other barriers to entry. Regardless, we believe that industry-specific proposals should be limited to cases where our BCI indicates that market power has increased. It is not sufficient that concentration has risen, nor that large firms are aggregating share at the expense of smaller firms – policies should be targeted at industries that are suffering from the ill effects of market power.

[32] With regard to technology, please see *"Robots at the Gate: Humans and technology at work"* from our 2018 Equity Gilt Study.

Pro-competitive macroeconomic policies

One set of potential remedies is supply-oriented macroeconomic policies that encourage new entrants and enable the migration of resources. For example, investment tax credits could counterbalance some of the disincentives to invest faced by prospective new entrants to an industry characterized by dominant incumbent firms. Another example is the immediate expensing of investment, which was included for many types of equipment in the 2018 Tax Cuts and Jobs Act.

Similarly, policy makers could take steps to address the significant, economy-wide decline in job churn. Various influences that restrain the ability of workers to migrate to new jobs play into the hands of dominant firms and help suppress wage growth. Solutions that have been floated include improving the portability of employer-provided health insurance or easing zoning laws in highly productivity cities where high housing costs often deter worker inflows.

These approaches require neither industry-specific rules, nor the identification of specific pockets of market power. That said, they also have limitations. Studies suggest that investment tax incentives have had mixed effectiveness and may be difficult to design in a way that bolsters the comparative position of entrants. Moreover, poorly designed policies could bolster the position of incumbents in unexpected ways, such as by increasing the costs of insuring workers or by subsidizing existing capital expenditure plans of incumbents, rather than stimulating new investment by entrants.

Enhanced regulatory scrutiny of mergers

One obvious step to address market power would be to tighten standards for merger approval. This could come in two forms. The first would be to implement tighter standards for approving horizontal mergers. There are a variety of legislative tools already in place that prohibit monopolistic business practices, such as the Sherman Antitrust Act (1890) and the Clayton Antitrust Act (1914). These laws include specific prohibitions of certain anticompetitive practices such as price-fixing, tying and exclusive dealing, as well as prohibitions on M&A that satisfy legal standards for being anticompetitive. Enabled by this legislation, antitrust authorities can – and occasionally do – object to horizontal mergers that increase market concentration in ways that raise competitive concerns.

However, the courts have substantially raised the legal thresholds that antitrust authorities must demonstrate to apply these laws, reflecting the emergence of the Chicago School approach in the 1970s. Under this, the legal standard shifted from antitrust protecting small businesses to a broader focus on fostering economic efficiency – that is, overall consumer welfare. In principle, this involved not just effects on prices, but also considerations such as quality, overall innovation, and product evolution. However, in legal application, these more nuanced criteria are difficult for antitrust authorities to demonstrate, and the courts have tended to hone in on whether a given action raises prices. This narrowing occurred, in part, because effects on prices are much easier to quantify than other, more abstract, considerations, such as how specific business practices might affect consumer welfare through potential innovation.

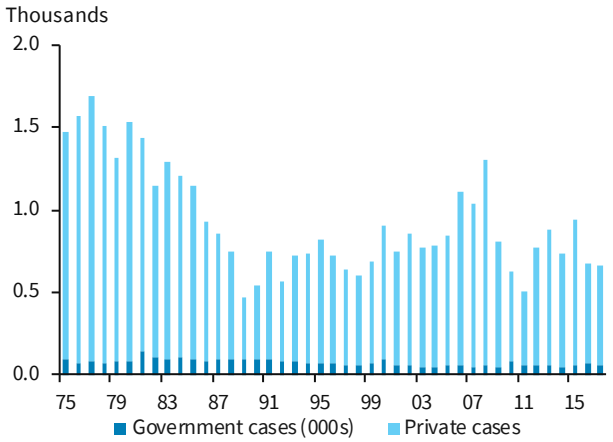
One critique of the Chicago School approach that has emerged is that it raises the bar for antitrust authorities to provide evidence of economic harm, generally with a narrow focus on prices. As mentioned above, it is possible, or even likely, that dominant firms learn to exploit their market power to boost profits in ways other than by indiscriminately raising prices. For instance, large companies can use various practices designed to leverage advantages in size and scope, such as via suppliers and workers, orienting research and investment toward activities that galvanize their dominant position without benefiting consumers, or influencing the legislative process to tilt the regulatory playing field in their favor. Such practices may at least help explain the surprising decline in antitrust enforcement that has accompanied the intensification in industry concentration (Figure 17); companies may have learned how to avoid scrutiny.

The second, and more controversial, step to address market power would be enhanced scrutiny of *vertical* mergers. The school of thought that emerged in the 1970s holds that such mergers do not pose competitive concerns. The theoretical grounding is that it makes little economic sense for a company with power in one market to use those profits to price out competitors in another.[33] Consistent with this thinking, no vertical mergers were contested by antitrust authorities from 1979 to 2018, when the DoJ unsuccessfully challenged the proposal to merge AT&T with Time-Warner (TW). However, a new school of legal thought – the Brandeis School – has begun to challenge the assumption that vertical integration is harmless, based on economic arguments and evidence.[34] Indeed, some have argued that Amazon is a counterexample, as it clearly uses profits from some segments to subsidize investments in others.[35] Of course, this cross-funding need not itself be anticompetitive, as Amazon would need to be creating dominance and then abusing it.

In principle, antitrust measures to limit mergers could help address competitive concerns. Elevated M&A volume (Figure 18) has likely been one channel through which companies have accumulated market power. Scrutiny of vertical mergers in particular would be new and could address a previously unrecognized (or ignored) competitive threat. However, there are also challenges associated with this approach. First, in the short run, some mergers may actually enhance competition if the resulting entity is better able to compete with existing or growing incumbents. One possible example is the DoJ's aforementioned challenge of the AT&T-TW merger. The proposal had been challenged on the grounds that AT&T (a content distributor through DIRECTV and U-verse) could use its ownership of TW (a content creator) to place competing distributors at a distinct disadvantage in terms of negotiating content. An alternative narrative is that the merger creates another viable competitor within a market

FIGURE 17

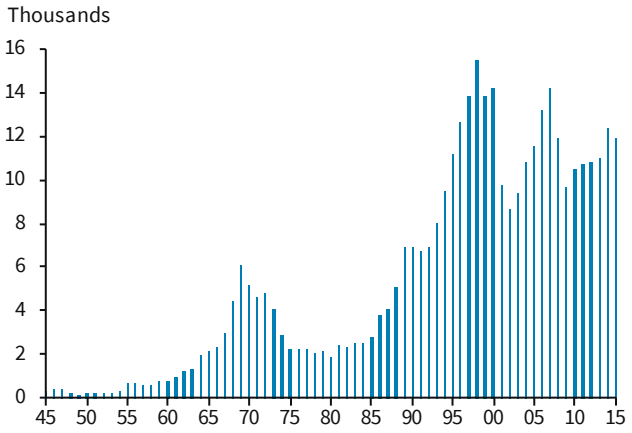
Antitrust case filings have fallen off since the 1970s



Note: Government totals include civil and criminal cases involving the government as a plaintiff or defendant. Data for 1975-1991 are for the 12-month period preceding June of that year. Data for 1992-2000 are for the fiscal year, and 2001 onward are for the calendar year. Source: United States Courts, Sourcebook of Criminal Justice Statistics

FIGURE 18

Corporate mergers and acquisitions have been elevated for some time



Source: Institute for Mergers, Acquisitions, and Alliances

[33] The skepticism included a view that government action was more likely to do harm than good – specifically, that the lost efficiency gains from inappropriate challenge of mergers that benefited consumers would outweigh any benefits from blocking bad mergers. (For example, see Robert Bork, *The Antitrust Paradox, 1978*.) As is evident for the proposed ATT and TW merger, concerns about blocking "good" mergers remain valid in the eyes of the court, even though recent research pointing to negative economic effects of intensifying concentration suggests that thinking on the part of economists has become more nuanced.

[34] See "The Rise, Fall, and Rebirth of the Antitrust Movement," M. Stucke and A. Ezrachi, *Harvard Business Review*, December 15, 2017.

[35] This is among the arguments that features in "Amazon's Antitrust Paradox," Lina M. Khan, *The Yale Law Journal*, January 2017.

whose competitive makeup has been disrupted by the emergence of non-traditional entities such as Amazon, Netflix, and Hulu, which have placed single-market entities such as TW and AT&T at a disadvantage by pairing content creation and delivery. This is an example where disruptive entrants are at least perceived by incumbents to be a threat, perhaps forcing them to reorganize their own business models to address disadvantages. In such an environment, indiscriminate regulatory scrutiny of vertical mergers may be misplaced, inadvertently strengthening the dominant position of vertically integrated incumbents.

The second challenge to the antitrust approach is that evaluating a merger requires an accurate definition of a market or set of competitors, a task made all the more difficult by the rapidly evolving nature of many high profile industries (such as media). But this is exactly the type of issue that our BCI is designed to address. It does not require identification of every competitor, but instead extracts information about competitiveness from firm outcomes.

Finally, more intense regulatory scrutiny of mergers would not help alleviate market power issues posed by existing dominant firms, or at least not immediately. Over time, limiting mergers could allow competitors to emerge that otherwise might have been subsumed within the incumbent firms. Although a more immediate remedy would be to attempt to break up these existing firms, this would be extremely difficult to execute and would require a degree of certainty regarding the competitive landscape that would be very difficult, if not impossible, to achieve in practice.

Enhanced regulation to limit dominant firms' ability to abuse their positions

An alternative approach is to enact regulations designed to limit business practices in ways that prevent dominant firms from abusing their position. This would involve a set of industry-specific rules that apply to all firms or the largest ones within that industry, targeting a set of practices identified as problematic.

There are few, if any, recent examples of sweeping rules targeting competition to use as examples. But there have been a number of industry-specific regulations adopted recently motivated by other concerns, that have limited or changed existing business practices. These are useful to consider as they can help illustrate the difficulty of using this approach to mitigate competitive concerns. One example is the US adoption of enhanced banking regulations following the Global Financial Crisis, which were enacted to improve the safety and soundness of the financial system. Those rules were set out in the Dodd-Frank Act (2010), which included specific measures that apply to only the largest banks, such as enhanced capital requirements, heightened merger scrutiny, and prohibitions on proprietary trading. Europe's General Data Protection Regulation (GDPR) is another example, designed to address burgeoning privacy concerns.

There are two critiques of using rules to limit specific business practices in a competitive context. First, these detailed, industry-specific rules take years to develop and are exceedingly complex. In practice, the time it takes to craft them can render them irrelevant or even counter-productive. Further, complexity can often lead to unintended consequences, which can often cause severe issues of their own. For example, initial limits on bank leverage in Dodd-Frank appeared to place unnecessary pressures on repo markets in the US – so much so that they were subsequently revised.

Second, we believe such rules could risk cementing the position of incumbent firms. This is because complying with this type of regulation is expensive, which presents a significant barrier to entry. Even if such rules do mitigate existing anticompetitive behavior, regulatory overhead can boost fixed costs in ways that tend to discourage competition, thereby thwarting new entrants and reducing the competitive threat to incumbents. As an example, the number of new FDIC-insured commercial bank charters, which had averaged about 170 per year from

2005-07, has slowed to about one per year since the 2010 passage of Dodd-Frank. While there may be other reasons why new banks are failing to form, costs associated with ongoing regulatory disclosures and other rules have almost surely contributed. This is not a critique of Dodd-Frank – it was designed for macroprudential reasons, not to enhance competition – but it does help illustrate the relevance of regulations when considering barriers to entry.

New regulatory frameworks designed to harness competitive forces

An alternative approach would be to introduce rules designed to increase competition, rather than eliminate abusive behavior. An example is Europe's Revised Payment Services Directive (PSD2), a set of retail banking rules meant to change the ownership structure of consumer banking data. In the old regime, a customer's banking data were owned by his or her bank, at least by default, if not explicitly by rule. Banks faced no impetus to make these data (credits and debits, credit card payments, mortgage payments, etc.) available either to its competitors or to the customer.

PSD2 changes the ownership structure by making them portable: consumers can migrate their data to other financial institutions. A consumer's financial data are a key determinant of his or her credit quality and, thus, serve as a key input to lending decisions. By allowing consumers to migrate their data (and to aggregate data generated through interactions with multiple financial institutions), PSD2 could, in theory (we don't comment here on whether or not it is working), allow customers to obtain more competitive terms for loans and other financial services. Unlike the old regime, where an initial choice of deposit institution tended to lock consumers into one banking relationship, consumers could use the data they generate at one institution to attract competition from others. Indeed, by limiting the fixed costs associated with acquiring depositors and building long data histories, PSD2 could allow new entrants (such as online banks) to compete with traditional incumbents.

The US high tech industry is one example where this type of approach could be considered. There is an ongoing debate about who owns data generated as a by-product of consumer on-line activities. In the US, it is clearly the case that such data are owned by the company that engaged in the online interaction with the consumer. However, with issues surrounding data ownership already evolving in Europe, a steady drumbeat of concerns with data collected by Facebook and other online entities has thrust this into the spotlight in the US.[36] With adjustments to ownership rights along the lines of the PSD2, consumers could have more control over how their data are monetized, and companies could be forced to compete for access to these data in ways that could improve the range of services available to consumers.

Another example of competition-enhancing rules is infrastructure sharing. These can be especially promising for industries that require a large and costly infrastructure (such as telecommunications networks), which tends to yield "natural monopolies" with a single, vertically integrated firm with a dominant position in the downstream product market. Infrastructure sharing severs the layers of this natural monopoly by creating "common carrier" obligations that allow competitors to access the company's infrastructure on same terms as its own downstream operation.

Infrastructure sharing has been applied by many European countries following late-1990s EU directives requiring wholesale liberalization of telecoms. One such idea is Local Loop Unbundling (LLU), which requires telecommunications incumbents (telephone, cable, and internet) to physically disconnect their exchange lines from their networks in order to enable connections by new entrants. Similarly, mobile telephone networks are required to offer access on a wholesale basis to mobile providers at a fair price. These competition-

[36] For example, the "right to forget" that is imposed on internet search providers clearly awards some rights to the data to individuals.

friendly measures have led to some very desirable outcomes: for instance, facilitating the transition of the French telecommunications industry from a single, government-controlled incumbent (France Telecom) to a highly competitive market where private providers offer a broad range of quality services at comparatively low prices.

Another similar example is the US experience with the deregulation of energy markets prompted by various federal legislative and regulatory initiatives.[37] In this case, regulators of participating states facilitated the breakup of vertically integrated utility monopolies by requiring local distributors to open their lines to private electricity generators that, depending on the jurisdiction, could either sell electricity in competitive wholesale markets or distribute directly to customers for end-use.

One potential downside of infrastructure sharing is that it may not provide sufficient incentives for owners to maintain a high-quality network. This boils down to setting a regulated access price that adequately compensates owners for their capital costs of maintaining networks. Identifying such a price may be easier said than done. However, if done right, such mechanisms may be an effective way to encourage competition in industries with natural scale economies while sidestepping the entry barriers (and waste) associated with replicating costly infrastructure. To be sure, such mechanisms tend to work well in markets with homogeneous products, such as the electricity or data transmission examples above. However, similar ideas might be adapted to enhance competition in other industries where concerns about vertical integration are becoming more prominent, such as media and internet commerce.

Approaches designed to harness competitive forces along these lines have some of the same downsides as approaches aimed at limiting abuses of market power; they require detailed industry-specific rules. The benefit is that this approach can enhance competition directly, rather than trying to limit the abuse of market power. This alternative could also avoid imposing large fixed costs that might discourage new entrants.

[37] These initiatives include the Public Utility Regulatory Policies Act (1978), which required utilities to buy power on a wholesale basis from unaffiliated producers, and the National Energy Policy Act (1992), which, among other things, created various incentives to facilitate the development of deregulated energy markets. Another key impetus was 1996 orders by the Federal Energy Regulatory Commission (FERC) designed to eliminate abusive price-setting practices by, among other things, establishing a system of transmission tariffs that allow generators to access utilities' transmission services on the same terms as the utility itself and requiring open access to real-time transmission information. See "*Evolution of Electric Industry Structure in the U.S. and Resulting Issues*," Navigant Consulting, report prepared for the Electric Markets Research Foundation, 2013.

Appendix A: Details about the construction of our industry panel dataset

As noted in the main text, our industry-level data for investment rates and labor's share of income are sourced from the BEA's industry-level GDP and capital stock estimates, data on business dynamism are from the BLS's Business Employment Dynamics survey, and data for Tobin's Q and industry-level concentration are formed using data on publicly traded companies from Compustat.

Compustat estimates for each were formed by aggregating across publicly traded firms within each three-digit NAICS industry. To form the HHI for each industry in each year, we first take the dollar value of gross sales for each firm, then form a sales share by dividing this sales figure by the sum of sales for all firms in the industry. We then square these sales shares (stated in percentage terms) across all firms in the industry to obtain an HHI measure. To the form Tobin's Q, we first compute the market value of each firm's outstanding equity and debt securities, then deduct the market value of its financial assets. To convert this market value to a measure of Q, we divide it by the book value of the firm's nonfinancial assets as reported on the balance sheet. To form an industry-level aggregate, we weight these firm-level Q measures using the same sales shares used for the HHI.

The BLS reports quarterly estimates by industry of job gains at opening and expanding establishments and job losses at closing or contracting establishments, both as levels and as a percentage of average industry employment in the current and preceding quarters. We form our annual estimates by first summing the level estimates of job gains and losses by industry in each quarter, then converting these estimates to annual flows. To express this total industry flow of job gains and losses as a percentage of employment, we divide it by the industry's average level of employment in the preceding year (which we back out from the second- and fourth-quarter estimates from the previous year).

Industry-level estimates from the three data sources are combined so that industry definitions are consistent for all variables. This step is necessary because industry source data from the BEA are organized by BEA industry segments, while the source data from the BLS are reported as three-digit NAICS, and our Compustat-based estimates are aggregated within each three-digit NAICS code. The BEA industry segments are somewhat more consolidated than the NAICS categories, so we can easily map from NAICS to BEA industries, but not the other way around. Hence, to impose a consistent sector view, we map from the three-digit NAICS into BEA industry segments.[38] To focus analysis on industries in the nonfinancial nonfarm business sector with good data coverage, our mapping excludes the financial and utilities sectors, as well as a small number of BEA sectors with insufficient representation in Compustat.[39] Given available annual estimates, the result is a full dataset with 38 industry sectors, covering the period from 1992 to 2016.

[38] We borrow this mapping scheme from "Investmentless Growth: An Empirical Investigation," Germán Gutiérrez and Thomas Philippon, *Brookings Papers on Economic Activity*, Fall 2017, pp. 89-174.

[39] The excluded BEA sectors are 230: Construction, 420: Wholesale Trade, 513: Broadcasting and Telecommunications, 514: Data Processing, Internet Publishing and Other Information Services, 531: Real Estate, 532: Rental and Leasing Services and Lessors of Intangible Assets, 550: Management of Companies and Enterprises, and 624: Social Assistance,

Appendix B: Interpretation of Principal Components Analysis

The goal of a PCA analysis is to find a set of unobserved factors that explains the joint variation in a set of variables. To summarize briefly, our PCA projects a system of observed variables $y_{i,t}^{p}$, (for $p = 1, \ldots, P$ variables, $n = 1, \ldots, N$ industries, for period t) onto a set of *P* unobserved factors $f_{n,t}^{1}$ for each industry n and period t:

$$\begin{bmatrix} y_{n,t}^{1} \\ \vdots \\ y_{n,t}^{P} \end{bmatrix} = \begin{bmatrix} \bar{y}_{n}^{1} \\ \vdots \\ \bar{y}_{n,t}^{P} \end{bmatrix} + \begin{bmatrix} b_{1}^{1} & \cdots & b_{P}^{1} \\ \vdots & \ddots & \vdots \\ b_{1}^{P} & \cdots & b_{P}^{P} \end{bmatrix} \begin{bmatrix} f_{n,t}^{1} \\ \vdots \\ f_{n,t}^{P} \end{bmatrix},$$

where $\bar{y}_{n}^{p}$ is a fixed effect for variable *p* in industry *n*. The set of factor loadings ($b_1^p, \ldots\ b_P^p$) for each variable *p* are fixed across industries and through time and are fitted such that the first factor explains the maximum amount of variation in the entire system across all industries and year, the second factor explains the maximal amount of variation after accounting for the first factor, and so on. The unobserved factors, by construction, are uncorrelated.

Prior to computing our principal components, we removed industry effects and standardized each variable. This normalization is motivated by our interest in explaining differences in the relative magnitude of variation in each of our data series. On the contrary, we do not want our PCA to overemphasize variations in these more volatile series. Similarly, we remove fixed effects because our focus is on time trends in the data series, not relative differences across industries that persist through time. In addition, to focus on variations in capital growth that are unrelated to fundamentals, we replaced capital growth in our system with residuals from a regression of capital growth on Tobin's Q.

For interpreting the fitted components, the same system can be represented equivalently with the signs on the factors and factor loadings for each variable flipped. Hence, the signs on each factor, and the corresponding factor loadings in Figure 11, are arbitrary. The important consideration for interpreting the factors is whether the effects work in a direction consistent with the given relationship. In this case, based on a combination of theoretical considerations and empirical findings, we posit that our competition factor should affect the three variables in our baseline PCA specification in the same direction. In fact, we find that all of the loadings for that factor have the same sign (positive or negative), consistent with that interpretation. Conversely, considerations suggest that a winner-take-all metric would affect labor's share of income and capital growth work in opposite directions (reflecting our discussion in the text, we take no strong view on how a winner-take-all factor affects dynamism). This interpretation is consistent with the loadings on the second factor in Figure 11.

To test robustness, we repeated our PCA analysis using a number of other specifications that include a broader set of economic variables, such as a time series of the HHI for each industry, industry-level productivity growth, and Tobin's Q. In all cases, we found that we were able to uncover a competition metric with characteristics similar to the one we show for our baseline specification. Our results are also qualitatively similar when we exclude from our PCA data for 2008, the time of the Global Financial Crisis.

CHAPTER 2

Beyond inflation targeting: Reconsidering tools, targets and theories

Christian Keller
+44 (0) 20 7773 2031
christian.keller@barclays.com
Barclays, UK

Jonathan Millar
+1 212 526 4876
jonathan.millar@barclays.com
BCI, US

Michael Pond, CFA*
+1 212 412 5051
michael.pond@barclays.com
BCI, US

Monetary policy makers are under pressure. Inflation targeting, the common policy framework that had worked so well since the early 1990s to rein in price gains, is struggling to lift inflation toward (a 2%) target. Still, the most commonly discussed alternatives seem to promise only limited help, while more radical proposals come with much larger risk. Hence, for investors the future monetary policy could be a future with fatter tails.

Our key findings

- **Inflation-targeting central banks today regularly face the restriction of an effective lower bound (ELB) in setting their policy rate.** Secular factors, including demographic change, globalisation and technological progress, have contributed to lower trend inflation and lower neutral interest rates.
- **Central banks' reactions have evolved since the Global Financial Crisis, and what were initially deemed extraordinary measures are now part of the standard policy toolkit.** These include an array of new tools: quantitative easing (QE), negative interest rates policy (NIRP), yield curve control (YCC) and forward guidance (FG).
- **As inflation dynamics remain weak, the discussion is turning from tools to *targets*.** Suggested alternatives for the 2% inflation target range from merely fine-tuning (eg, point target versus band), to increasing the target, to targeting price levels or average inflation, to targeting different variables altogether (eg, nominal GDP).
- **However, none of the alternative targets seems evidently superior in theory, and when considering real-world implementation, their costs may outweigh potential gains.** Most likely, central banks may rather accept inflation lingering below official 2% targets for longer (BoJ, ECB), while also tolerating above-target inflation following longer periods of undershooting (Fed).
- **A step further could be more radical conceptual changes that challenge the conventional distinctions between fiscal and monetary policy.** In this view, debt issuance and money creation are variations of the state's power to tax and to create money, where monetary policy, under certain circumstances, would accommodate or even outright finance fiscal deficit spending as the way to create sufficient demand.
- **Such concepts could gain more traction in the event of a serious economic downturn, but they would also come with large risks.** The issue with these concepts is not that they are theoretically flawed in the way they might boost demand and prices, but rather that politicians used to printing press-facilitated spending may be unwilling to rein in their largesse once the deflationary threat is overcome.
- **For investors, particularly those buying debt, this could mean fatter tails:** Constrained monetary policy implies a higher risk of deflationary scenarios with ever-increasing nominal debt burdens. But experiments that blur the boundaries of fiscal and monetary policy could result in sudden adjustments in expectations, with related swings in risk premia and exchange rates.

The authoring research analysts would like to thank Akash Utsav for his assistance in connection with the preparation of this report.

**This author is a debt research analyst in the Fixed Income, Currencies and Commodities Research department and is neither an equity analyst nor subject to all of the independence and disclosure standards applicable to analysts who produce retail debt research reports under US FINRA Rule 2242.*

How inflation targeting came under pressure

A success story from the 1990s

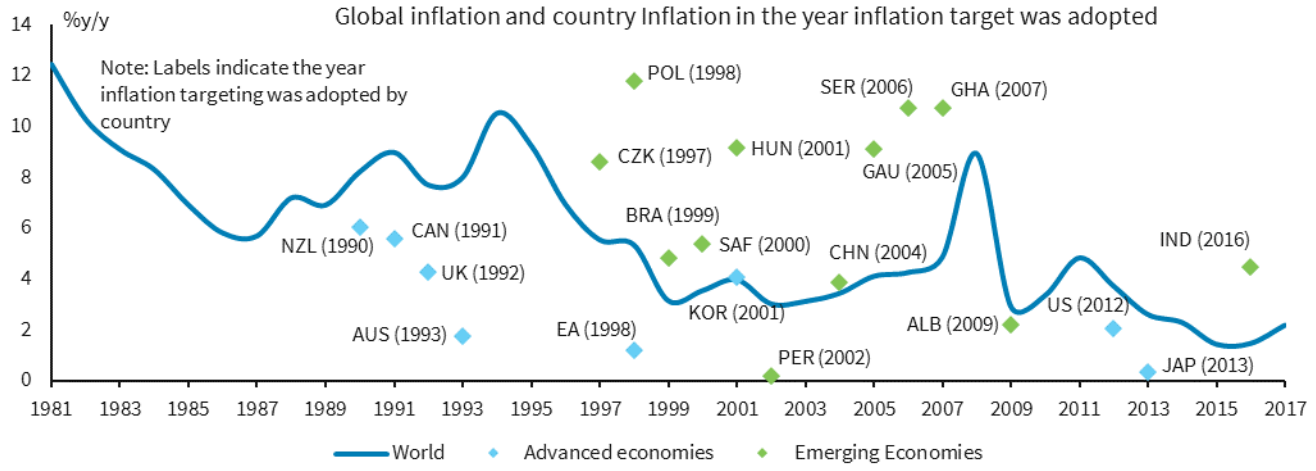
Monetary-policy regimes have changed over time. Inflation targeting (IT), which was 'born' in 1990, will soon have reached a life-span associated with other historical monetary-policy regimes: the Gold Standard (1870s-1914) and the Bretton Woods system (1948-1973), as well as the periods between wars (1919-1939) and between Bretton Woods and IT (1973-1990s)[1], when no single policy framework dominated. Although age in itself is certainly no reason to abandon a monetary-policy strategy, questions surrounding IT as a framework have been increasing at least since the GFC, with some having already declared "the death of inflation targeting."[2]

Inflation targeting offered a new framework following a period monetary policy experiments with mixed success

However, before delving into IT's challenges, it is important to understand its success. For a start, it arrived at the right time. IT offered a new conceptual framework after a number of false starts that followed the collapse of the Bretton Woods system, with attempts to actively manage perceived inflation-unemployment trade-offs, target money supply aggregates and run various forms of fixed exchange-rate regimes all tested and rejected. Almost all these experiments resulted in currency crises and/or high and volatile inflation; importantly, none had succeeded in anchoring public expectations. When New Zealand adopted IT in 1990, different types of exchange-rate pegs accounted for about two-thirds of monetary policy regimes in industrial countries. Accordingly, the 1992 ERM crisis motivated the adoption of IT in Europe. By the late 1990s, IT was also increasingly adopted in developing economies, amid CEE countries' transition to market economies and in the aftermath of the 1997-98 Asian financial crisis.

FIGURE 1

Inflation targeting spread across DM and EM economies since 1990, helping bring down and stabilize inflation globally



[1] For the purpose for this paper we define 'inflation targeting' loosely as a monetary framework that aims at achieving a certain rate of inflation (whether a point or within a band or a range; symmetric or not) by adjusting the short-term policy interest rate, under a flexible exchange rate regime. In this board definition, we consider all major central banks in advanced economies – including the Fed, ECB and BoJ – to be 'inflation targeters.'

[2] For example, see J. Frankel, May 16, 2012, "*The Death of Inflation Targeting*", Project Syndicate,

In contrast to the earlier policy experiments around 'indirectly' managing inflation through monetary aggregates or exchange rates, IT was grounded in more rigorous research-based findings. These pointed to central banks' inability to consistently achieve multiple goals with only one basic instrument (the policy interest rate) and to control real variables such as growth and employment (rather than just nominal ones) over a longer period. Moreover, research highlighted how high inflation harmed growth and the equitable distribution of income, and, perhaps most decisively, that expectations and credibility were crucial for the effectiveness of monetary policy.

Price stability mandate, institutional independence, transparency and accountability were IT's core elements

These insights pointed towards a framework in which monetary policy would be assigned one clear and credible objective: that of achieving and maintaining low inflation. In addition, policy credibility would be enhanced by strengthening the operational autonomy of the central bank, while at the same time ensuring a high degree of policy transparency and accountability. Thus, IT frameworks generally included a number of basic elements: (i) Central banks' explicit mandate to pursue price stability as the primary policy objective, combined with accountability for achieving this objective; (ii) a high degree of transparency of monetary policy strategy and implementation; (iii) explicit quantitative targets for inflation; and (iv) policy actions based on a forward-looking assessment of inflation pressures, taking into account a wide array of information.[3]

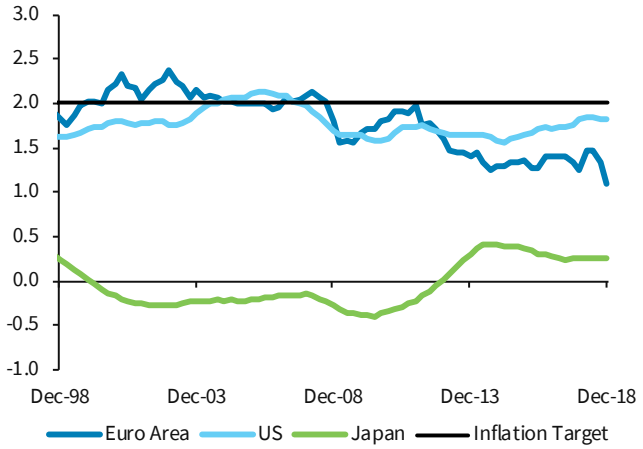
This framework helped boost central-bank credibility, which was crucial to anchoring inflation expectations and, in turn, stabilizing inflation outcomes. In addition to the institutional arrangements (central bank independence), credibility was achieved by emphasising rule–based policy making (eg, the Taylor rule) over discretion, clear mandates (ie, price stability/low inflation), and a strong aversion to monetary financing of fiscal deficits.

Credibility became crucial for anchoring expectations

The literature on the success of IT across economies is long. From 1990 to the GFC of 2008/9, the implementation of IT regimes was associated with low and stable inflation around official targets — 2% in most advanced economies — as inflation expectations settled around target. The rule-based monetary-policy approach of independent central banks was widely considered instrumental to the 'great moderation' that characterized the 2000s (until the GFC).

FIGURE 2

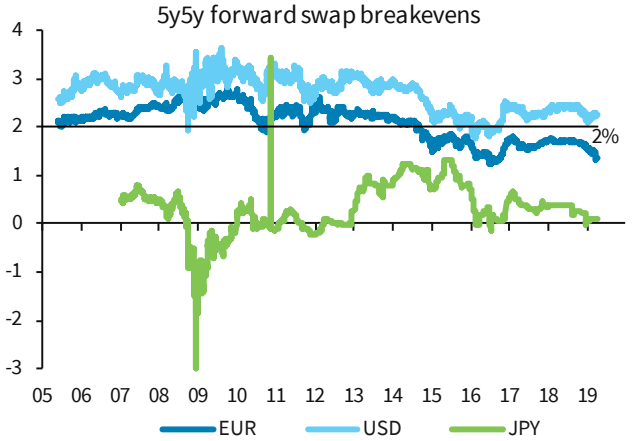
Trend inflation remains weak, especially in Europe and Japan



Source: OECD, Haver Analytics, Barclays Research

FIGURE 3

… and markets have come to expect soft inflation outcomes



Source: Barclays Research

[3] One notable exception to assigning the central bank with a sole objective to pursue price stability is the Federal Reserve of the United States, whose mandate is interpreted as having dual objectives of price stability and full employment.

First doubts: Inflation Targeting's role in the Global Financial Crisis

Unsurprisingly, the GFC triggered many questions about the role that monetary policy had played in it. First, some questioned whether IT contributed to the build-up of financial imbalances. Did the fixation on consumer price inflation (CPI) — which indeed remained low and stable in the decade up to the GFC — prevent central bankers from paying attention to financial risks (ie, asset bubbles) that were accumulating in the background?

Second, IT was criticized for contributing to sub-optimal policy responses in the aftermath of the crisis. Did the fixation on consumer-price targets prevent central banks from the aggressive easing that was required in this situation? The ECB's rate hikes in 2008 and 2011 can be seen as examples of a central bank tightening policies in the face of adverse supply and terms-of-trade shocks (eg, higher oil prices), because it was fixated on the impact on consumer prices rather than on output and employment.

Overly narrow focus on CPI can become a potential weak spot

These arguments are not easily dismissed. However, missing financial vulnerabilities (Fed) or misjudging the true state of the economy (ECB), may be more adequately characterised as "policy mistakes" than inherent flaws of IT in principle. IT frameworks certainly provide for the flexibility to look through transitory above-target headline inflation, and they also do not prevent central banks from monitoring financial stability risks and enacting prudential measures to address them.

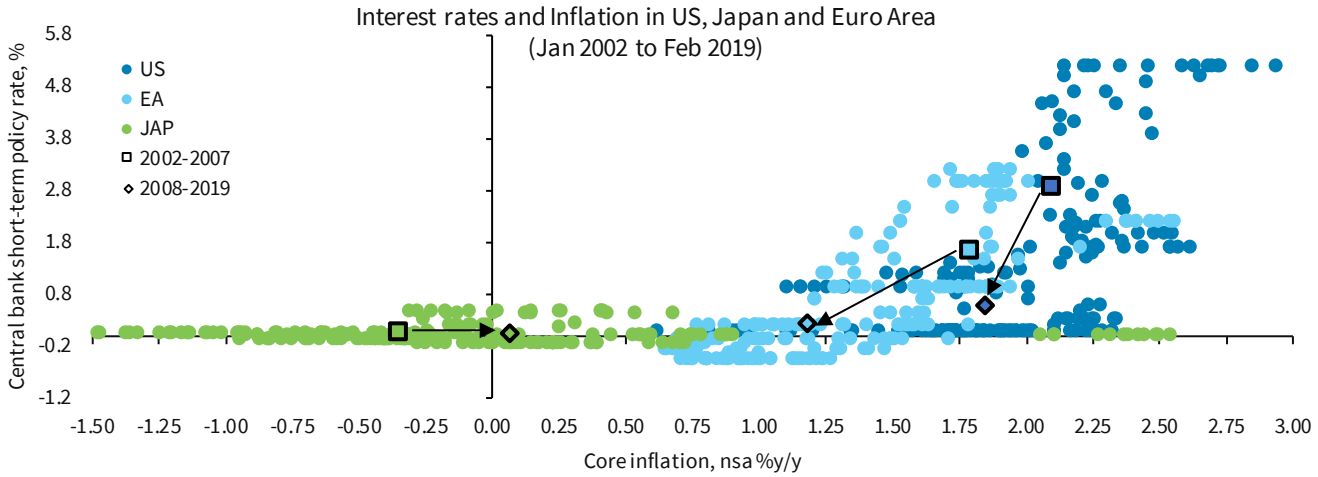
The new challenge: bringing back inflation in a low interest rate world

The challenge has shifted from above- to below-target inflation

IT's biggest challenge so far has turned out to be one that goes to its very core: inflation itself. But in contrast to the time of IT's birth, it is not that central banks wish to bring down inflation that is too high, but to spur inflation that is too low. A decade after the GFC, inflation has remained below official targets in most advanced economies, and at times has come perilously close to deflation even with sustained monetary-policy accommodation and strong labour-market recoveries. Certainly, differences remain across economies, with Japan's inflation remaining still closest to zero, the US having about reached 2% and the euro area somewhere in the middle. Even in the US, 2% has proven difficult to sustain despite full employment, a massive pro-cyclical fiscal boost, and still-accommodative monetary conditions. Hence, it seems as though there has been a fundamental change in economic relationships and, consequently, the effectiveness of monetary policy.

FIGURE 4

Closer to the 'trap': Europe and, less so the US, have moved closer to Japan's bad equilibrium of low rates and low inflation



Note: Inspired in part by Bullard, J. (2010), "*Seven Faces of `The Peril'* ", Bank of St. Louis Review, September/October 2010, 92(5), pp. 339-52, Source: OECD, BoJ, ECB, Eurostat, FRB, BLS, Haver Analytics, Barclays Research

Policy is implemented by the setting of the policy rate relative to the neutral level

Inflation targeting is implemented by adjusting short-term borrowing rates around what is considered an economy's equilibrium interest rate, the rate consistent with stable macroeconomic performance. This equilibrium or neutral rate, so-called r* (conceptually a real rate), is not observable but is nevertheless central for the models guiding policy in inflation-targeting regimes. When the interest rate is set above this equilibrium rate, the economy and inflation slow, and vice versa when policy rates are set below r*.

Within a modest positive range, the effectiveness of policy should be symmetric, with cuts as effective as hikes. Should inflation break out on the high side, and even if expectations become unanchored, the solution remains relatively straight forward: the central bank needs to tighten more aggressively (eg, the Fed under Paul Volcker, or some EM central banks that successfully achieved disinflation from high inflation environments). In principle, the policy interest rate just needs to be set sufficiently high for long enough that inflation outcomes decline and expectations move down again, even if at the expense of a slowing economy.

With low neutral rates, it is more likely that policy rates will be constrained by the lower bound

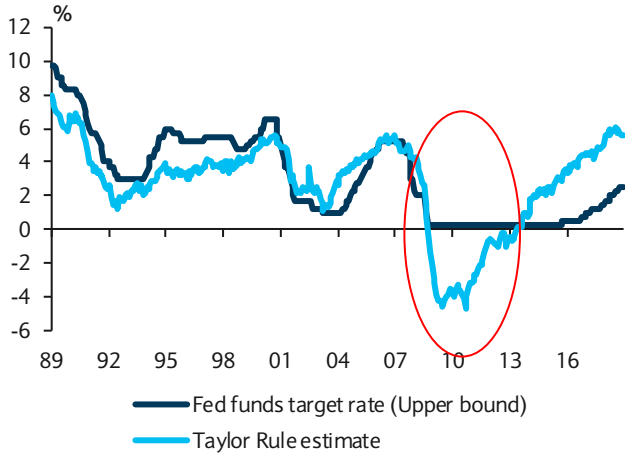
The same is not true in a world where inflation and r* are both very low. Given limitations on how low the nominal interest rate can be set, the policy rate is limited by the so-called effective lower bound (ELB), whereas the real interest rate can move well into negative territory. Thus, if expectations are for very low inflation or even deflation, even a policy rate at zero may not be low enough to push the real rate sufficiently below r* to re-stimulate growth and inflation. For example, in the wake of the GFC, Taylor Rule estimates of the appropriate nominal Fed funds rate were as low as -4.6%, yet the Fed stopped at zero (Figure 5).

Estimates of the neutral rate have fallen, forcing central banks to consider new tools

Today, policy makers face a world of very low estimates for r*, combined with low inflation expectations. Thus, even by lowering the nominal policy rate to zero, real interest rates may not go low enough to push inflation back to target. This fundamental challenge to the orthodox IT framework has forced central banks to consider what tools they could employ beyond the traditional policy interest rate.

FIGURE 5

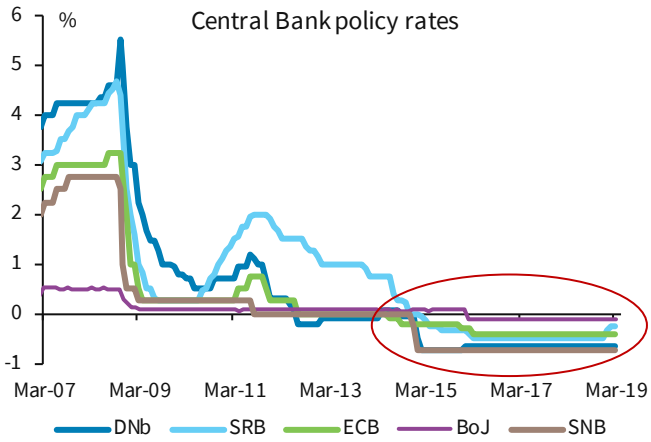
The Fed stopped at zero, but r* estimates were much lower



Source: FRB, Haver Analytics, Barclays Research

FIGURE 6

European central banks followed the ECB into NIRP



Source: DNb, SRB, ECB, BoJ, SNB, Haver Analytics, Barclays Research

Box 1: Why are neutral interest rates so low?

Global decline in r* driven by lower growth, demographics and technology

The question of which interest rate is consistent with a stable macroeconomic performance is a crucial one in modern, developed economies. Even though such neutral or equilibrium real interest rates (r*) are unobservable, an understanding of them is fundamental to setting appropriate monetary policy. A policy rate above r* should tend to suppress activity and thus inflationary pressure, while a rate below r* would have the opposite effect.

Over the past four decades, long-term (real) interest rates have declined across economies and asset classes. This suggests neutral real rates have fallen. Model-generated estimates of r* show declines as well — often even suggesting a negative r* in the wake of the GFC. Given the close conceptual link between r* and trend growth, the deceleration in trend across developed economies has likely played a key role in pushing r* down. In turn, this deceleration is mainly explained by demographic factors and slowing productivity growth. Population growth in advanced economies has fallen in the past decades from 1.4% p.a. in the 1970s to less than 0.4% today, while measures of both labour and total factor productivity (TFP) have largely declined in parallel.[4]

Alongside lower trend growth, global shifts in desired saving and investment are also related to the long-term decline of r*. Again, demographics play a crucial role, as population growth, ageing, and choices about length of retirement affect the prevailing balance of saving and investment, and hence equilibrium interest rates. This imbalance has likely been exacerbated by a glut of precautionary saving by emerging markets and by the drag on spending from widening income inequality, which driven overall savings higher. Meanwhile, slower technological progress and lower public investment have put downward pressures on global investment.

Estimations by the BoE for the global r* suggest a total 450bp decline over the past 40 years, of which 400bp are explained by the combination of lower trend growth (100bp) and shifts in the balance of desired savings and investment (300bp), with an additional savings element driven by demographics (90bp). Although these estimates come with large uncertainties and depend on a number of assumptions, they do provide a good impression of the different factors and orders of magnitude at play. Importantly, most of these forces are expected to persist or intensify (such as population ageing).

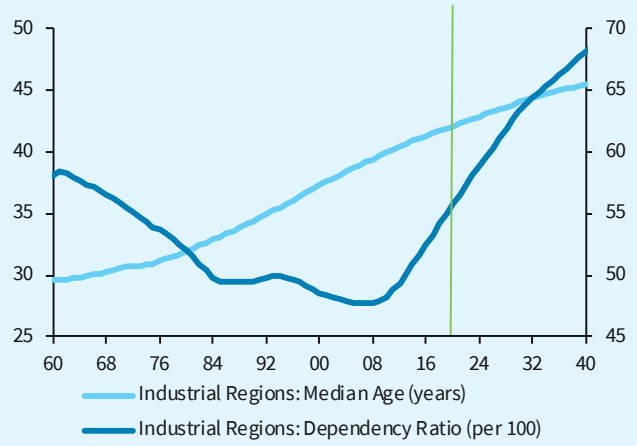
Diminishing Inflation Expectations

Nominal rates along the curve are also being pushed down by low expectations for inflation. With inflation having trended down for several decades and falling further in the aftermath of the GFC, inflation expectations — which IT regimes had earlier managed to anchor around their targets — have started to shift down as well. Both inflation-linked assets and broad consumer surveys show evidence of this: as priced by the market, 5y5y breakeven inflation rates from US TIPS and nominal US Treasuries and 5y5y US CPI swaps have both been 60-80bp lower, on average, in 2015-19 than in 2010-H1 14. 5y5y HICPx swaps indicate that market-based inflation expectations have dropped in Europe as well. The measure of 5-10y inflation expectations from the University of Michigan Survey and the 3y ahead inflation expectation measure from the NY Fed's Survey also confirm that consumer inflation expectations have fallen over the past several years.

[4] L. Rachel and T.D. Smith (2015): *Secular drivers of the global real interest rate*; Bank of England; L. Rachel and L.H. Summers (2019) On falling neutral rate, fiscal policy, and the risk of secular stagnation; Brooking Papers; *Equity Guilt Study, Chapter 2, (2016): When absolute zero isn't low enough*; Barclays Research

FIGURE 7

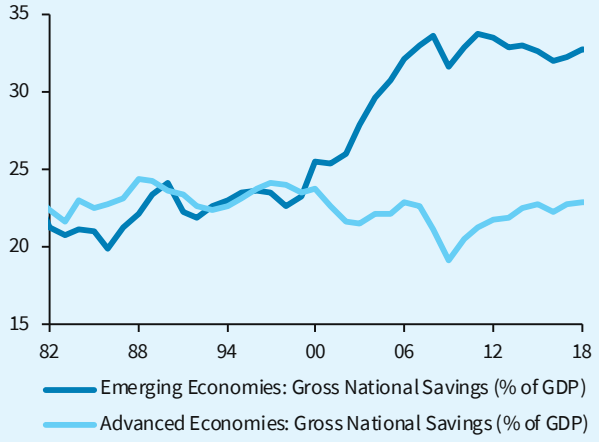
Demographic shifts due to lower birth rates and longevity…



Source: UN, Haver Analytics, Barclays Research

FIGURE 8

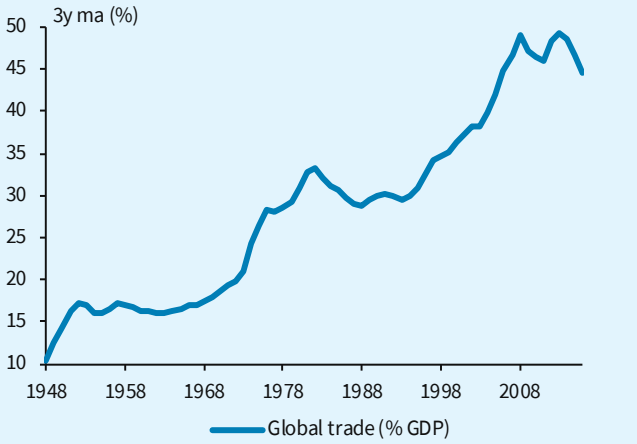
…increases in EM economies' savings ratios…



Source: IMF, Haver Analytics, Barclays Research

FIGURE 9

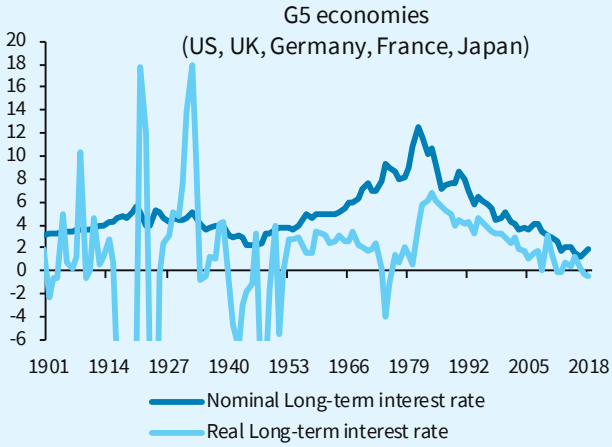
…and globalisation of commerce and labor markets …



Source: IMF, Barclays Research

FIGURE 10

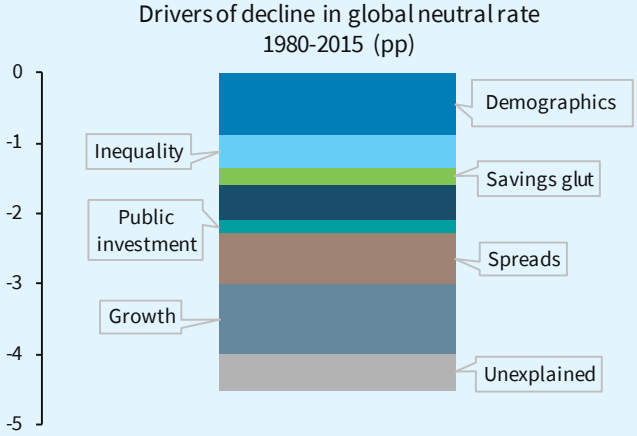
… all contributed to lower nominal and real interest rates



Source: Jordà-Schularick-Taylor Macrohistory Database, Haver Analytics, Barclays Research

FIGURE 11

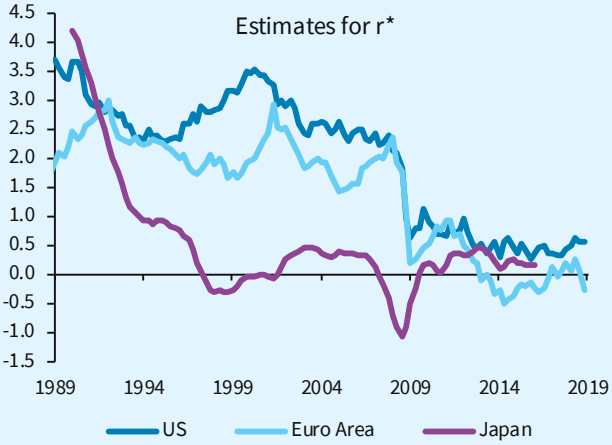
The global neutral rate is estimated to have declined by over 400bp since 1980, mainly due to demographics and growth



Source: Bank of England, L Rachel and T.D. Smith (2015)

FIGURE 12

Estimated neutral rates (r*) hover around zero for the euro area and Japan and only slightly higher for US



Source: Federal Reserve Bank of New York, *Measuring the Natural Rate of Interest*, BoJ, Barclays Research

Initial crisis response: bringing out new tools

Quantitative Easing (QE)

Quantitative easing is a tool by which a central bank expands the monetary base by buying assets in the secondary market. There are generally a few channels through which QE is thought to affect activity: increasing bank credit extension, lowering longer-term borrowing rates in the capital market, supporting asset prices (also known as the portfolio-rebalance channel as investors are pushed out the risk spectrum) and as a signalling mechanism. While there is a fine line between QE and debt monetisation, the distinction is that central banks could reverse QE by secondary market sales.

Central banks expanded the monetary base by buying assets in the secondary market

Long before the GFC, the Bank of Japan was deploying QE from 2001 as it increased the monetary base after a zero-interest-rate policy (ZIRP) introduced in 1999 failed to eliminate deflation. Initially focused on buying JGBs, it expanded the program to equity purchases in autumn 2002. The Fed followed in December 2008 with it its own long-term asset purchase program, later known as QE1, which focused on mortgage purchases. It would go on to QE2, which focused on US Treasury purchases, then Operation Twist (which technically was not QE because it sterilized purchases with sales of shorter-maturity Treasuries), and QE3, which included both Treasury and mortgage purchases. The BoE began its program in March 2009 with a concentration in UK gilts. The ECB launched its own version in late 2014, when they bought asset-backed securities and covered bonds and later expanded the program significantly in early 2015 to include bonds issued by euro-area governments, agencies and European institutions.

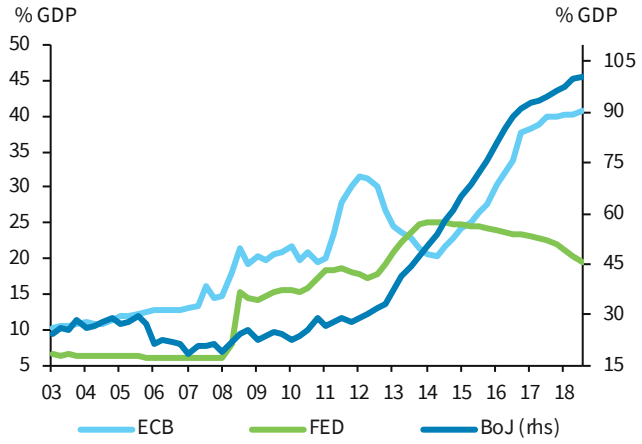
Forward Guidance (FG)

Forward guidance seeks to commit the central bank to future policy actions

Another tool central banks have used to stimulate growth is pre-committing to easy policy through FG. It can be an effective tool when clearly communicated, provided that the central bank has credibility. The implementation of FG can be put into three broad categories: qualitative, time contingent and threshold-based.

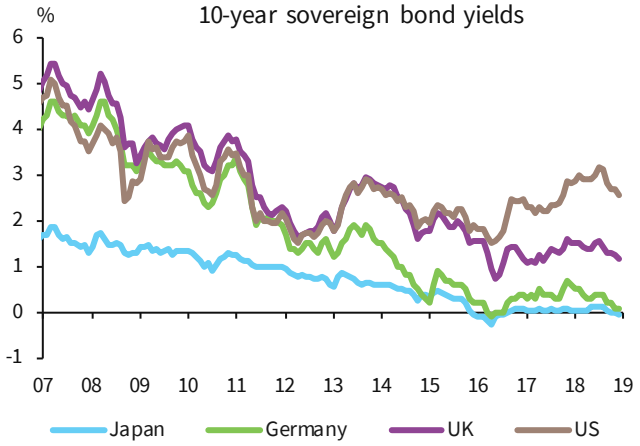
The BoJ was also a pioneer in providing the market with some certainty through FG. When it introduced the ZIRP in 1999, the Bank explicitly committed to continuing it "until deflationary concern is dispelled." The Bank of Canada, the Fed and the Riksbank all implemented FG shortly after the onset of the recession, with the BoC and Riksbank both

FIGURE 13
Central banks' QE expanded their balance sheets…



Source: FRB, ECB, BoJ, Haver Analytics, Barclays Research

FIGURE 14
…bringing down longer-term interest rates



Source: US Treasury, MoFJ, Bbk, BoE, Haver Analytics, Barclays Research

providing time-contingent guidance in April 2009. The ECB and BoE joined others in mid-2013, with the BoE basing its low-rate policy in part on the unemployment rate. At its March 2019 meeting, the ECB updated its FG by stating that it expects its key interest rates to "remain at their present levels at least through the end of 2019."

Negative interest rates (NIRP)

The effective lower bound on the policy rate can be negative because it is costly to store cash

While the low neutral-rate problem facing policy makers in a downturn is often attributed to a zero-lower bound on nominal rates, several central banks have shown that nominal policy rates can be pushed into negative territory and held there to provide further stimulus. Most have found that there is a limit to how low negative rates can be set; after all, one would only pay to park money when the risk-adjusted cost is lower than an alternative storage facility. The primary concern with NIRP has been the potential effect on bank profitability, which can weigh on the bank credit channel of monetary policy.

Switzerland used NIRP in the 1970s in an attempt to deter a flood of foreign investment and control the currency. Following the financial crisis, first Sweden (2009), then the Dankse Bank (2012), ECB (2014), Swiss National Bank (SNB, 2015) and BoJ (2016) all pushed some policy rates below zero. Many have implemented NIRP with a tiered or partial approach. For example, the SNB only applies negative interest rates to the portion of deposits that exceeds a given exemption threshold. Similarly, when the BoJ adopted NIRP, it implemented a three-tier system where a 0.1% rate was applied for a member bank's "basic balance," a 0% rate for a "macro add-on balance," and a -0.1% rate for holdings in excess of these two balances. While the Fed has not ruled out using NIRP in the next downturn, there remains considerable debate as to whether it would work in the US.

Yield Curve Control (YCC)

While traditional short-term interest-rate focused monetary policy attempts to influence longer rates through the expectations channel and QE works, in part, through its influence on term premia, yield-curve control takes it one step further by setting targets for both short and longer interest rates. It is essentially QE where instead of announcing a fixed notional amount of assets to be purchased, the central bank commits to purchase whatever amount is needed to cap rates at some portion of the yield curve. This approach leads to more control over the term structure of interest rates – so long as that commitment can be fulfilled. This is subject to some risks, as it is possible that the central bank is unable to purchase enough bonds to fulfil its commitment or that central bank buying becomes so dominant that the market ceases to function effectively.

Currently only used by the BoJ, yield curve control could become an option for other banks as well

YCC was first implemented by the Fed during WWII in the early 1940s, with an implicit commitment to cap long rates at 2.5%, mainly to help the Treasury finance the war, though it was rarely binding. In September 2016, after QE and NIRP failed to push up inflation to a desired level, the BoJ committed to purchasing longer bonds in a flexible manner such that 10y JGB yields "will remain around zero percent." While other central banks have not followed the BoJ, the Fed's Richard Clarida recently noted that the Fed "can send some solid long-term signals with this (yield curve control) and that would help in a future downturn." Thus, it appears that it might be a regular tool in central banks' toolkits.

Non-standard tools have become standard…

One broad conclusion regarding the new tools central banks have employed since the GFC seems increasingly accepted: the non-standard has become the standard. What were initially regarded as extraordinary emergency measures have been incorporated into the regular policy toolbox. There is no indication that central banks' balance sheets will decline back to their pre-GFC crisis levels and, in case of significant deteriorations of the current macro environment, QE would likely be reactivated, with YCC being an additional variation. Similarly, now that some central banks have shown that it is possible to set negative policy rates, to a certain degree, it seems likely that this option will be considered more widely.

Indeed, ongoing efforts to reduce some of NIRP's negative side-effects on banks (eg, tiering of reserves) suggest that the option of negative policy rates is here to stay.

…but even that seems insufficient to credibly attain inflation targets

That said, these new tools have still not allowed central banks to deliver satisfactorily on their inflation targets. Even in the US, where the Fed's preferred core PCE inflation measure has reached around 2%, it has occurred only late in the cycle and with a very low unemployment rate that usually would be associated with stronger inflationary pressures. Hence, while in Japan and Europe the 2% target remains out of reach, the risk of not sustainably delivering 2% also remains high in the US. This could damage the credibility of these target, raising risks that inflation expectations become anchored at rates below 2%. Moreover, with QE programs implemented to date having already pushed down term premiums, future programs could plausibly have less traction on longer-term borrowing rates. Thus, with the logic of the 2% target being questioned, it is not surprising that central banks have started to consider potential changes to the IT framework itself. The Fed's ongoing strategy review, which is expected to be complete by mid-2020, is an important example.

Beyond the crisis: different *targets* for a new normal?

Some considerations for evaluating the options

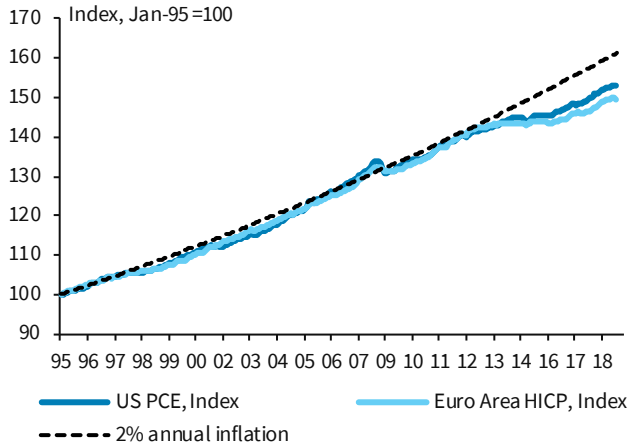
Having conceded that additional policy tools such as QE, FG, YCC are imperfect substitutes for the conventional policy rate instrument, discussion around modifying or replacing IT is typically motivated by the increased likelihood that policy rates could regularly hit the ELB in a low neutral rate environment. In theory, many of the proposals being discussed – such as targeting a higher level of inflation, price *levels*, or *nominal GDP* – could bolster FG in ways that help address this issue. But this narrow focus will not suffice, as policymakers will need to weigh the costs (both temporary and permanent) and other practical shortcomings of these proposals.

Any new target needs to be credible to shape expectations

One crucial issue when weighing these alternatives is the formation and management of expectations by market participants. Although an idea may sound promising in theory, its effectiveness in practice will depend on whether policy can influence market *expectations* in the intended way. In other words, will the proposed 'target' be a credible commitment device for guiding expectations? This is not assured, because today's commitments may not be *time consistent* (in economics jargon), meaning that even well-intentioned policymakers will have strong incentives that will prevent them from following through on a commitment.

FIGURE 15

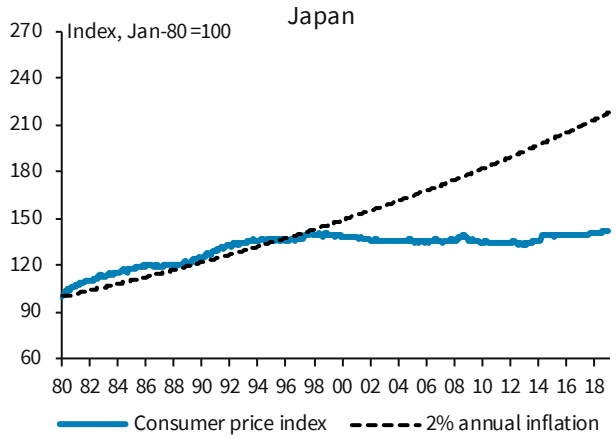
Price level targeting could require…



Source: Eurostat, BEA, Haver Analytics, Barclays Research

FIGURE 16

…significant catch-up, in particular for Japan



Source: MIC, Haver Analytics, Barclays Research

In particular, a commitment to eventually allow inflation to run above or below some long-run desired level may prove exceedingly costly in the event, and therefore may not influence expectations as intended.

Alternative targets come with costs

There are other meaningful costs to consider, some of which are transitory, and others more lasting. For instance, many of the new frameworks discussed below aim to meaningfully increase inflationary expectations. To the extent that such efforts are successful, the outcome would clearly benefit some market participants (such as borrowers) at the expense of others (lenders), implying substantial re-distributional consequences during the transition. Even after the transition, higher inflation would likely prove costlier for some groups (including those who are inadequately hedged for inflation) than others. While re-distributional consequences are unavoidable for any policy change, there may be considerable reluctance to shift away from a framework that for two decades, by and large, has delivered notable improvements relative to previous approaches.

Setting a higher inflation target

A higher inflation target would create more space for rate cuts

Perhaps the simplest alternative under discussion is to permanently raise the inflation target (such as from 2% to 4%). By essentially maintaining the IT framework, this approach would inherit many benefits, including the flexibility for policymakers to let bygones be bygones when supply shocks occur. To the extent that the higher target is credible, the added benefit would be higher inflation expectations and nominal interest rates. With greater scope to reduce the policy rate in a downturn, central banks would be less likely to hit the ELB. Higher inflation expectations would also bolster stimulus once the ELB has been reached, since anticipated real rates of interest would be lower. With less time seemingly spent at the ELB, recessions would be less costly and average economic activity would be higher.

Can a 4% target be credible when even 2% has not been achieved?

But, as with all alternatives, these benefits come with costs. The most obvious is that economic participants would have to live with higher expected and realized inflation rates. This is meaningful because inflation is not costless: a choice to hold cash would come with a greater sacrifice of purchasing power, and actions to avoid these costs – such as economizing on cash holdings and inflation hedging – involve deadweight losses for the economy. Arguably, these costs would fall disproportionately on those who lack access to cash substitutes, such as lower-income households. At the same time, these same households may benefit disproportionately from spending less time at the ELB.

Higher inflation means losses for some

Boosting inflation targets would also involve substantial transition costs. As mentioned earlier, higher inflation expectations tend to transfer wealth from existing lenders to existing borrowers. To provide a ballpark sense of the magnitudes at play, the US Federal Government has sold to the public about $8.2 trillion of longer-term nominal debt securities.[5] Given the average duration of these securities (6.2 years), a credible commitment to permanently raise the inflation target by 1 percentage point would raise yields by about the same amount, thereby transferring about $500 billion of wealth from bondholders to the US Federal government.[6] Of course, this is only a fraction of nominal debt contracts outstanding, so the overall wealth transfer would be much larger.[7]

[5] The $8.2 trillion total excludes treasury bills, inflation-indexed bonds, and bonds held by the Federal Reserve.
[6] This magnitude is calculated as the change in the aggregate market value of these debt holdings, approximated using the formula: Change in value of securities = duration x value of securities x change in yields.
[7] The political reality of these redistributions is perhaps part of the reason that Federal Reserve Chair Jay Powell has stated during Congressional testimony that the FOMC has ruled out this alternative. See Powell, J.H.,, February 27, 2018, "*Semimanual Monetary Policy Report to the Congress*", Before the Committee on Financial Services, U.S. House of Representatives, Washington, D.C.,

FIGURE 17
The costs and benefits of alternative frameworks differ

Alternative		Lower probability of ELB?	Enhance policy at ELB?	Accommodate supply shocks?	Main drawbacks
Higher inflation target		Yes	Yes	Yes	may lack credibility wealth redistribution
Price level target	temporary	Possibly	Yes	Yes/No	may lack credibility
	permanent	Yes	Yes	No	may lack credibility potentially destabilizing with supply shocks challenging to calibrate, ex ante
Average inflation target		Yes	Yes	Yes	may lack credibility challenging to calibrate, ex ante heightened risk of political interference
Nominal GDP target	growth rate	Possibly	No	Yes	somewhat counterproductive at ELB misleading supply signals may constrain policy unstable inflation expectations
	level	Yes	Yes	No	may lack credibility misleading supply signals may constrain policy challenging to calibrate, ex ante

Source: Barclays Research

Price level targeting

Price level targeting (PLT) has been advocated since the late 1990s, when it was proposed by a number of prominent economists to help Japan emerge from its ongoing liquidity trap.[8] With this approach, central banks target a trajectory of the price level, commonly one in which prices rise at a pre-specified rate – which, for illustration, we assume is 2% y/y.

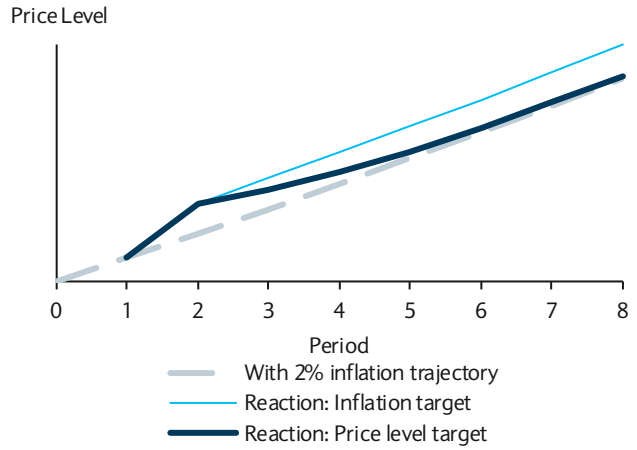
Making up for the years of below-target inflation with years of above target inflation

The main benefit of PLT relative to IT is to bolster the credibility of FG at the ELB. In such a scenario, inflation would generally be running well below 2%, and, to eliminate the shortfall, the central bank would eventually need to let the economy run hot so that inflation exceeds 2% for a time. If financial markets view this as credible, they would factor in expectations of lower policy rates when the economy emerges from the ELB, which would stimulate activity immediately by forcing down longer-term borrowing rates. In turn, this would provide central banks with more ammunition to avoid reaching the ELB: with the economy expected to spend less time at the bound when it is reached, markets would presumably boost inflation expectations to around 2%, thereby raising nominal interest rates. Of course, these benefits depend critically on the credibility of the commitment to keep rates lower for longer after emerging from a liquidity trap.

[8] For instance, see "*Price Level Targeting vs. Inflation Targeting: A Free Lunch*," by Lars Svensson, *Journal of Money, Credit and Banking*, Vol 31, 1999 and *NBER Working Paper No. 5719.*

FIGURE 18

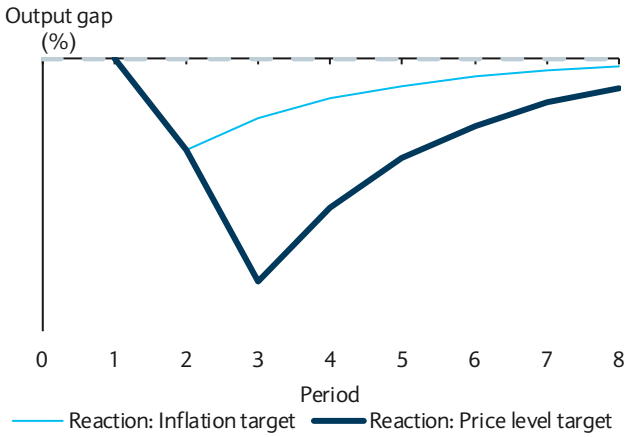
A price-level target would require the central bank to reverse supply shocks…



Source: Barclays Research

FIGURE 19

…which would tend to destabilise activity



Source: Barclays Research

However, credibility issues with PLT are more acute than demonstrating a willingness to tolerate inflation after reaching the ELB: meaningful tensions will also arise in the event of adverse supply shocks (or "price level shocks"), when the virtues of PLT can rapidly become a vice. This is illustrated in Figures 18 and 19, which compare the response of prices (left panel) and the output gap (right panel) to a persistent adverse supply shock – such as an increase in the price of oil. With both a forward-looking IT regime (the light blue lines) and a PLT regime (the dark blue lines), the shock initially raises consumer prices and leads to a slight contraction in real activity. With IT, the central bank lets bygones be bygones, allowing the shock to temporarily raise inflation in the short run and the output gap to gradually close. However, with PLT, the central bank seemingly does not have the luxury of prioritising economic stability ahead of defending the target. Policy would need to be tightened in order to undo the inflationary impulse from the shock, leading to a costly period of foregone activity. Since shocks are quite common, policy may need to engineer many such reversals to secure the credibility needed to reap the benefits of PLT at the ELB.

But should central bank really suppress inflation below target after a period of overshoot?

PLT also raises subtle, but important, issues with implementation. For example, once a target has been established, adverse demand shocks may well occur after a period when the economy has been running above potential, with prices pushed above the target. Figure 21 depicts such a situation, using the experience of the US in the run-up to the GFC as an example. The lines in the figure show accumulated gaps between PCE prices and core PCE prices and a plausibly calibrated target.[9] With this calibration, both prices had ascended well above their targets (in part due to an ill-timed energy price shock) so that the FOMC would have entered the crisis with an intention to keep its policy stance *tighter* than otherwise to unwind these overruns. Even if the Fed had fully anticipated the magnitude of the impending crisis at the time, its commitment to the target would have seemingly undermined its ability to respond.

Although targets can surely be recalibrated to support FG in cases where levels are clearly misaligned with the public interest, the possibility of doing so speaks to its credibility as a commitment device. If a central bank can opportunistically boost its target when the economy is operating below full employment, it can just as easily reduce it when the time comes to reflate the economy following a bout at the ELB.

[9] We assume each target rises at 2% y/y, and normalise each so that the initial gap is zero in Q2 2005 – the last quarter prior to the GFC when the US unemployment rate gap was closed.

These various shortcomings are part of the reason that former Federal Reserve Chairman Ben Bernanke has proposed a *temporary* PLT approach.[10] In this alternative framework, the central bank would only commit to the PLT when the policy rate is at or near the ELB, with an eye to boosting the credibility of FG to keep rates lower for longer. Although this alternative seemingly helps address some of the shortcomings of a permanent PLT discussed above, it may still lack credibility, as policymakers can always renege on the commitment when the time comes to follow through with high inflation.

Average inflation targeting

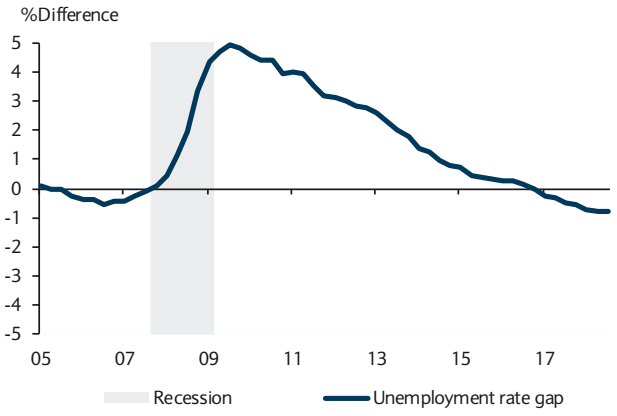
John Williams, the current head of the New York Federal Reserve branch and vice-chair of the FOMC, has proposed the idea of average inflation targeting (AIT).[11] With this approach the central bank would vary its inflation target over time, committing to intentionally set to targets somewhat above 2% – such as 2.25% – in periods when the economy is running in the vicinity of full employment and a somewhat lower target – such as 2.0% – otherwise.

Targeting an average inflation rate over time may be a workable alternative

AIT can be thought of as a hybrid that seeks to extract the most useful features of IT and PLT. The main idea is to bolster inflation expectations to levels closer to 2%, acknowledging the strong likelihood that inflation will tend to run well below the target for extended periods when the policy rate is trapped at the ELB. On paper, the commitment to adjust the target at a later date, as necessary, to balance out low-inflation outcomes would work much like PLT, reinforcing FG at the ELB by assuring markets that the policy rates will be kept lower for longer when the ELB no longer binds. As with PLT, this could also help provide more ammunition for central banks to avoid ELB outcomes, by raising expected inflation and neutral interest rates when the economy's output is closer to potential.

FIGURE 20

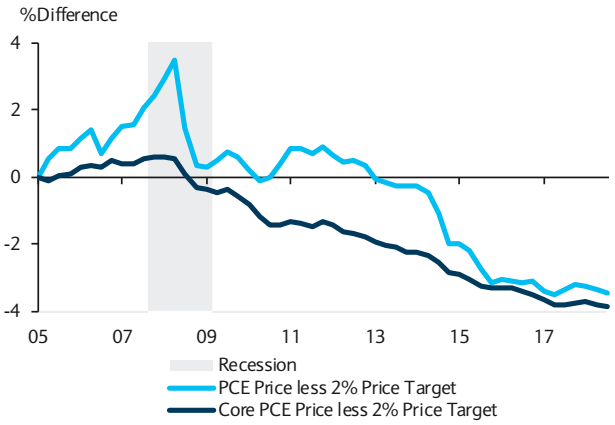
The Fed's full employment mandate clearly called for an accommodative policy stance in the GFC…



Note: Target is normalized to Q2 2005, when the unemployment rate gap is closed according to the CBO. Source: Congressional Budget Office, Bureau of Economic Analysis, Barclays Research.

FIGURE 21

… but a price level target may have undermined its ability to respond



Note: Target is normalized to Q2 2005, when the unemployment rate gap was closed according to the CBO. Source: Congressional Budget Office, Bureau of Economic Analysis, Barclays Research

[10] "*Monetary Policy in a New Era*" by Ben S. Bernanke, paper prepared for conference on Rethinking Monetary Policy, Peterson Institute, Washington DC, October 2, 2017.

[11] Williams has outlined this approach in a number of speeches, including recently with "*Monetary Policy Strategies in a Low-Neutral-Interest-Rate World*", presented at the Plenary Meeting of the Group of Thirty, Federal Reserve Bank of New York, November 30, 2018.

However, AIT resembles IT in the sense that it provides scope to temporarily prioritise economic stability above defending the target when the economy is hit by supply shocks. This is because the target within each regime can be treated much as in a flexible IT framework, with a forward-looking view that de-emphasizes the need to reverse supply shocks. With this shift in emphasis, it would be considerably easier for the central bank to demonstrate the credibility of its commitment to an AIT framework. Another potential benefit is that AIT may be more intuitive to the public than PLT, which could also help reinforce credibility.

Enhanced flexibility could come at the expense of lower credibility

But this enhanced flexibility potentially comes at the cost of undermining credibility, and may also expose central banks to heightened political pressures. By construction, an adjustable target may lack credibility because it is subject to future adjustment. As with PLT, markets will also be aware that policymakers will eventually need to grapple with the costs imposed by a commitment to let the economy run hot, and may not view this commitment to be credible. Policymakers also would not know the duration of an upcoming expansion, which would leave open to debate the appropriate adjustment to the target. Among other things, this would provide scope for political interference, as a given political administration, once in power, will have incentives to pressure the central bank to set the higher target – thereby reaping the benefits of a strong economy while leaving the central bank to sort through any hangover effects on inflation and financial stability.

Nominal GDP targeting

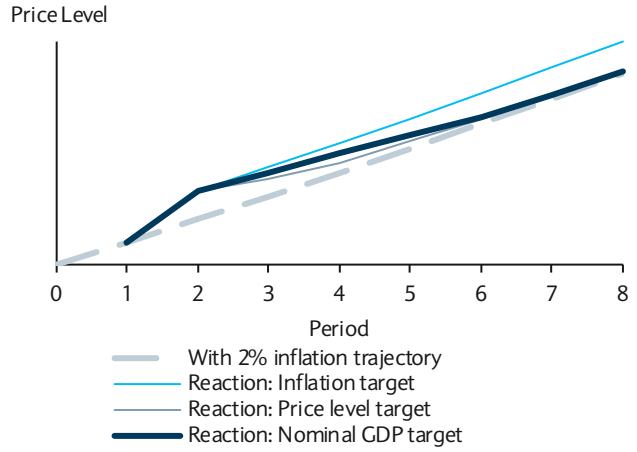
A key theme of the forgoing discussion is that frameworks based solely on a price stability objective, such as IT or PLT, can sometimes be at odds with full employment. Nominal GDP targeting (NGT) is a framework that attempts to achieve a more consistent balance between these two considerations, using a single target that weights both goals.

Targeting nominal GDP is an elegant solution in theory …

NGT has two main variants. In the first, the central bank would target a specific growth rate – such as 4.5% q/q saar – at some horizon, much as it targets consumer inflation with IT. Since nominal GDP growth is (approximately) the sum of GDP price inflation and real GDP growth, the target would place equal weight on the gaps between (a) the growth rates of output and potential, and (b) GDP price inflation and an inflation target (set implicitly, as the nominal GDP target less potential GDP growth). As with IT, policymakers would receive an unambiguous signal to make policy rates more accommodative if both gaps are expected to run negative, and the converse if both gaps will run positive. Hence, the framework would direct policymakers to lean against demand shocks as with IT, automatically steering the

FIGURE 22

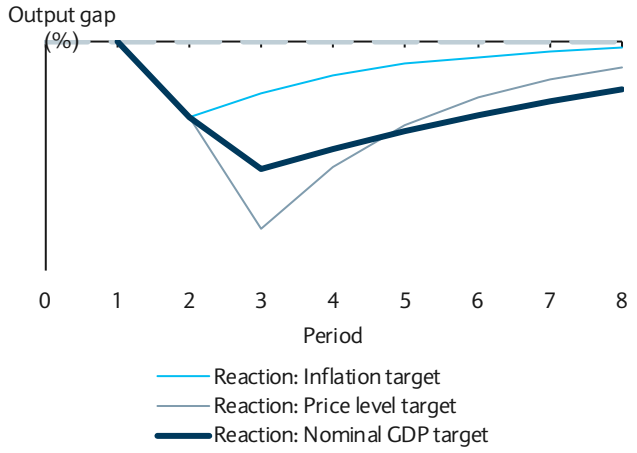
With a nominal GDP target, the central bank would be react more gradually to supply shocks than with a price target…



Source: Barclays Research

FIGURE 23

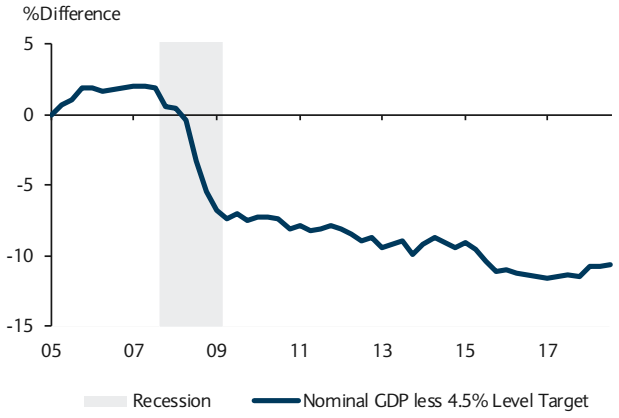
…which would be less destabilizing for activity



Source: Barclays Research

FIGURE 24

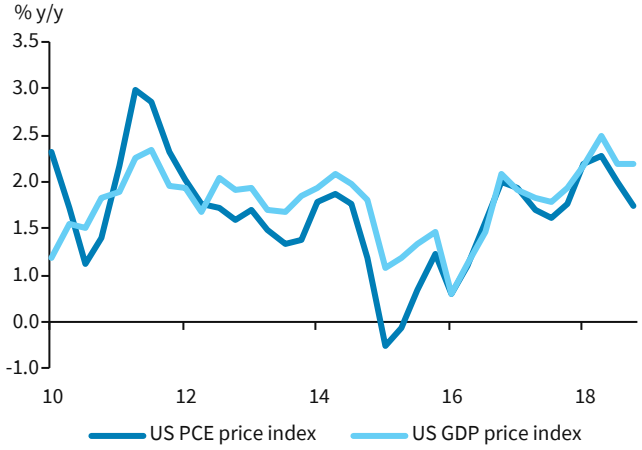
At the onset of the GFC, a nominal GDP level target may have slowed the Fed's policy response



Note: Target is normalized to Q2 2005, when the unemployment rate gap is closed according to the CBO. Source: Congressional Budget Office, Bureau of Economic Analysis, Barclays Research

FIGURE 25

Nominal GDP targeting ignores the distinction between GDP and PCE prices



Source: BEA, Haver Analytics, Barclays Research

economy toward full employment. [12] When supply disturbances hit, the two gaps would send mixed signals, and any dilemma about which gap to prioritise would be resolved by weighting them equally. This would tend to split the burden of adjustment between activity and prices in the short run.

A key shortcoming of NGT is that it may not effectively reinforce FG when policy rates are constrained by the ELB. As discussed, a pledge to keep rates lower for longer will only be effective if policymakers can credibly commit to future outcomes where the economy is allowed to run "hot" to generate expectations of higher inflation. But such outcomes almost surely require a sustained period of rapid nominal GDP growth, which would violate the NGT when the time comes to follow through on the pledge.

…especially when targeting a nominal GDP level rather than growth rates…

The second variant helps address this shortcoming by having the central bank adopt a *level* nominal GDP target (NGLT) that grows each year at a specified growth rate. Much like a PLT, this approach would counsel policymakers to take an accommodative stance when nominal GDP is persistently falling short of its target, and a restrictive stance when the opposite is the case. Among other virtuous aspects, this would reinforce forward policy guidance at the ELB, by committing policymakers to run the economy hot until the NGLT is reached. Indeed, this commitment may be more credible with PLT or AIT, because the nominal GDP benchmark automatically directs policymakers to make trade-offs between inflation and unemployment that might otherwise lack credibility. With more effective FG, ELB episodes would tend to be shorter in duration, which would typically raise inflation expectations and interest rates on balance, once again providing the central bank with more ammunition to avoid ELB outcomes. A NGLT would also not be as much of a straightjacket as PLT when the economy is hit with adverse supply shocks, with the burden of adjustment split between activity and prices.

Another key benefit of NGLT is that it seemingly de-emphasizes the need to assess unobserved supply variables. With central banks calibrating policy to a readily observed nominal GDP benchmark, policymakers need not go to such pains to assess economic

[12] Indeed, some proponents of nominal GDP targeting propose that the central banks calibrate its monetary policy stance using a futures market for the level of nominal GDP. Specifically, policymakers would loosen policy if the futures market pointed to nominal GDP growth below the target, and would tighten policy if the futures market pointed to growth above the target.

slack. This might help make policy more transparent and predictable, as decisions need not be tied to judgmental assessments of unobserved variables and the weights placed on inflation and unemployment.

But these virtues would be accompanied by meaningful disadvantages. The first is that a NGLT does not let bygones be bygones. As with PLT, this would be most apparent when the economy is hit by a supply shock when it is operating near full employment. As shown in Figures 22 and 23, the framework would tend to direct policymakers to reverse adverse supply shocks; otherwise the level of nominal GDP would exceed the target when output returns to potential. The balanced priorities of NGLT merely provides flexibility for policymakers to smooth costs in terms of foregone activity, likely implying a more prolonged adjustment than with a price level target.

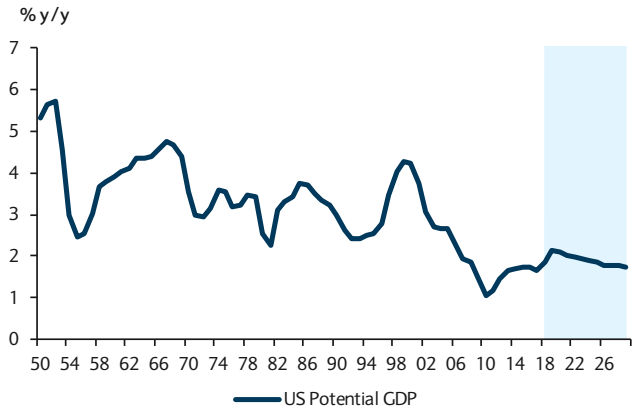
A second disadvantage is that policymakers would sacrifice some nimbleness. As with a PLT, policymakers in each period inherit some accumulated gap between GDP and the target. Given the cyclical tendencies of the economy, downturns will tend to hit at times when cyclical forces have been pushing nominal GDP above its target. With policymakers generally adopting a restrictive stance in such cases, it is reasonable to think that they will be more reluctant to respond to signs of an economic downturn than they would be with a target that lets bygones be bygones. As shown in Figure 24, this may well have been the case in the United States in the early stages of the GFC, when nominal GDP had generally been growing at rates exceeding plausible nominal GDP targets.[13]

But nominal GDP targeting comes with a number of conceptual as well as practical challenges

Beyond these disadvantages, NGT and NGLT are subject to a number of meaningful conceptual issues. First, NGLT may not do enough to stabilize prices that matter for consumers. Conceptually, the price index reflected in nominal GDP captures prices of domestically produced goods that may not be important to consumers, and is not the same as consumer price benchmarks that measure changes in households' living costs. Indeed, the rate of inflation in GDP prices can often differ substantially from rates based on PCE prices (see Figure 25), especially in countries with a high import content. Second, policymakers would need to grapple with how changes in potential GDP growth will interact with inflationary outcomes. In most developed countries, potential GDP has been

FIGURE 26

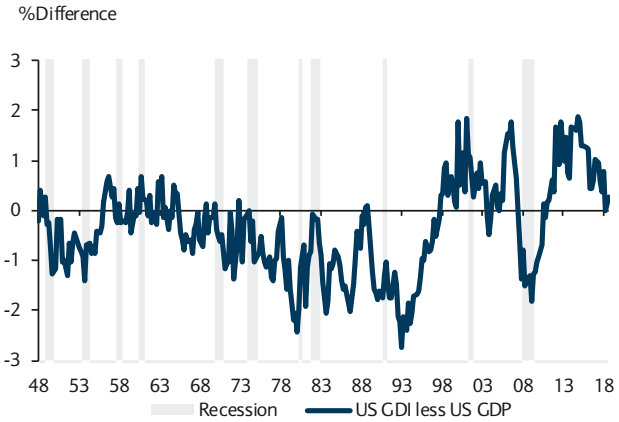
The ongoing deceleration of potential GDP poses problems for nominal GDP targeting



Source: Congressional Budget Office, Barclays Research

FIGURE 27

Nominal GDP is subject to substantial measurement errors



Source: Haver Analytics

[13] One reasonable target, given the rate of potential GDP growth (about 2.5% y/y, according to current estimates from the US Congressional Budget Office) that prevailed in the mid-2000s and the Fed's preference of inflation around 2%, would have been 4.5% y/y.

gradually decelerating for decades due to population demographics and other influences (Figure 26) – and this trend is expected to continue. The consequence of this deceleration, with a fixed NGT, would be gradual upward creep in inflation.[14] Lastly, nominal GDP is subject to numerous measurement difficulties that would complicate monetary policy. This is apparent from Figure 27, which shows discrepancies in the US between nominal GDP and GDI (which are conceptually equivalent but are measured using different approaches). Reflecting these measurement difficulties, real-time measures of nominal GDP growth are prone to substantial revisions over time as statistical agencies periodically revisit their estimates to incorporate better source data and alter measurement conventions.[15] With such revisions often occurring within months of initial estimates, policymakers would often receive misleading signals about the appropriate stance of policy, which would pose issues for communication and implementation.

More radical conceptual changes

As part of the Fed's strategy review, the above alternatives to the current IT framework are transitioning from the pure academic sphere to that of policy practitioners. The future of monetary policy frameworks has entered the discussion in other central banks as well, even if merely for debate.[16] In academia, more radical concepts are being discussed, many of which seek a break from long-standing policy and social conventions. They may be far from being seriously considered today, but if the past decade has shown anything, it is how quickly the unorthodox can become orthodoxy.

Abolishing cash

Without cash holdings as an alternative, negative interest rates would be fully effective

One proposal is for central banks to fully eliminate (cash) currency, as to overcome the ELB.[17] By removing the arbitrage opportunity of escaping negative interest rates through substituting deposits for cash, the asymmetry of interest rate policy can be overcome: policy rates can, in principle, be moved both above and below zero without boundaries. Freed from the ELB, monetary policy would have regained interest rates as its core instrument with ample room for counter cyclical downturns. In addition, proponents argue that the full digitization of money would create savings by reducing the costs associated with the physical storage and transport of cash, while also hampering some illegal activities and promoting transparency.

A cashless society would bring more transparency at the cost of diminished anonymity…

There are a number of drawbacks, however. Transacting and storing value in cash has survived throughout the centuries. For example, ECB surveys find that 80% of transactions in the euro area at the point of sale are still in cash. Furthermore, while full digitization might reduce illegal cash transactions, it may also open the door for new type of criminal activities. Indeed, even law-abiding citizens may have a preference for cash and could perceive its abolition as an assault on their freedom and their right of anonymity. Likewise, savers may view the abolition of cash, coupled with a negative nominal interest rate on deposits, as a form of unfair wealth tax. That said, such attitudes can change and some societies outside the euro area are becoming increasingly cashless (eg, China and Sweden).

[14] To be sure, this upward creep may offer some advantages, such as helping to offset the effect of slowing potential on the nominal neutral rate of interest.

[15] For instance, the US BEA expanded the scope of GDP in 2013, when it added a number of categories of intangibles – such as R&D expenditures – to its estimates of business fixed investment. These changes affected the entire history of GDP estimates back to 1929, with the various definitional changes boosting the level of nominal GDP in 2012 by more than $0.5 trillion (3.4%).

[16] See, for example, Constâncio, V., 25 May 2017, "*The future of monetary policy frameworks*", Instituto superior de Economia e Gestao, Lisbon,

[17] See Buiter, W.H. (2009), "*Negative Nominal Interest Rates: Three ways to overcome the Zero lower Bound*", NBER Working Paper 15118; Rogoff, K.S. and Reinhart, C.M (2014), "*Recovery from Financial Crises: Evidence from 100 Episodes*", NBER Working Paper No. 19823; Goodfriend, M. (2016), "*The case for Unencumbering Interest Rate policy at the Zero Bound*", Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming.

… breaking with long-standing social convention

In sum, the proposal to abolish cash is radical as it would break with long-standing social convention, depriving economic agents of the ability to hold and deal with cash. Its economic logic, in contrast, follows conventional reasoning regarding the limitations of interest rate policy due to the ELB. From this perspective, it would be a radical new tool, rather than a new conceptual approach to monetary policy. Given this radical nature, , an important final concern about eliminating cash would be financial stability. Many argue that interest rates close to zero have significantly driven up prices for real assets, raising concerns about asset price bubbles and excessive leverage. The ability to maintain very negative interest rates for extended periods would only deepen these concerns.

Accepting low inflation — reassessing the threat of deflation

Whether proposing new tools, adjustment in targets or even abolishing cash, all these attempts aim ultimately at reviving inflation. Having inflation rates back at around 2% is part of a superior economic outcome, as it helps to achieve employment mandates and reduces the threat of deflation. It assumes that the negative side effects of the measures taken to reach the 2% level again can be contained through prudential policies.

Aggressively pursuing an unattainable 2% target could fuel financial bubbles…

However, this assumption that these side effects can be contained is open to challenge. Concerns about the potential influence of persistently accommodative monetary policy on financial cycles and stability are behind a fundamentally different school of thought which advocates that central banks accept the reality of low inflation.

Underlying inflation appears to be gradually trending lower over recent decades – arguably reflecting many of the same structural influences that are weighing on neutral interest rates: demographics, globalisation and technology. These structural influences are largely beyond the influence of monetary policy. If trend inflation rate is, in fact, below 2%, persistent attempts to reach 2% inflation targets may require monetary policy to continuously adopt an accommodative stance to stimulate demand. Such accommodation could fuel financial cycles, driving unsustainable increases in credit and asset prices. Although prudential regulations can lean against these pressures, they may be unable to prevent them. If and when asset price bubbles burst, the deflationary impact could be significant, likely stronger than the disinflation that would occur during periods of slow growth and/or supply-driven price reductions.[18]

… and bursting asset bubbles could create worse deflation scenarios…

In other words, stubbornly aiming at an unattainable inflation target could ultimately result in what the policy is aiming to avoid: deflation. Deflation is feared because of its adverse effect on economic activity, even though this link may vary over time, depending on circumstances. In principle, deflation undermines the economy's ability to adjust to adverse demand disturbances because of various *nominal rigidities*: the key ones are the ELB, nominal wage rigidities, and the possibility of debt deflation. When these rigidities are present, inflation can help ease adjustments to adverse economic shocks. For example, if nominal wages cannot be reduced, letting inflation erode wages' real value can hasten the process of labor market adjustment, while unexpected inflation can reduce the real burden of debt servicing. The presence of such rigidities poses an asymmetric risk to economic stability. In an extreme case, an economy could become stuck in a 'deflationary trap', where the ELB prevents real interest rates from falling enough to push the economy back to full employment, and the deflationary impetus from nominally denominated debt and other nominal distortions becomes self-reinforcing.

[18] See "*Monetary policy in the grip of a pincer movement*", Claudio Borio *et al*., BIS Working Papers, No. 706, March 2018.

Box 2: Lessons from Japan's experience

Bursting asset bubble ends in deflation

In a number of ways Japan lends itself as a reference to the broader situation across advanced economies today. Following a boom period from 1986-1991, during which real estate and stock market prices soared massively, Japan's asset price bubble burst in 1992 and the country entered into what many dubbed the 'Lost Decade' of economic stagnation. Non-performing assets accumulated, productivity growth slowed, and, notably, consumer price inflation started to steadily decline. Japan's potential growth rate is estimated to have declined from around 4 percent in the early 1990s to around 1 percent in the late 1990s. the CPI finally slid into deflation in the late 1990s, where, with brief exceptions, it stayed for 15 years. The BoJ's response to this deflation dynamic has been an issue of debate. Critics argue that the BoJ's hesitance to ease monetary conditions more decisively, and its premature exit from such measures after it finally acted, contributed to the dynamic, largely by allowing for inflation expectations to permanently shift downward.

Central bank commitments must be credible to shape expectations

With core inflation dropping into negative territory, in 1999, the BoJ introduced the zero interest rate policy (ZIRP), in which the uncollateralized overnight call rate was guided to virtually 0 percent. In 2001, QE was introduced, increasing the monetary base. While these steps no longer appear extraordinary in today's context, they were path-breaking policy steps at the time. Importantly, the BoJ took them isolation rather than in the wake of a global phenomenon like the GFC, where central banks pretty much all moved together into 'unorthodoxy.' Indeed, the idiosyncratic nature of these actions may also have caused the BoJ to act too hesitantly, failing to convey the strong commitment needed to give its policies necessary credibility. Paul Krugman opined in 1999 "while the Bank of Japan has actually been engaging in some quite unconventional monetary operations…, it is doing so in a surreptitious, almost shamefaced manner, and therefore not creating the sort of 'credible promise to be irresponsible' that I argued was necessary."

Indeed, after entering ZIRP in February 1999 the BoJ withdrew from the policy in August 2000, when inflation was still negative. At the time, the BoJ stated that, "the downward pressure on prices stemming from weak demand has markedly receded". Instead of considering whether the exit was premature, BoJ communication almost apologetically tried to explain why it had maintained ZIRPs for so long. Sure enough, deflationary pressures soon returned and just six months later the BoJ reversed course and returned to ZIRP in Q1 2001. This was also the first instance the BoJ embarked on a course of QE, with the official objective to "continue until the consumer price index… registers stably a zero percent or an increase year on year." The initial asset-purchase program was later expanded and the BoJ also engaged in unsterilized FX intervention. However, in March 2006, when inflation had recorded just four consecutive months of non-negative readings QE was ended. Soon after, in July 2006, the BoJ raised the policy rate above zero. Subsequently, inflation did climb to over 2% in Q4 08, but by Q2 09 it had slumped back into negative territory.

The withdrawal from QE in 2006 may be more difficult to qualify as a 'policy mistake', given that the BoJ was certainly not alone in not foreseeing the events of 2008/9, which also drove Japan back into deflation. However, the story of Japan's monetary policy response reiterates how crucial it is for any commitment to be credible, which requires persistent policy actions. Indeed, the ECB seemingly committed similar mistakes in 2008 and 2011, when it prematurely hiked rates, which it corrected subsequently through forceful policy measures and communication. Another lesson from Japan is how difficult it is to significantly raise inflation expectations once economic agents have experienced deflation for a prolonged period.

Demography matters and no inflation does not have to mean no growth

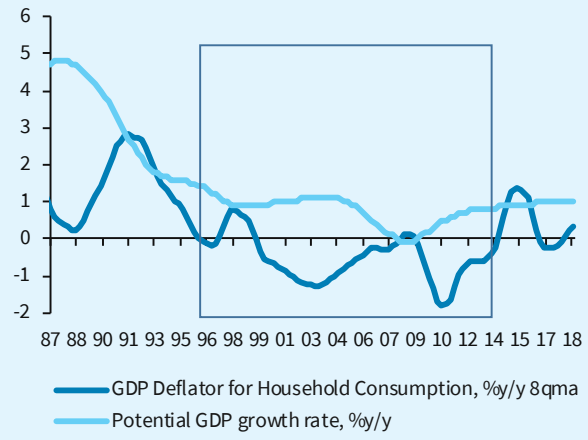
That said, it would also be misleading to explain Japan's experience as pure consequence of a monetary policy mistake. Important other factors played a role, notably Japan's demographic situation. Japan's population decline and aging is progressing at a faster pace than in other major economies. The effect of such demographic shifts on macroeconomic variables such as in potential growth, r*, and inflation has been well documented in research, and it should therefore be no surprise that Japan has been particularly affected.

However, Japan may still also serve as a lesson that periods of low inflation and/or mild deflation may not necessarily result in economic misery. In spite of continued below-target inflation over the past ten years, Japan's economy is experiencing its longest post-war expansion, unemployment has dropped to record lows, and, importantly, per capital GDP growth has been stronger than in the US, the euro area, UK and Canada. Looking back over the last 30 years, Japan's average per capita GDP

growth rate was in line with that of the other advanced economies: it was much higher than others in its pre-deflationary period (ie, pre-1997), much below others during the period when deflation took hold (ie, post-1997), but has again outperformed others since the GFC. This could lend support to the argument that highly advanced but rapidly ageing economies may be just fine with below 2% inflation, as long as conditions do not descend into a deflationary trap.

FIGURE 28

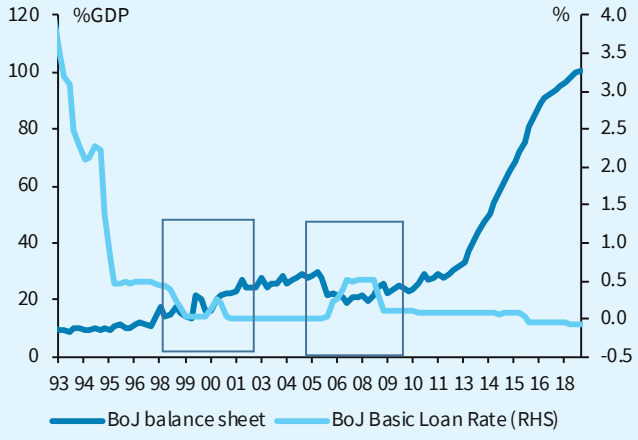
After the crisis, growth slowed and deflation followed



Source: CAO, Haver Analytics, Barclays Research

FIGURE 29

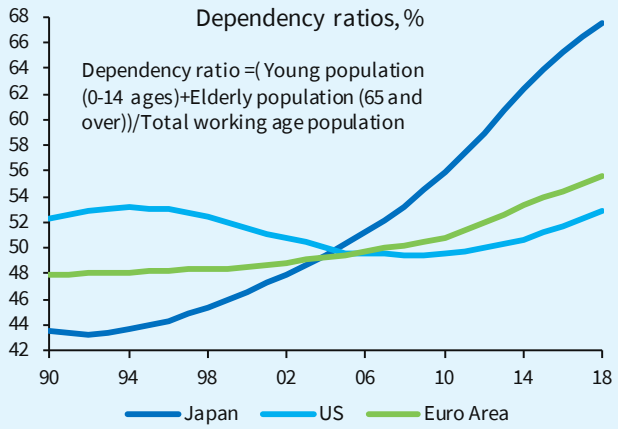
The BoJ acted, but at times hesitated and exited prematurely



Source: BoJ, Haver Analytics, Barclays Research

FIGURE 30

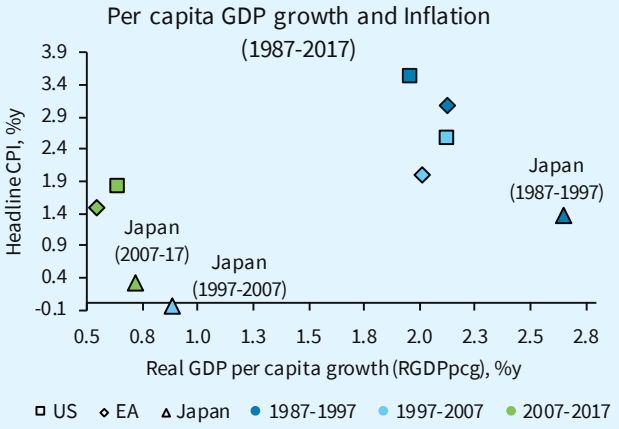
Japan's demographic transition is extremer than elsewhere



Source: UN, Haver Analytics, Barclays Research

FIGURE 31

Japan's per capita growth has not underperformed



Source: World Bank, BLS, EABCN, MIC, OECD, Haver Analytics, Barclays Research

… than a mild deflation during a downturn in a low-growth environment

While this is a well-established argument, some of its assumptions may hold less weight today. For example, labour markets seem to have become more flexible, with wage-price Phillips curves not only flatter but also allowing nominal wage growth to fall below zero. Moreover, there is a case to be made that deflation is less disruptive if driven by positive supply side shocks (eg, productivity improvements) in an environment of constrained demand, rather than by adverse demand shocks. Indeed, empirical work on inflationary periods during history and across countries suggests that many deflationary episodes have been rather benign, with temporary and relatively mild price declines.[19] In fact, one could

[19] See "*Back to the future? Assessing the deflation record*", Claudio Borio and Andrew J. Filardo, BIS Working Papers, No. 152, March 2004.

point out that Japan — despite being commonly cited as an example of dysfunctional monetary policy, with CPI inflation having persistently run at (often negative) rates well below those of the US since the mid-1990s — has still managed to achieve the same per capita real GDP growth as the US over the past 30 years.

In sum, these arguments challenge the increased 'policy activism' of other proposals, advocating that central banks simply accept lower inflation rather than fight against it. In practical terms, this could imply tolerating a wider band of inflation outcomes (eg, between 1-3%) or simply a de facto negligence of the 2% target. Even though this would likely imply hitting the ELB with greater frequency, this would be gauged against the threat of potentially more destructive scenarios from pursuing an unattainably high inflation target, such as financial instability and self-reinforcing deflationary spirals.

Debt monetization — 'Modern Monetary Theory' and 'helicopter money'

While conventional theory suggests fiscal policy should complement monetary policy…

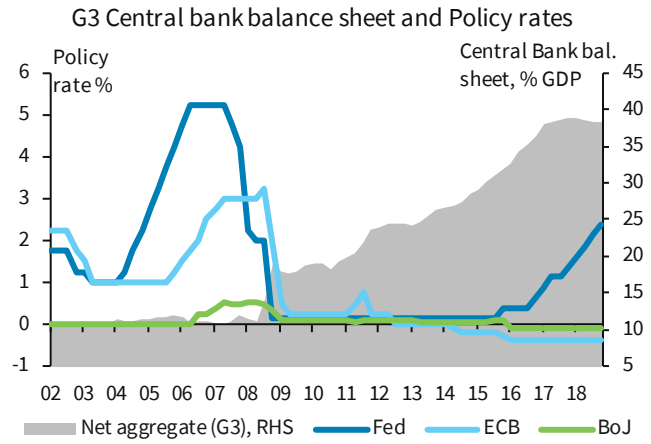
Other concepts agree with the limited effectiveness of monetary policy, but are less concerned over financial stability concerns. Instead, they point to the need for more active fiscal policy in combination with monetary easing. At first sight, this does not seem new, as monetary policymakers have long argued for fiscal policy to share more of the burden of stabilizing the economy. In particular, when policy rates are pinned at the lower bound, theory suggests that fiscal expansion should be especially effective at boosting growth and employment.[20] Demanding a policy mix with active counter-cyclical fiscal policy seems therefore uncontroversial. However, the approach advocated by Modern Monetary Theory (MMT) is more radical, arguing that central banks should defer economic stabilisation fully to fiscal policy, eschewing other objectives apart from funding the government.

…monetization of debt has historically led to out-of-control inflation

More specifically, MMT essentially argues that governments should take an active role in manipulating fiscal policy to keep macroeconomic activity near potential levels. This fiscal policy would exploit a wide range of policy levers that influence overall demand, including spending, taxation, credit policy, and regulations. The unorthodox twist is that the government would actively use *debt monetization* as its primary funding source, thereby delegating taxation to a secondary role. One way to envision how this would work is to think of a case where the central bank monetises government debt beyond the point where financial markets are in a liquidity trap, with nominal interest rates pinned near zero.

FIGURE 32

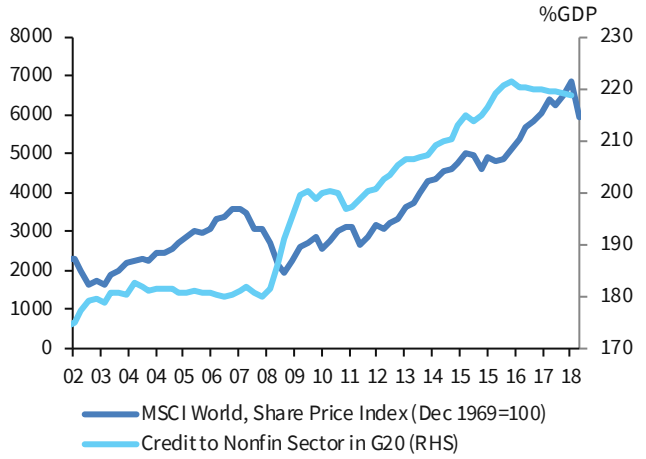
Aggressive monetary easing in core economies…



Source: BoJ, FRB, ECB, Haver Analytics, Barclays Research

FIGURE 33

… boosts credit growth and asset prices globally



Source: MSCI, BIS, Haver Analytics, Barclays Research

[20] For example, see "The Economic Recovery and Economic Policy", Speech by Chairman Ben Bernanke at the Economic Club of New York, New York, NY, November 20, 2012.

Could central banks just print money to finance governments, while fiscal policy manages demand?

In one aspect, this mechanism is already exploited though QE, where the central bank purchases government securities to expand its balance sheet, and, while it holds these bonds, returns profits to the government. The difference is, however, that the QE debt on the bank's balance sheet is not rolled over but has to be repaid by the government when it matures. Hence, the debt is only temporarily 'monetized'. In contrast, MMT represents permanent monetization, with the central bank effectively rolling over its bond holdings in perpetuity. From this perspective, 'helicopter money' could be seen as a special case of MMT. Different from mere QE, the government debt would actually be monetized, but the monetization by helicopter would be a one-off measure to escape a liquidity trap.

The pivotal question is whether monetizing debt in this way would be inflationary. Under ordinary conditions, this would not be controversial. Following the standard chain of macroeconomic logic, expanding the balance sheet would tend to boost the money supply, which, under normal conditions, would reduce real interest rates below neutral levels, thereby contributing to an overshoot of aggregate demand relative to potential output that feeds through to higher inflation. Indeed, history is replete with episodes that seemingly establish the inflationary nature of debt monetization, including Germany's experience of hyperinflation in the aftermath of WWI, the experience of Zimbabwe in the late 1990s, and Venezuela's recent experience with runaway inflation.

Helicopter money could work…

In the case of 'helicopter money', proponents would argue that such inflationary risks are limited due to the one-off nature of the measure, as the helicopter would 'land' and the printing press stop as soon as the liquidity trap is overcome. In contrast, MMT aims to sever the link between debt monetization and inflation through a very active fiscal policy, which would keep activity at a maximum, non-inflationary level. When private demand is weak, stabilizers would kick in automatically: eg, MMT proponents suggest a government commitment to temporarily hire unemployed workers (at a low reservation wage) to provide public goods. Equally, when output is set to run above potential, the government would have to withdraw demand though countercyclical discretionary measures, such as raising taxes and reducing spending.

… but would the helicopter land again in time?

Although perhaps possible in theory, MMT's implementation raises a host of doubts: first, governments simply do not seem well equipped to enact timely countercyclical measures that would be needed to forestall inflationary pressures. They would not only need to have extremely good forward looking models of the economy, but also extremely efficient administrative processes, to implement the appropriate countercyclical fiscal measures in time. Even proponents would concede that governments have a poor track record in fine-tuning demand in this way.

Political economy concerns paramount

Importantly, the *political economy* dimension of countercyclical fiscal policy also raises concerns over *time inconsistency*: With the burden of funding constraints seemingly lifted, governments would likely find it politically difficult to enact countercyclical policies when the economy is booming. Such concerns weigh very heavily against MMT, as the theory rests on the government's ability and willingness to effectively carry out not only fiscal loosening but also tightening when the private economy is running hot. If it fails in the latter, the ongoing debt monetization could radically unmoor inflation, leading to large and abrupt jumps in expectations. In the case of 'helicopter money' proposals, the concerns may be reduced somewhat by its intended one-off nature, but the political economy concerns would still apply.

Expectations could adjust very abruptly and drastically

One could see MMT and the special case of 'helicopter money' as opportunistic responses to the various conditions that have proved so challenging to monetary policy: (1) the very shallow Phillips curve, with relatively well-anchored inflation expectations; (2) low neutral interest rates; and (3) the elevated probability of ELB outcomes. All of these conditions seemingly challenge the chain of logic linking debt monetization with inflation. Even though

central banks have dramatically expanded their balance sheets since the GFC, effects on standard measures of the money supply (such as M1 or M2) have not been proportionate. This is because private banks have substantially increased reserve holdings for a variety of reasons, including new regulations that encourage liquid reserves, the shift to paying interest on excess reserves, and the close substitutability between currency and interest-bearing assets at the ELB. Even though the increased money supply has helped to push down interest rates at various horizons, this has often proven insufficient to generate inflationary conditions given weakness in demand from other structural influences. Finally, in the few cases when aggregate demand has been boosted to levels in excess of potential — as in the US — the inflationary response has been subdued.

In sum, if disinflationary pressures persist in spite of the dramatic bank balance expansion of the past, fears that various forms of debt monetization will rekindle inflation could start to fade. Radical conceptual changes as proposed by MMT still seem very unlikely to be seriously considered. However, more limited proposals such 'helicopter money', as one-off policy measures to overcome a liquidity trap episode, may no longer be as remote as they would have seemed in the past.

Conclusion: Not the 'end of history'

IT has reached the life-span of previous dominant regimes …

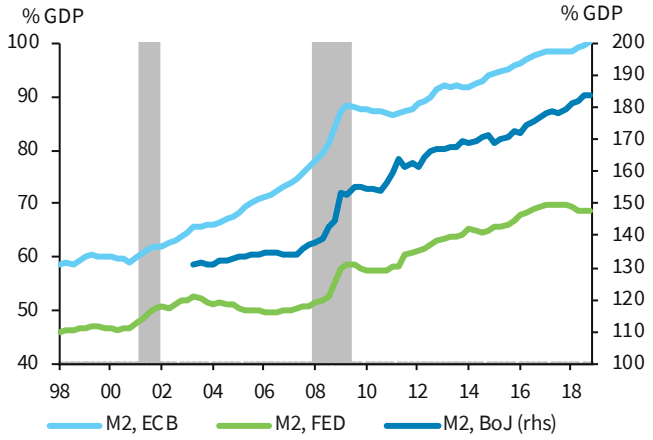
Monetary policy has undergone many changes in history. Even if IT's sophistication and great initial success created the sense of an "end of history" moment for monetary policy, the framework is coming increasingly under pressure as it approaches its 30th birthday. Coincidentally, this has been roughly the life-span of previous monetary regimes that dominated a certain period: the Gold Standard (1870s-1914) and the Bretton Woods fixed exchange rate system (1948-1973). In between such periods, monetary policy typically became more experimental and more diverse. Once again, we may have entered such a new phase in monetary policy.

… which were typically followed by more experimental and volatile periods

The challenge for monetary policy has turned from the need to reduce high inflation to preventing inflation from becoming too low in the face of secular trends that are weighing on inflation and neutral interest rates. The unorthodox policy tools with their many acronyms — QE, NIRP, FG, YCC — introduced in response to the GFC are well on their way to becoming orthodox. But as IT regimes struggle to meet inflation targets, alternative goals — higher inflation, price levels or average inflation, nominal GDP — have started to be discussed. None seems necessarily superior when weighing their pros and cons, especially when considering the additional obstacles of their implementation in practice. It seems

FIGURE 34

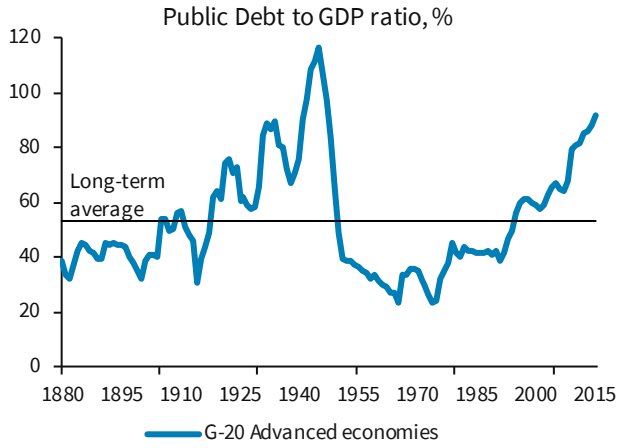
QE's effect on the money supply has been muted



Source: FRB, ECB, BoJ, Haver Analytics, Barclays Research

FIGURE 35

High public debt raise concerns about more fiscal expansion



Source: FRB, ECB, BoJ, Haver Analytics, Barclays Research

likely that rather than formally moving away from IT strategies, central banks will either become more tolerant of inflation that stays below target (BoJ, ECB) or adopt frameworks along the lines of average inflation targeting, seeking to achieve more symmetric outcomes. Hence, policymakers would at least aim for inflation somewhat above 2% (Fed) after long periods of undershooting.

'Unorthodox' policy tools must now be considered standard

However, when the next economic downturn inevitably arrives, simply re-engaging existing non-traditional tools (such as QE) could no longer be enough, and fiscal stimulus may well have to play a larger role. Concerns about public-debt sustainability, combined with the fact that past QE has generally been unable to lift inflation rates back to targets, could increase demands to consider monetising fiscal expansions.

Move towards average inflation targets could be next

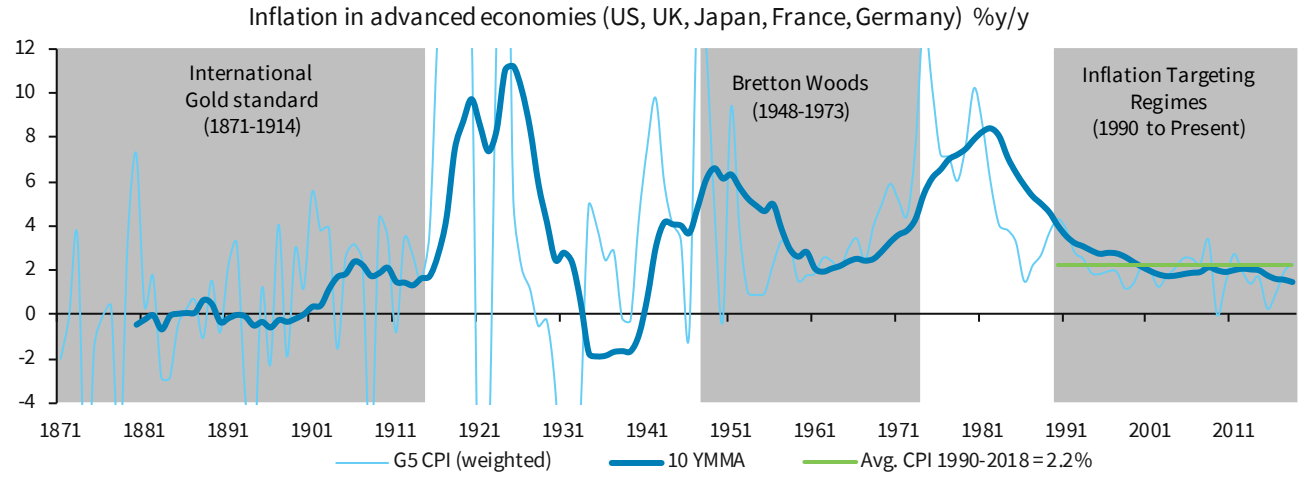
While the radical ideas of Modern Monetary Theory seem very unrealistic, some forms of helicopter money could eventually be considered. The true challenge to these concepts are not theoretical flaws in the effectiveness of their mechanisms but rather human nature: once initiated, it is not hard to imagine how such seemingly "free" spending power could become addictive to political decision takers. Thus there are risks that when "liquidity traps" are eventually overcome and the link between monetary expansion and inflation re-established, expectations could become unanchored.

But a more pronounced downturn could bring more radical concepts to the fore

For investors, in particular those buying debt, this creates a future with fatter tails. While inactive monetary policy creates the risk of deflationary scenarios with ever increasing nominal debt burdens, aggressive experiments that blur the boundaries of fiscal and monetary policy could eventually result in sudden and sharp upward adjustments in inflationary expectations, with related swings in risk premia, and exchange rates.

FIGURE 36

Inflation targeting is unlikely the end of monetary history. Notably, periods of dominant policy regimes were typically followed by periods when monetary policy became more diverse and experimental—and typically also higher inflation.



Source: Jordà-Schularick-Taylor Macrohistory Database, Haver Analytics, Barclays Research

CHAPTER 3

Rethinking Emerging Markets: Fables of the Reconstruction

Marvin Barth*
+44 20 3134 3355
marvin.barth@barclays.com
Barclays, UK

Nikolaos Sgouropoulos*
+44 20 3555 1578
nikolaos.sgouropoulos@barclays.com
Barclays, UK

Marek Raczko*
+44 20 3134 0089
marek.raczko@barclays.com
Barclays, UK

Wen Yan*
+44 20 3134 0379
wen.yan@barclays.com
Barclays, UK

This author is a debt research analyst in the Fixed Income, Currencies and Commodities Research department and is neither an equity analyst nor subject to all of the independence and disclosure standards applicable to analysts who produce retail debt research reports under US FINRA Rule 2242.

Contrary to conventional wisdom, we expect a trend relative decline of EM asset prices and exchange rates over a multi-year horizon as technological progress flips from supporting faster EM growth through globalisation to undermining it. The silver lining for unbenchmarked EM managers is that dispersion and volatility likely will increase.

Our primary findings

- **We expect the trend relative decline in EM asset prices and exchange rates that began in 2010-12 to continue and find evidence that it may be less than halfway to its endpoint. EM equities may have a further 70pp of underperformance relative to DM, and EM currencies could have a downside of up to 15pp in real terms if the 1990s offer an example.**
- **Our thesis for trend underperformance of EM rests on a shift in the effects of technological progress from encouraging globalisation to incentivising 'localisation' of production back in major economies to the detriment of EM aggregate and per capita growth.**
- **We illustrate here that this thesis is not just speculation: it is apparent in the data for investment, foreign direct investment and relative DM expenditure on manufactured goods already, to say nothing of the multi-year underperformance of EM asset markets.**
- **Further, we present evidence that these effects may be leading to a degradation of EM institutions that has the potential to create a 'vicious' downward spiral in some EM economies.**
- **Yet we also see the potential for major exceptions within EM and increasing dispersion that will benefit absolute return EM managers, even as benchmarked EM managers suffer from the trend relative decline of their asset class.**

Fables of the reconstruction

We challenge the conventional wisdom that EM 'are where the growth and returns' are in the future, as technological progress undermines its foundations

Conventional wisdom holds that emerging markets (EM) are where the returns are to be found in the future: their (larger) populations grow faster and their expected convergence to developed markets (DM) in both capital-to-labour ratio and total factor productivity imply sustained higher growth rates, especially compared to developed markets that are mired in 'secular stagnation'. We submit that every aspect of this thesis is challenged, to varying degrees, and that a broad rethink of the relative merits of long-term investment in EM is necessary. (It is beyond our scope here, but recent US and Japanese growth challenge too the notion that DM still are 'stagnant'.) A more realistic assessment of EM, that accounts both for actual demography and a change in the effects of technological progress, implies that the trend underperformance of EM assets and currencies that began in 2013 is set to continue over a multi-year horizon and may be less than halfway to its relative nadir.

In two prior pieces ('Rethinking Emerging Markets' parts 1 and 2) we presented the main contours of the thesis: the EM growth model is broken and equities will be more affected than fixed income

In *Rethinking Emerging Markets – Part 1: Reckoning*, 27 September 2018 (REM1) we laid out the contours of our thesis: the two main EM growth models are broken. Commodity exporters face a long-run downtrend in real commodity prices now that the commodity 'super cycle' is over; and more importantly, technological progress, once a facilitator of globalised supply chains, now challenges EM manufacturers' climb up the value-added ladder and productivity growth. In *Rethinking Emerging Markets – Part 2: Re-positioning*, 6 December 2018 (REM2), we illustrated how these effects likely will be more pronounced in equity performance than in fixed income and perhaps FX.

Here, we demonstrate our thesis is not mere speculation but already underway and visible in the data

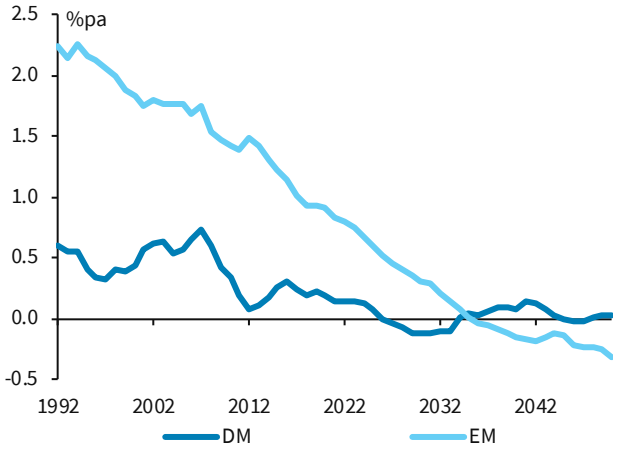
Here, we demonstrate that our thesis is not mere speculation on the future of EM but a *reality today*. We present evidence that challenges each aspect of the conventional wisdom of long-term EM outperformance and illustrates that the technology-driven shifts in globalisation that we postulated already are underway to the advantage of DM asset prices and exchange rates over EM. Indeed, we document that these economic trends – investment and consumption reorienting towards DM, downward convergence of EM total GDP, per capita GDP and total factor productivity (TFP) growth to DM growth rates – and the relative decline of EM asset prices and FX are apparent in the data from at least mid-decade. Even the remaining advantage of EM, population growth, is both declining and, in those countries where it continues, of questionable advantage in an increasingly 'knowledge economy' given much lower levels of human capital. Given broad acceptance of the end of the 'super cycle' and its effects on commodity producers, we will concentrate here on the challenge that non-commodity producers in EM face, but many of our findings apply equally to the former.

We extend the thesis to incorporate the knock-on effects to institutions that likely will challenge EM fixed income and FX, too

Extending our thesis, in a way that applies equally to commodity and non-commodity producers in EM, we examine how these changes may create a 'vicious' self-reinforcing cycle, noting some recent EM examples, that more broadly affect political economy and institutions, in ways that likely will both increase the relative risks of investing in EM and reduce absolute returns. These effects may challenge risk-adjusted EM fixed income and FX returns as much as those in equities.

FIGURE 1

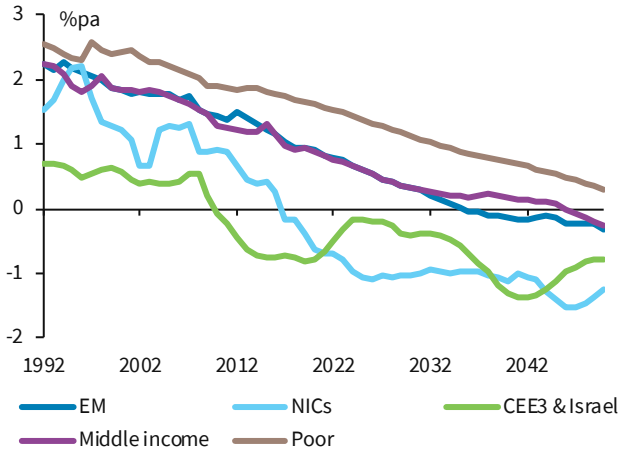
Median working-age population growth rates, actual and projected, 1992-2050



Note: Working age is defined as 15 to 64 years old.
Source: US Census Bureau

FIGURE 2

Median working-age population growth rates, actual and projected, selected EM groupings, 1992-2050



Note: Newly Industrialised Countries (NICs): Hong Kong, Korea, Singapore and Taiwan; Middle income: Argentina, Brazil, Chile, Colombia, Malaysia, Mexico, Thailand, Turkey, and South Africa; Poor: Egypt, India, Indonesia, Pakistan, Peru, and Philippines. Source: US Census Bureau

We use the Solow growth model as a framework for analysis, show the predicted effects already are in the data and asset returns, benchmark the potential downside, and highlight economies that may be exceptions to the thesis

We start by analysing the foundations of the conventional wisdom of long-run EM outperformance through the lens of the Solow growth model and find them less sound than assumed. We then document how globalisation patterns already have turned in a manner that is both consistent with our technology-driven thesis and disadvantageous to EM economies' convergence with DM. Next, we consider the important role of institutions in EM economic development and how they may create a self-reinforcing feedback loop with foreign investment that exacerbates the EM-DM differences. We explicitly connect these shifts both to EM asset prices and exchange rates and benchmark the potential downside for both. Finally, we examine the characteristics of EM economies that may lead some to be exceptions to the trend of underperformance relative to DM, highlighting the second major implication of our REM thesis: increasing dispersion is likely.

Eponymous: Rethinking long-run EM outperformance

EM outperformance is expected to stem from more rapid population growth and convergence to DM in human and physical capital, and total factor productivity

The conventional wisdom of long-term EM outperformance is based on two pillars: 1) that more rapid population growth and assumed convergence to DM levels of productivity imply sustainably higher economic growth in EM; and 2) that higher *aggregate* economic growth implies higher EM assets returns. Yet, even the starting point, more rapid EM population growth, is untrue for key EM countries and of questionable benefit to others in a 'knowledge-based' economy. Subsequent sections of this report will show that convergence with DM productivity is far from given. Further, the connection between economic growth and asset price performance is not straightforward: it is possible, and even likely for some EM, that their economies grow faster than DM but their asset prices underperform.

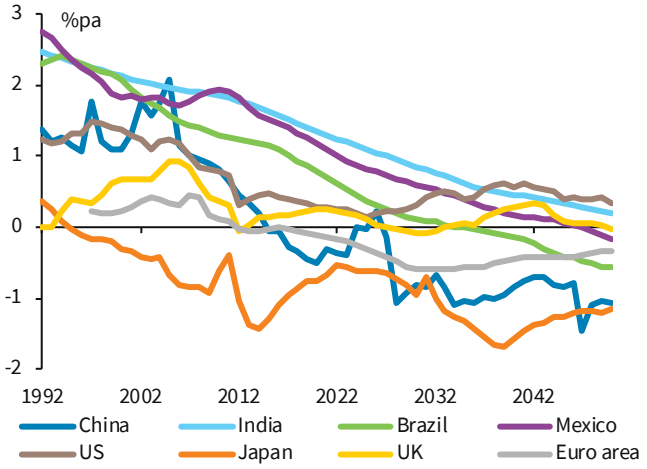
Driver: Solow growth model accounting for expected EM outperformance

This follows directly from the Solow growth model that breaks income growth into its component parts

The first pillar of faster trend growth in EM comes from the arithmetic of the Solow growth model.[1] Production of economic output (Y, or GDP) is divided into its component parts: labour input (L, the number and hours of workers), the capital (K, machines) available to those workers, how skilled the workers are (H, education or human capital), and 'total factor productivity' (TFP, or the application of technology and organizational management in using the three other parts most efficiently). Thus, contributions to *trend*, or *potential* economic growth can be expressed mathematically as:

FIGURE 3

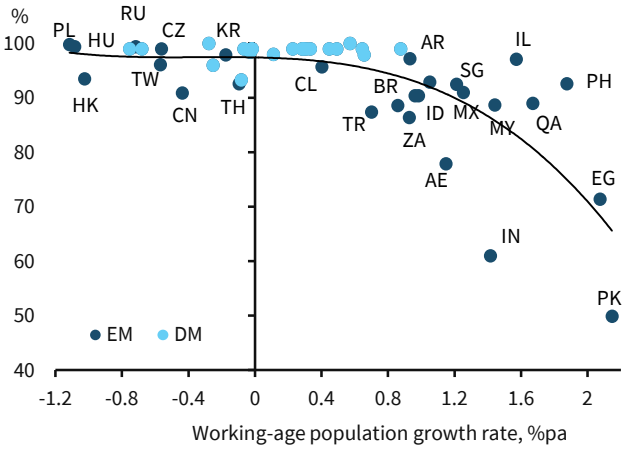
Median working-age population growth rates, actual and projected, selected large economies, 1992-2050



Source: US Census Bureau

FIGURE 4

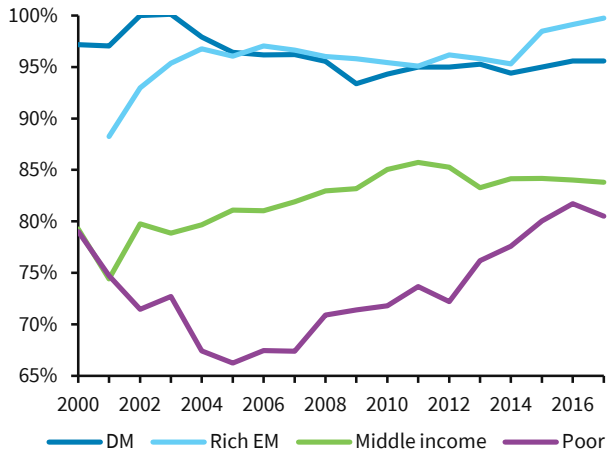
Adult literacy rates vs working age population growth rates



Source: US Census Bureau, CIA Factbook

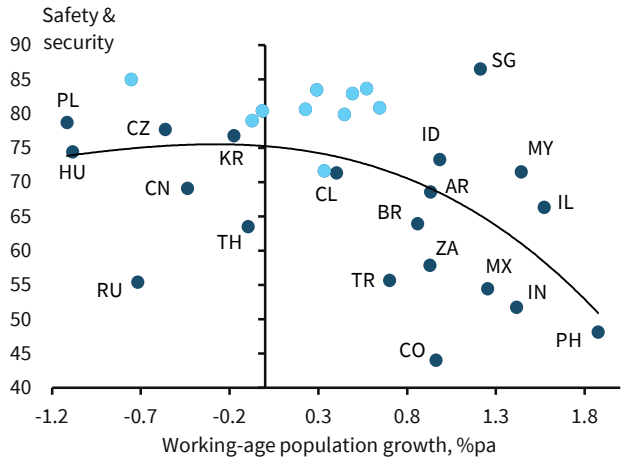
[1] Solow, Robert M. "A contribution to the theory of economic growth." *The Quarterly Journal of Economics* 70.1 (1956): 65-94.

FIGURE 5
Lower secondary education completion rates, selected country groupings



Source: World Bank

FIGURE 6
Safety and security vs working age population growth rates



Source: US Census Bureau, Legatum Prosperity Institute

$$\Delta Y = \Delta TFP + \alpha * \Delta K + \beta * \Delta L + \gamma * \Delta H^2$$

These components highlight the potential for EM outperformance, as each is expected to grow faster in EM

This breakdown makes clear the expected outperformance of EM growth relative to DM: EM populations are (assumed) to grow faster (higher ΔL), and convergence to DM in both education and physical capital per capita imply, at least theoretically, higher contributions to growth from ΔH and ΔK than DM, and as EM adopt more sophisticated technologies and management techniques from richer economies their TFP, too, should grow faster.

Discover: Do the data support the conventional wisdom?

Yet, even assumed faster growth of populations in EM is not necessarily true; only some EM economies are expected to outpace DM population growth

The first problem with the conventional wisdom, albeit the one we will spend the least time on, is that it no longer is clearly the case that EM populations are growing faster than in DM. Figure 1 plots median working-age population growth rates for DM and EM from 1992 and projected through 2050. The EM population growth advantage already has fallen to 0.7pp, just 40% of its 1996 peak of 1.8pp. Looking into the future, beyond 2035, the median DM population growth actually *outpaces* the median EM country, whose working age populations begin to shrink.

There are significant differences within EM; only the poorest are expected to retain faster population growth

However, Figure 1 masks significant divergence in growth rates among countries. Figure 2 presents the working-age population growth in EM by stage of development. The richer, more industrialised EM economies in EMEA and East Asia ('Newly Industrialised Countries') already have shrinking working-age populations, a trend that is expected to accelerate. Only middle income – countries with PPP-adjusted per capital incomes between $13,000 and $25,000 (2011 USD) – and the poorest EM countries retain positive (but falling) population growth for the next few decades.

[2] The coefficients on ΔK, ΔL and ΔH, α, β and γ generally are assumed to sum to 1 to preserve constant returns to scale, though some model allow for increasing returns to scale from human capital, while others assume β = γ = 1- α.

Population growth in the US and UK is expected to accelerate in the next decade, where among key EMs, only India sees sustained population growth in coming decades

Figure 3 compares the divergence in growth rates between four large EM economies and the four largest developed economies. While Japan and the euro area have well known shrinking future populations, both the US and UK retain increasing workforces through 2050 and their rates of growth even are projected to pick up in the next decade. Indeed, the US working-age population is expected to grow faster than any of the plotted countries beyond 2038. Similar diversity is apparent in the four large EM: China's working-age population began to shrink in 2015 and is expected to accelerate, rivalling Japan's rate of shrinkage post-2025; Brazil's growth slows to a standstill by the middle of the next decade and turns negative in the middle of the next; Mexico's follows a similar pattern lagged by a decade, but slows below the US rate in 2033; and only India, among these EM countries, continues to see its working-age population growth above zero by 2050.

Complete Rarities: Population advantages in the 'knowledge economy'

But population growth without education may be a hindrance to growth in the growing burgeoning 'knowledge economy'

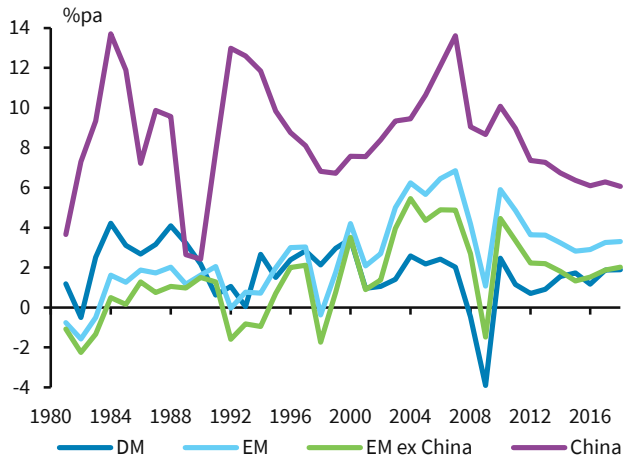
Another problem with the conventional wisdom on EM economies' population growth advantage is that it assumes all labour are equal, an assumption that increasingly is undermined by technology, the driving force of the REM thesis. Technological advancements in artificial intelligence and robotics increasingly are defining economic growth in the so-called 'knowledge economy', where human capital accumulation defines employability. The knowledge economy requires effective communication, problem-solving skills, ability to learn, and collaboration.[3] Literacy is compulsory for the first three and a safe, secure society is required for the last.

Yet, those EM countries with the fastest population growth appear the worst prepared to enter the knowledge economy

On these bases, the fastest-growing populations within EM appear unprepared to participate in a knowledge economy. Figure 4 charts, for both DM and EM, working-age population growth rates versus adult literacy rates by country. The fastest-growing economies generally have the lowest literacy rates. The outlook for their future does not appear significantly better, unfortunately. While the poorest EM countries have improved their secondary education rates in recent years, they have converged only to middle income rates that plateaued nearly a decade ago at levels well below the more advanced EM economies and DM (Figure 5). Further, as illustrated by Figure 6, the countries with the fastest-growing populations also tend to have lower levels of personal safety and security, conditions that are conducive to and likely necessary for the complex collaboration required in the knowledge economy.

FIGURE 7

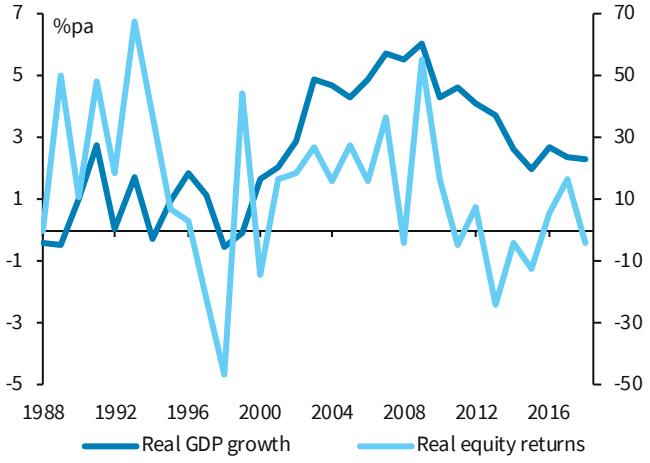
Real per capita GDP growth (PPP-adjusted) by group



Source: IMF WEO

FIGURE 8

EM minus DM real growth and equity returns



Source: Bloomberg, IMF WEO, MSCI

[3] Beatriz Pont and Patrick Werquin, "Competencies for the Knowledge Economy", in *Education Policy Analysis*, Chapter 4, OECD 2001.

Rising populations with slower capital and TFP growth imply lower per capita income growth that may become self-reinforcing

As we expand upon below, inability to participate in the modern knowledge economy also likely will impair EM capital accumulation and TFP growth. The combination implies slower per capita income growth, which for EM economies excluding China already has slowed to DM rates (Figure 7). Further slowing has the potential to create a self-reinforcing trend in these economies as lower per capita incomes likely will put pressure on education funding and on the institutions that support accumulation of both human and physical capital, and TFP, as discussed below.

The Automatic Box: Connections between economic growth and asset returns

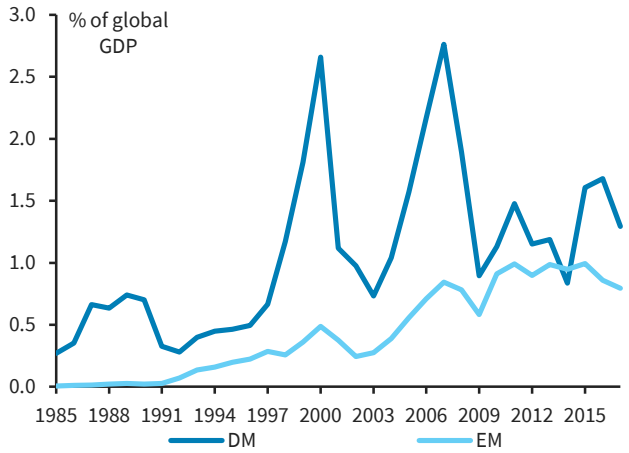
Aggregate economic growth and country-level asset returns are not as connected as assumed

Indeed, without a change in growth strategy, the trends that we document below imply a situation where EM economies may continue to grow as a share of the global economy, but still witness a decline in their shares of global asset markets. While asset returns and economic growth generally are positively *correlated*, they do not have a strong correspondence in *level*. Figure 8 presents the difference between EM and DM real growth rates and real equity returns.[4] The correlation between the two series – the difference in levels of EM and DM performance – is nearly zero and there are extended periods of high relative EM returns amid poor relative growth (the 1990s) and the reverse (the 2000s). China is an example: from 2007 to the present, Chinese equities have returned just two thirds of what the MSCI All Country World index has returned, yet its share of the global economy has grown 1.7 times; more astoundingly, Chinese aggregate share prices are down 15% since 1992 despite a staggering 17-fold increase in real Chinese output.

Aggregate growth can expand with population, but private financial securities are claims on capital and TFP, not labour

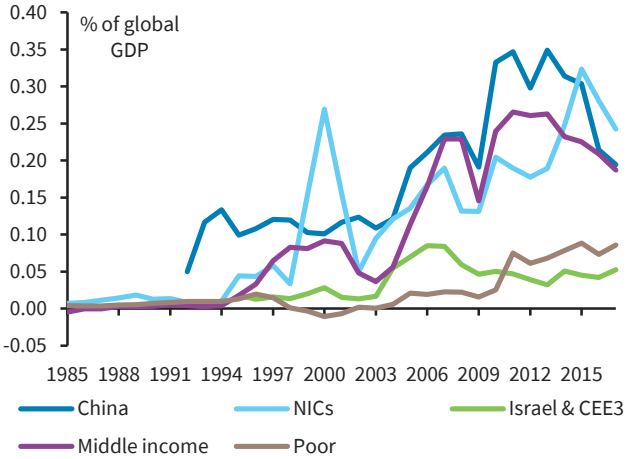
More fundamentally, the Solow growth model well illustrates how asset returns can diverge from economic growth by breaking each into their respective component sources. Financial assets generally are claims either on the earnings of private, productive entities (firms and partnerships) and real assets (equipment or infrastructure), or on taxation authority (sovereign liabilities). The former are claims on economic growth generated by *K* and *TFP* – and as we will see below, these two Solow factors are most responsible for equity returns (Figure 21) – whereas the latter can be a claim on any of the inputs to economic output but predominately falls on *L*. Thus, exposure to more rapid labour growth comes predominantly from government bonds, and to a lesser extent, the currency. Since government bonds and currency typically return – in trend – only the risk-free rate plus any country risk premium,

FIGURE 9
Inbound foreign direct investment by economy type



Source: Haver Analytics, national sources, Barclays Research

FIGURE 10
Inbound foreign direct investment by EM region



Source: Haver Analytics, national sources, Barclays Research

[4] We use equity returns alone for illustration due to their longer available data histories.

an economy with high population growth that drives higher aggregate GDP growth but little increase in either its capital-to-labour ratio or TFP is unlikely to generate higher sustained rates of return on private assets and the financial claims on them.[5]

Collapse into now: Globalisation already has changed for the worse for EM

The REM thesis implies a shift in investment and production from EM to DM, and these trends already are apparent

Recent trends in global investment and trade data suggest that the technology-driven shift in globalisation away from EM and back to DM is more than postulation: it already is afoot. The technology-driven trends that underlie the REM thesis should imply a shift in investment activity from EM to DM and an increase in DM market share in manufactured goods expenditures. These trends already are apparent in the data. Both domestic and foreign investment in EM are declining as a share of domestic income and total global investment. Developed economies also increasingly purchase manufactured goods for consumption or investment either from domestic sources or from other DM, ending a multi-decade rise in the share of DM goods consumption imported from EM. The coincidence of all three changes in trend over roughly the same period clearly suggests that 'something has changed' and fits the predictions of the REM thesis.

New Adventures in Hi-Fi: Technology turns from pro- to anti-globalisation force

Technological progress that once facilitated globalisation to the benefit of EM now threatens to reverse those gains

While technological progress was a major if not the driving force of globalisation in recent decades by enabling management of complex global supply chains and associated logistics, increasingly it undermines the incentives for those globalised supply chains in three respects: automation is cheaper, allows for more specialised local-taste production and increasingly requires collaboration that is better done locally.[6]

With automation costs increasingly falling through even the cheapest labour, extended, complex supply chains no longer are desirable

First, with automation costs for most manufacturing processes falling below that of even the cheapest labour economies, there no longer is an incentive for DM firms to outsource production away from their main demand centres or home markets. As the costs of local production through automation fall, transportation costs and the risks from disruptions to complex, extended supply chains rise in relative terms. While automation typically has higher up-front costs, not only are per hour operating costs lower than workers, but downtime due to absenteeism and worker training, pension and injury costs fall, and quality control, repeatability and system flexibility all rise.[7] Furthermore, the more expensive fixed costs of automation bias adoption to developed economies whose wealth and financial access already allow for higher capital-to-labour ratios.

Customised products encourage local production on demand where your customers are

Second, those same falling costs of automation with localised production allow for specialised production tailored to local or even individual tastes and preferences, reinforcing the incentive to produce locally. An excellent example, albeit not a 'traded' good, is the development of a hamburger robot that freshly grinds custom meat choices, cooks hamburgers to order with selected toppings and wraps for service or takeaway.[8] But, even the quintessential cheap-labour, outsourced manufacturing, athletic shoes, is seeing a return to local production in high labour-cost Germany due to the combination of technological feasibility – robotics and 3-D printing – and customer demand for immediate customization of products: Adidas now produces custom-fit shoes on the spot at selected retail stores in major markets.[9]

And automation increasingly requires centralized rather than dispersed production

Third, automation increasingly requires local collaboration. 'Robotic process automation', a business management technique based on integration of robotics into manufacturing processes generally requires workers, engineers and managers to work together, 'hands on',

[5] Specific credit and equity sectors (eg retail) may benefit disproportionately from population growth alone, but broader country-level market returns may not.
[6] 'IT future shifts from labor arbitrage to productivity,' Peter Bendor-Samuel, *CIO Magazine*, 7 February 2017.
[7] 'Cost of Manual Labour vs. Automation,' *RNA Automation*, corporate infographic, 25 January 2018.
[8] 'The Mission to Build the Ultimate Burger Bot', Laura Smiley, Wired, 21 June 2018.
[9] 'Inside Adidas' Robot-Powered, On-Demand Sneaker Factory', Anna Wiener, 29 November 2017.

collaboratively on location to design the production process, work out kinks and evolve it to meet shifting customer needs.[10] This limits the scope for outsourcing by raising its opportunity costs.

Reveal: Global investment patterns already reflecting shifts in technology

Foreign direct investment patterns already reveal a relative shift away from EM to DM

The change in incentives from globalised to localised, knowledge-intensive production already is apparent in global investment patters, with a clear shift in both foreign direct investment trends and relative DM and EM investment intensity of economic activity. Figure 9 charts foreign direct investment flows, as a share of the global total, going to DM and EM economies. FDI into EM economies grew rapidly through the 1990s and 2000s, but it began to plateau in 2011 and has been in decline since 2015. Figure 10 breaks EM FDI inflows down by income: in China and middle income EM economies, the turn in FDI was clearer and started in 2011; in EMEA it started even earlier, in 2006-07; only in the richest EM (the NICs) and the poorest has FDI continued to trend higher. Some caution is needed on the inflows into the poorest EM countries as a significant share is coming from China and may be more politically than economically motivated.[11] FDI inflows into the NICs, like those in DM (Figure 9) generally have trended higher with intermittent surges associated with peak global mergers and acquisitions cycles, illustrating that in terms of manufacturing capabilities the NICs are more like DM than EM economies.

A similar pattern is apparent in investment shares of GDP for DM and EM a shift from the latter to the former

The same shift, with roughly the same timing, also is apparent in the relative investment intensities of DM and EM economies. For roughly three decades going into the GFC, investment-to-GDP ratios in advance economies fell (Figure 11), whereas – with some notable surges and crashes, like that in East Asia in the 1990s – investment shares in EM generally trended higher over the same period (Figure 12). These trends were associated with a shift in global manufacturing capacity from DM to EM. Yet, since the GFC both trends have reversed: with the possible exception of Europe, the investment share of GDP has grown steadily in major DM economies over the past decade, while it has shrunk in nearly all EM economies.

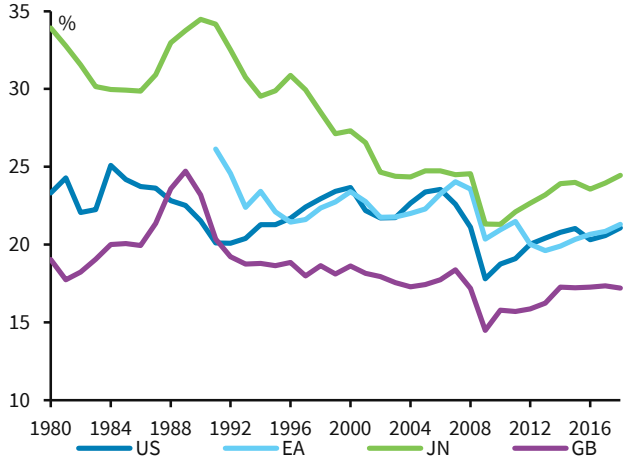
Up: DM expenditure on manufactures also reflects the shift

A switch in DM goods expenditure towards domestically produced manufactures from imports also is apparent in recent years

Coincident with the change in investment patterns, there also appears to be a shift in DM expenditure on manufactures that is consistent with a move towards local production or a change in DM preferences for goods in which DM manufacturers appear to have a comparative advantage. While the definitions differ somewhat by country, Figure 13 plots the imported share of non-commodity manufactured goods purchased, either for

FIGURE 11

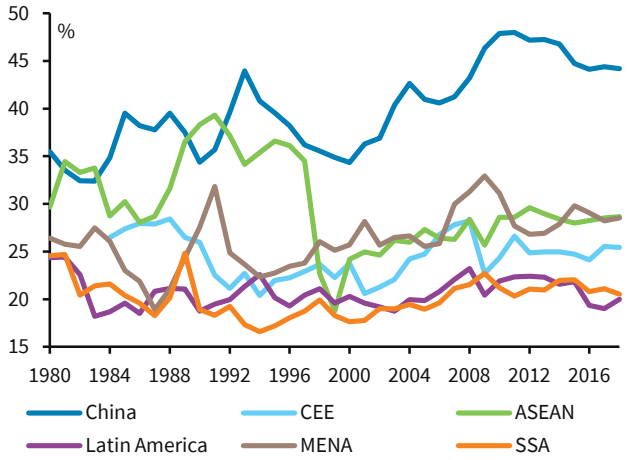
Investment share of GDP, selected DM economies



Source: IMF WEO

FIGURE 12

Investment share of GDP, selected EM regions



Source: IMF WEO

[10] 'How outsourcing companies are using Robotic Process Automation' Ignacio De Marco, ITProPortal, 27 February 2018.
[11] 'Frontier market debt at 15-year high', Steve Johnson, *Financial Times*, 9 March 2019.

consumption or as investment in machinery and equipment, for the G4 economies. The trend break since the GFC is stark for the US: prior to 2010 the import share rose steadily, accelerating around 2000; but since 2010 it has trended sharply lower with only a slight rebound in the last couple of years as the US economy has moved to a positive output gap. In the other economies a shift is less clear but visible. The import share in the UK levelled off in the 1990s; in Japan in 2013; and in the euro area it has continued to rise, though this may reflect the continued steady integration of Eastern European economies into the EU local production chain.

And EM manufacturers no longer are gaining market share in good imports

The coincident break in trend in the source of G4 goods imports is much clearer. As shown in Figure 14, two decades of steady decline in the share of imports from other DM economies – ie the expansion of EM market share in global trade – ceases in all four economies in 2010-12. Since then it has either levelled off (euro area and US) or trended slightly higher (Japan and UK), reflecting either an end to the trend of increasing EM competitiveness or a shift in DM consumer preferences towards traded goods in which DM appear to have a comparative advantage in production relative to EM.

Whether this is a shift in DM competitiveness or tastes, it bodes ill for the EM growth model

It is beyond the scope of this piece to isolate which is responsible for the change in DM consumption towards either domestic goods or those produced in other DM economies: a shift in relative competitiveness of DM vs EM, or a shift in DM consumer preferences. But it is sufficient for us to note that both are consistent with the technology driven thesis we have put forward for trend underperformance of EM asset prices and exchange rates. And most important, it is happening now.

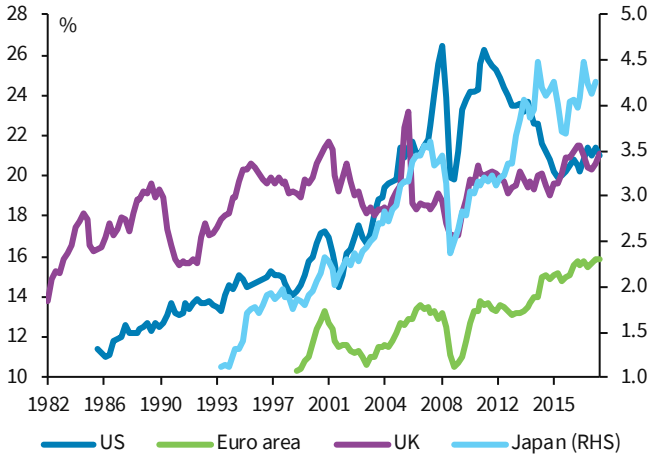
Accelerate: the role of FDI and feedback reinforcing EM-negative trends

Perhaps more worryingly, the potential for feedback between EM trend growth and institutional strength could cause a 'vicious' cycle

The trends in investment, particularly foreign investment, are the most concerning for EM as they have the potential to be self-reinforcing and they also are the ones most likely to affect EM asset prices, both directly and indirectly through political economy channels. FDI directly affects growth through both capital deepening and technology transfer that increases TFP. But it also plays a role in fostering stronger institutions and 'soft' inputs into production and asset prices like so-called 'social capital'. Because those factors also play a role in attracting FDI, the potential for a 'vicious' cycle of feedback is high and some recent examples suggest that process already has begun.

FIGURE 13

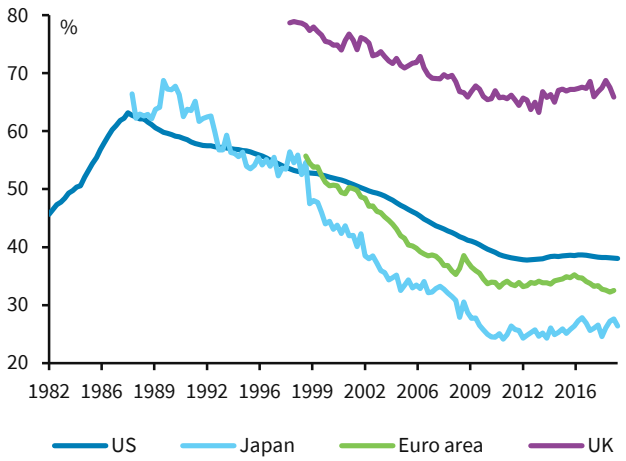
Imported share of goods expenditure for consumption and investment in equipment



Source: Haver Analytics, national sources, Barclays Research

FIGURE 14

Share of goods imports from developed markets



Source: Haver Analytics, national sources, Barclays Research

Murmur: Direct and indirect effects of FDI on EM growth rates

FDI directly affects EM growth through capital deepening; but it also can affect growth indirectly

Inbound foreign direct investment supports EM aggregate and per capita income growth both directly and, perhaps more importantly, indirectly. The direct effect is illustrated in Figure 15: by raising directly the capital stock of the recipient country. In both DM and EM economies, FDI is responsible for roughly 20% of annual total gross fixed capital accumulation, a figure that has grown significantly since the 1980s. As shown in Figure 16, there are significant differences within EM. As much as 60-90% of gross fixed capital formation in the East Asian NICs is due to FDI due to the continued rise in inbound direct investment to these economies shown in Figure 10. In most other EM economies, the share of total capital accumulation due to FDI has been gently trending lower to 10-20%, and in China the decline has been more significant, due both it its aberrantly high domestic investment rate and the trend decline in FDI that began in 2011.

FDI typically is associated with technology transfer that boosts EM TFP

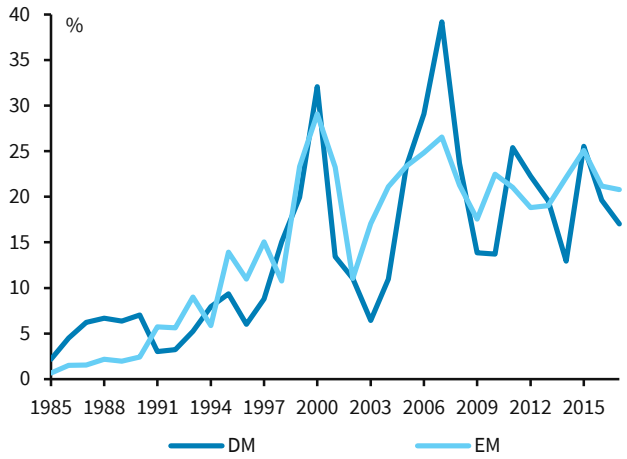
But, FDI also has important indirect effects by transferring technology, manufacturing techniques and management principles from more advanced economies to developing economies. There is a large Economics literature showing, both at a microeconomic and macroeconomic level, that these transfers via FDI improve total factor productivity in the recipient country.[12]

We confirm these findings of the Economics literature in our own study of the effects of FDI and institutions on EM capital accumulation and TFP

To confirm and gauge the size of these effects we estimated the effects of inbound FDI as a share of recipient country income on the four Solow growth model contributions to output growth. We also included as regressors four measures of institutional strength: rule of law, corruption (expressed as an index that increases as the rate of corruption falls), judicial independence, and 'social capital', a measure of trust within a society. Figure 17 presents the results of the regressions. (Neither labour or human capital accumulation are shown as there were no significant effects.)

FIGURE 15

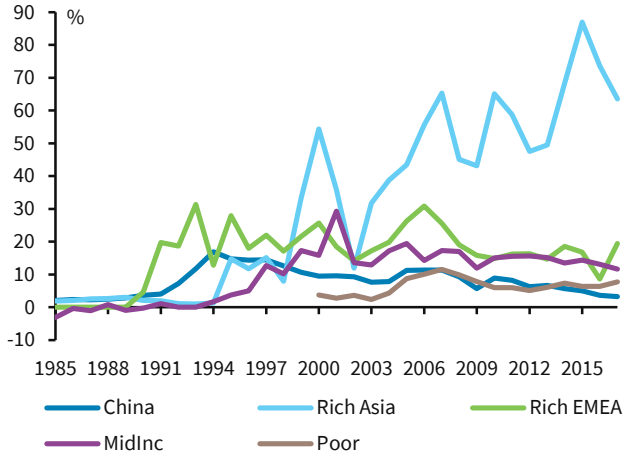
FDI share of total gross fixed capital formation



Source: Haver Analytics, national sources, Barclays Research

FIGURE 16

FDI share of total gross fixed capital formation, EM detail



Source: Haver Analytics, national sources, Barclays Research

[12] For recent examples, see 'Foreign direct investment and reverse technology spillovers: The effect on total factor productivity', Edmund Amann and Swati Virmani, *OECD Journal: Economic Studies*, September 2014; 'Foreign Direct Investment and Total Factor Productivity: Is There Any Resource Curse?', Patrice Rélouendé Zidouemba and Koffi Elitcha, *Modern Economy*, vol. 9, March 2018; and 'Foreign Direct Investment and Total Factor Productivity Growth: New Macro-Evidence', Botirjan Baltabaev, *World Economy,* vol. 37, no. 2, December 2013.

FIGURE 17

Panel regression of Solow growth contributions on changes in inbound direct investment and measures of institutional strength, 23 EM economies, 2008-2014

	Inbound FDI/GDP	Rule of Law	Corruption	Judicial independence	Social capital
TFP	0.1386**	0.0796	0.0733	0.0068	-0.0889
Capital	0.0039	0.03021*	0.0031	-0.0002	-0.0050

**Denotes statistical significance at better than a 1% level; *denotes statistical significance at between a 1% and 5% level. Notes: All regression variables expressed as annual changes; both country and year fixed effects estimated but not shown. Source: Barclays Research

Our analyses also reveal a clear indirect effect of FDI on these variables through its effects on institutions

The first line, with TFP as the regressand, confirms the result of the economic literature and shows a relatively large and highly statistically significant effect of FDI on current year productivity growth. A 1pp increase in FDI as a share of GDP increases TFP by almost 14bp in the year of investment.[13] While measures of country institutional strength do not directly affect TFP growth, we will see shortly that they do *indirectly* through their effect on FDI.[14]

And confirm the intuition that the rule of law is important for capital investment

The rule of law does show up as a significant positive influence on capital accumulation, as shown in the second line of Figure 17. As intuition would suggest, strong legal protections against property seizure do appear important in promoting both domestic and foreign investment in fixed capital assets.

Around the sun: Feedback loops and the role of strong institutions

The joint effects suggest the potential for non-linear reinforcement: FDI and institutions reinforce – or undermine – each other

The importance of institutions, and particularly the rule of law, in promoting capital investment leads to an important feedback loop that has the potential to worsen the adverse trends for EM we have observed in globalisation since the GFC. This is because FDI also influences and is influenced by the other variables on the right-hand side of the regressions in Figure 17. Foreign investment not only brings advanced foreign manufacturing techniques, but also influential demands for stronger protective institutions and cultural reinforcement of those institutions.

Testing this feedback mechanism, we do find clear evidence of strong reinforcement of institutions by FDI, but the reverse also is true

To test this, we also regressed measures of institutional strength like the rule of law on current and multiple lags of FDI investment. For measures of corruption, judicial independence and social capital, results were inconclusive in panel regressions that included all EM economies in our sample.[15] But, as shown in Figure 18, foreign investment appears to have a strong and persistent positive effect on the trend of rule of law in a country. Coefficients on current and all lags of FDI are positive and they are statistically significant for current and all lags up to four years, except three years. The statistically significant coefficients sum to 0.66, which implies a large effect for a highly persistent, trending dependent variable with a 30pp average range through time for countries in the sample. Furthermore, the large, highly statistically significant coefficient on current year FDI likely implies that causality goes both directions: not only does FDI positively affect a country's rule of law, but the rule of law attracts the FDI.

This feedback loop implies the potential for 'virtuous' or 'vicious' cycles.

The combined results in Figure 17 and Figure 18 imply the potential for a strong feedback loop that can lead to either 'virtuous' or 'vicious' (nonlinear) cycles in investment and growth in EM: a pick-up in FDI in an EM economy should improve institutions such as the rule of law, which in turn attracts more FDI, creating a positive, self-reinforcing circle. But, a trend decrease in FDI should run the cycle in reverse, worsening institutions and reinforcing the trend lower in FDI.

[13] In robustness checks, we also find that lagged FDI has smaller, positive and statistically significant effects.
[14] Indeed, we find some evidence of multicolinearity between FDI inflows and the rule of law. When the former is excluded from the regression in Figure 17, the statistical significance of the latter improves.
[15] Although not shown here, we did find that in certain subsamples of EM economies, particularly middle income and poorer countries, there were some statistically significant effects of lagged FDI on both corruption and judicial independence, albeit the results were not robust to alternative specifications.

FIGURE 18

Panel regression of index of rule of law on current and lagged values of inbound foreign direct investment as a share of GDP, 23 EM economies, 2008-2017

	Lags of FDI/GDP				
	Current	Year -1	Year -2	Year -3	Year -4
Rule of law	0.175**	0.140*	0.160*	0.112	0.188**

Note: **Denotes statistical significance at better than a 1% level; *denotes statistical significance at between a 1% and 5% level. All variables expressed in levels with an AR(1) term (not shown) to control for high persistence in dependent variable; country fixed effects also included but not shown. Similar results were obtained omitting the AR(1) term and including time fixed effects. Source: Barclays Research

The political economy of the associated effects on per capita income reinforce the non-linearity.

Figure 18 also implies that the path an EM country takes, a vicious or a virtual cycle, has a large effect on expected aggregate and per capita income growth. A trend improvement in institutions like the rule of law supports a trend of FDI growth that improves TFP and growth of the total capital stock that further enhances labour productivity. The reverse leads to a deterioration in both personal and aggregate incomes by undermining labour productivity growth.

Automatic for the people: Idiosyncratic events or part of a trend?

This calls into question markets' perceptions that recent EM deterioration was 'idiosyncratic' rather than a trend.

These analyses call into question the markets' general perception that much of 2018's underperformance of EM assets was due to 'idiosyncratic' political events rather than being part of a trend. Many of the worst performing EM asset markets were countries that witnessed either clear deterioration of institutions or significant perceived threat to those institutions. Consider as example:

- ***Turkey*** was the exemplar: Following an attempted *coup d'état* in 2016 that was met with a widespread purge of opponents and clamp down on the press, President Erdogan further consolidated his grip on power by winning the presidential election after a referendum to enhance its constitutional powers, then immediately used his new authority to appoint relatives to key positions (amid the leaking of audio files suggesting endemic corruption in his administration), to aggressively interfere in central bank policy, and to spend significant sums of public funds on a new presidential palace. Turkey's relationships with Europe and the US – key sources of FDI – also have deteriorated sharply under President Erdogan.

- ***South Africa***: While the rise to power of President Ramaphosa has brought some hope of a change in direction, the damage to institutions under former President Zuma has become increasingly clear: state-owned enterprises Eskom, Prasa and SAA all have been hit by scandals and show clear signs of managerial abuse. The replacement of meritocratic managers with political cronies likely will have long-lived effects and be difficult to reverse, and has real economic consequences, as can be seen in the persistent power outages resulting from Eskom's mismanagement. Against this backdrop, growing political pressure for aggressive land reform raises a clear challenge to the country's commitment to property rights and the rule of law.

- *Mexico*: Since his election to the presidency, AMLO has: cancelled construction of a major new airport in Mexico City based on a referendum that was non-transparent and had a participation rate of only 1.6% of registered voters; brought to a halt the needed energy reform process and promised to introduce a yet-defined consultative process for it and other economic policies; publicly criticised regulators and autonomous agencies; attempted to silence the head of the Energy Regulatory Commission; and appointed his dovish former economic advisor to the board of the central bank.

In several recent 'idiosyncratic' cases, the co-movement of FDI and institutional strength is apparent.

In all three countries key institutional measures – including rule of law, perceptions of corruption, governance effectiveness, and regulatory environment – have deteriorated since the peak of EM FDI flows in the middle of the decade. While it likely still is too early to tell if these are indeed idiosyncratic examples or the start of a broader trend in EM, our analysis suggests that EM investors should be wary that it may be the latter.

Out of time: effects on EM asset prices

The trend deterioration in per capita and aggregate EM growth and in their institutions also is present in EM asset prices and exchange rates

As with the predicted shift in globalisation patterns away from EM, the effect on EM relative asset prices already is apparent. Furthermore, our analysis suggests that continued relative underperformance is likely if the trends in global investment and possibly EM institutions become entrenched, as we postulate they will. Using the prolonged period of EM underperformance in the 1990s as a benchmark, our analyses suggest that the adjustment EM asset markets face may be less than half way through, with the potential for 70pp of relative underperformance to come in EM equities and 15pp in EM currencies in real effective terms. Further, contrary to current market consensus, risk spreads for EM do not look cheap when compared to the adjustments EM assets suffered in the 1990s.

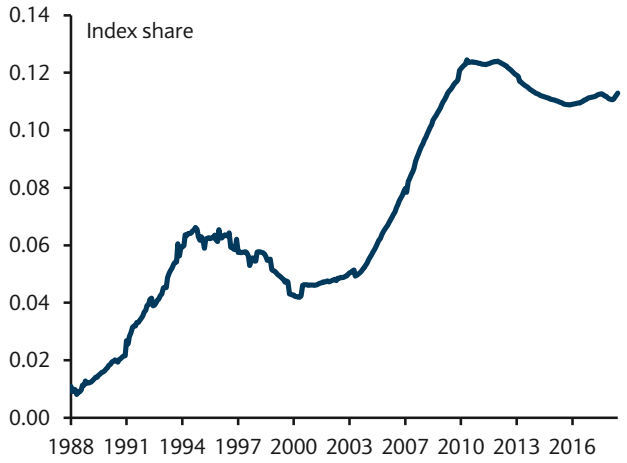
Document: EM underperformance already is underway

EM asset prices and exchange rates peaked in relative terms in 2012-13 and have continued to underperform even as the 'Taper Tantrum' faded for other markets

EM asset prices already peaked in relative terms in 2012-13. After a nearly 9pp gain from the late-1990s, EM crisis-induced lows, EM equity markets peaked as a share of global market capitalisation in 2012 at just under 13% (Figure 19). But since then, the EM share has fallen by over 1pp. Figure 20 shows the same pattern for real trade-weighted exchange rates of EM economies relative to their DM peers. From the early 2000s to early 2013, EM REERs collectively rose roughly 35%, even after adjusting for 'Balassa-Samuelson' productivity effects on domestic price levels.[16] Since then, they have fallen about 15% and remain under pressure. In the immediate aftermath of the 'Taper Tantrum', EM asset markets' retreat was seen as a one-off shock. But its persistence for half a decade and consistency both with the observed trends in globalisation and the technology-driven REM thesis suggests that 2013 was a secular peak in relative value and a multi-year trend of underperformance already has begun.

FIGURE 19

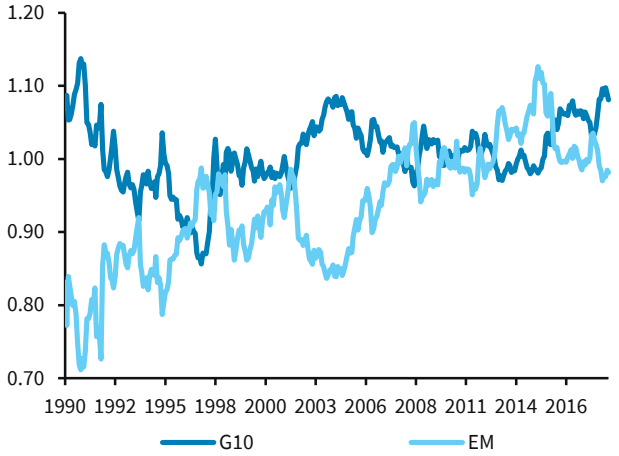
EM share of MSCI All Country World Index market cap



Source: Bloomberg, MSCI

FIGURE 20

Income-adjusted real effective exchange rate indices, developed and emerging market aggregates



Note: REERs are adjusted for Balassa-Samuelson effects, the rise in non-traded goods prices predicted when poorer countries converge in productivity and income levels to richer countries. Source: Barclays Research

[16] The Balassa-Samuelson thesis predicts that as productivity and real, per capita incomes rise in a country, so will its non-traded goods (real estate, haircut) prices, leading to a real effective exchange rate appreciation. See Balassa, Bela. "The purchasing-power parity doctrine: a reappraisal." *Journal of political Economy* 72.6 (1964): 584-596; and Samuelson, Paul A. "Theoretical notes on trade problems." *The Review of Economics and Statistics* (1964): 145-154.

We find, as we predicted, that equity returns are the most susceptible to slowing in capital deepening and TFP

To test the relationship between our analysis of sources of growth and EM asset price performance, we regressed real asset price and exchange rate returns on the Solow growth contributions in a panel regression of 23 EM economies. The results are presented in Figure 21 and confirm our earlier analysis. Equity returns are strongly positively affected by increases TFP and physical and human capital, as we expected based on our delineation of the sources of growth and asset returns under the Solow growth framework. The results also highlight again the importance of the feedback loop between FDI and sources of economic growth that directly affect asset prices.

FIGURE 21

Panel regression of real annual asset returns (in 2011 PPP-adjusted USD) for various asset classes on Solow growth contributions, 23 EM economies, 1995-2014†

	TFP	Capital	Labour	Human capital
Equities	3.44**	3.71*	0.67	14.24*
Credit	-1.17	2.67	1.5	-3.05
FX	-0.48	-1.55	-0.43	1.56

Note: **Denotes statistical significance at better than a 1% level; *denotes statistical significance at between a 1% and 5% level. †Equity regression sample begins in 1995; credit begins in 1994, and FX begins in 1998. All variables expressed as log changes with both country specific and time fixed effects (not shown). Regressions using nominal USD returns yield nearly identical results. Source: Barclays Research

Also as predicted by our earlier analyses, fixed income and FX are less affected

In contrast, none of the coefficients on Solow growth components are statistically significant in the credit return and FX return regressions. This, too, is consistent with our earlier analysis that fixed income returns are more influenced by maintenance of a threshold rate of growth – ie, a level consistent with debt repayment – rather than fluctuations in the growth rate itself or its sources (see REM2, *Rethinking Emerging Markets – Part 2: Re-positioning*, 6 December 2018).

Dead Letter Office: Institutions matter (especially for fixed income)

Yet, institutions are important to fixed income and currency returns

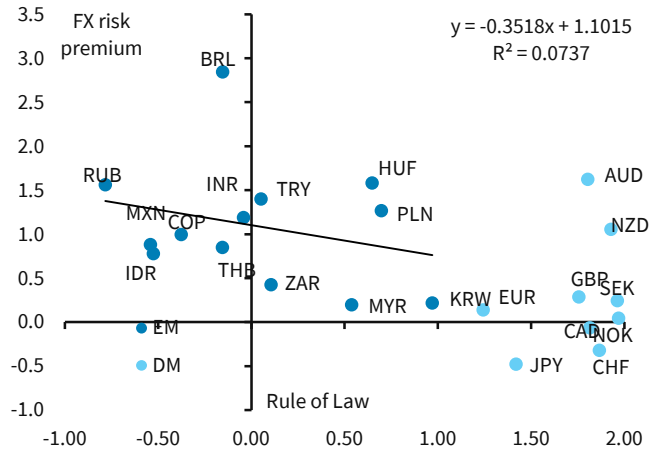
But fixed income returns are affected by institutional factors that affect repayment and policy consistency. Because these measures are low frequency (annual), have a short sample history (since the 2007) and are slow moving, they do not lend themselves well to time series regression analysis. But the strong relationship between them and asset prices – or more precisely, risk premia – is clearly apparent in cross section as shown in Figure 22 through Figure 25.

We find a clear cross-sectional relationship between FX and credit returns and country institutional strength

Figure 22 displays the country FX risk premium – measured as median excess return from 2007 to the present – versus the respective rule of law index measure for each EM (and for reference DM) economy in our sample. There is a clear negative relationship between the FX risk premium and the strength of the rule of law in a country. Figure 23 presents the same analysis for credit spreads and shows – as one might expect for debt contracts – an even clearer and stronger negative relationship between risk premium and rule of law. While not shown, this negative relationship also is clear for the equity risk premium.

FIGURE 22

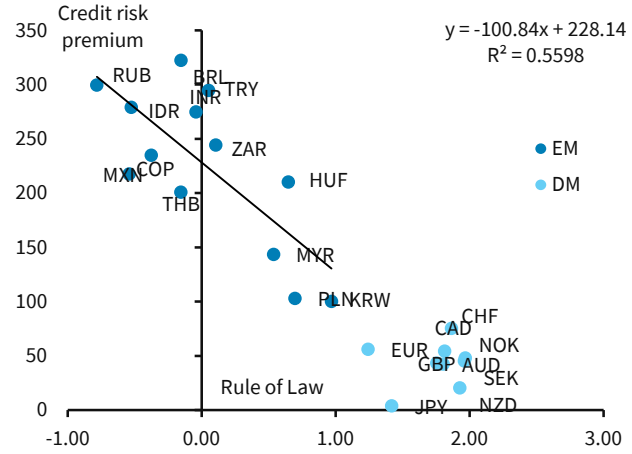
Historic FX risk premia vs index of rule of law



Note: Country FX risk premium is estimated as its median monthly, carry-inclusive 3m nominal return; Rule of Law is country average index level; both since 2007. Source: Bloomberg, Legatum Institute, Barclays Research

FIGURE 23

Historical credit spreads vs index of rule of law



Note: Country credit spread is the median monthly, option-adjusted spread of its Bloomberg-Barclays Hard Currency Aggregate; Rule of Law is country average index level; both since 2007. Source: Bloomberg, Legatum Institute, Barclays Research

These same results hold for equities and are strongest from strength of rule of law and judicial independence

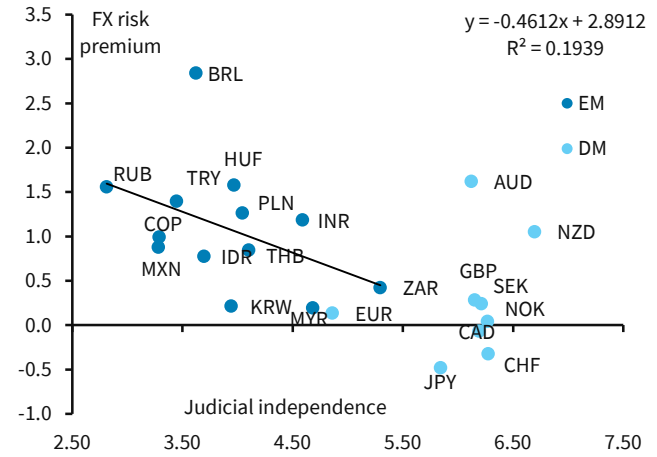
Figure 24 and Figure 25 present the same analysis for FX and credit risk spreads versus measures of judicial independence. Again, there is a clear negative relationship in both cases between risk premia and the strength of institutions. The same analysis, though not shown, holds true for perceived corruption, government effectiveness, monetary policy consistency, and social capital. As in the case of rule of law, these analyses hold true for equity risk premia, too.

Taken together the evidence suggests a worrying trend of reinforcing underperformance lies ahead for EM assets

Taken together, these analyses impress the trend nature and likely continuation of EM relative asset price and FX underperformance. If our hypothesis regarding the technology-driven shift in globalisation and its negative effects on EM growth and development are correct – as patterns in global capital flows and consumption suggest is the case – then we should expect the deterioration in trend per capita income growth in EM to continue. In turn this should result in continued trend underperformance of EM asset prices and exchange rates, particularly in risk adjusted terms. The feedback loop between globalisation,

FIGURE 24

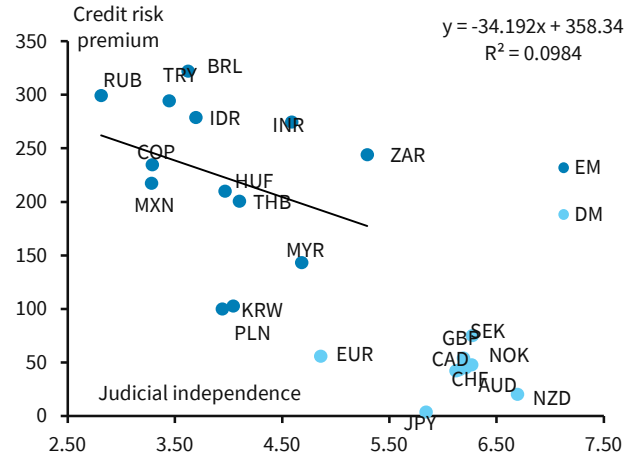
Historic FX risk premia vs index of judicial independence



Note: Country FX risk premium is estimated as its median monthly, carry-inclusive 3m nominal return; Judicial independence is country average index level; both since 2007. Source: Bloomberg, Legatum Institute, Barclays Research

FIGURE 25

Historical credit spreads vs index of judicial independence



Note: Country credit spread is the median monthly, option-adjusted spread of its Bloomberg-Barclays Hard Currency Aggregate; Judicial independence is country average index level; both since 2007. Source: Bloomberg, Legatum Institute, Barclays Research

institutions, income growth, and asset prices reinforces these trends. Unless EM economies are successful in finding a new growth model, the trend underperformance of EM assets in risk-adjusted terms likely will continue.

Monster: Projecting the scale of EM underperformance

The magnitude of the effects could be very large; and benchmarking on the 1990s experience, EM may be only halfway through the process and may have as much as 70pp of further underperformance in equities

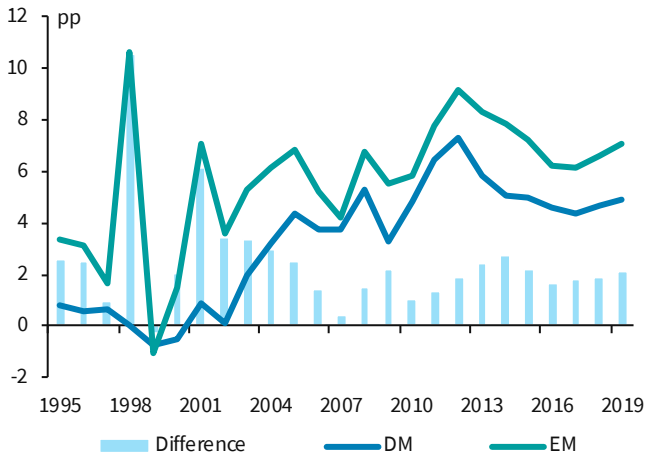
How large is the likely magnitude of underperformance? History suggests the scale could be very large and that we are less than halfway through the relative decline. It is important to keep in mind that we are forecasting relative decline, not absolute losses, though the historical precedents suggest both. If the relative decline in the EM share of global stock indices in the last prolonged period of EM underperformance serves as a benchmark, EM stocks could underperform DM stocks by a further 70pp over the next several years. The peak to trough underperformance of EM share prices relative to DM from the former's peak share of global market capitalisation in September 1994 to their relative nadir in January 1999 was just over 130pp (reflecting a 68% absolute decline in EM share values and 62% gain in DM). Since the EM share of global stock market capitalisation peaked in September 2010, EM shares have fallen about 2% and DM stocks have risen 57%, for a total underperformance of 59pp, implying a further 70pp relative underperformance if the 1990s example is repeated.

Investors seeing current EM stock multiples as relatively cheap may want to consider the large relative widening of the equity risk premium for EM in the 1990s

An alternative way to think about the scope of EM asset underperformance that likely is more appropriate for fixed income but applicable to equities as well is the relative adjustment in risk premia. In equities, we use the equity risk premium (ERP) because the level of interest rates – much higher in the 1990s than in the past decade – has a large effect on measures such as price/earnings (P/E) ratios.[17] Data on trailing P/E ratios for MSCI indices only become available in 1995, so we compare the average ERP over that year for the DM and EM indices with the average for 1998, the final full year of EM underperformance. In 1995, the average monthly EM ERP of 3.2% exceeded the average DM ERP 0.8% by 2.4pp; by 1998, the gap had soared to 10.6pp, with EM stocks having a monthly average 10.6% ERP and DM stocks yielding no risk premium over long-term real US Treasury yields (Figure 26). The 1990s experience should give pause to equity investors who see current EM equity multiples as cheap relative to DM shares based on the 1pp expansion in the relative ERP of EM shares over DM stocks since 2010 or who consider the nearly 2pp widening through 2014 to be the downside for EM share prices.

FIGURE 26

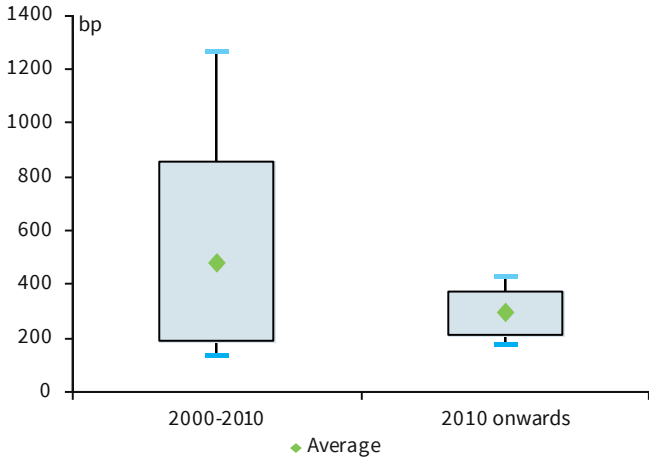
EM vs DM share prices, equity risk premia and difference



Source: Bloomberg, Barclays Research

FIGURE 27

Monthly dispersion and historic average of 11-country average EM USD credit spread (OAS), last two decades



Source: Barclays Research

[17] We use the trailing earnings yield (inverse of the P/E ratio expressed as a percent) of each index less the 10y US TIPS yield as a measure of the equity risk premium. Because TIPS were not issued until 1997, we subtract the average implied breakeven inflation rate from the first year of TIPS issuance from nominal 10y US Treasury yields in prior months as a measure of 10y real interest rates.

A similar benchmarking of credit spreads implies that EM fixed income, too, has the potential for significant further deterioration if worsening per capita income growth leads to ratings downgrades

Benchmarking relative returns for EM fixed income is more difficult, as market capitalisation share is not an appropriate metric and fixed income instruments are not a relative price like exchange rates. Instead, Figure 27 illustrates the compression in both the range and average of an unweighted average of 11 large EM issuers hard currency credit spreads from the 2000s to the post-GFC period.[18] Much of the decline reflects the improved credit quality and average ratings of these issuers. As we noted in REM2, if these countries maintain their credit quality, EM relative credit spread deterioration is unlikely to be as severe as the likely ERP widening in EM equities. But if the underperformance of growth that we anticipate does lead to more widespread erosion of EM countries' institutions, as noted above, it likely will increase the dispersion of EM credit spreads and lead to a widening of average EM credit spreads. The 2000s may serve as a good benchmark for the potential scale of deterioration and dispersion.

The late development of EM local debt markets does not lend them to benchmarking to the 1990s experience

Because the market for EM local debt did not develop significantly until nearly the peak of EM economic and asset outperformance at the end of the last decade, we cannot do the same benchmarking to early globalisation stage as a metric of scope for deterioration. But the lessons from other asset classes illustrated above suggest that it would be unwise for local market debt investors to assume that the relative wides in EM real yields of the last decade will represent the apex of possible risk spreads (as Turkish lira rates recently have shown).

EM real effective exchange rates have unwound less than half of their gains from the early 2000s

A benchmarking of EM FX to its 'early globalisation' lows suggests that EM currencies, like EM equities, may be less than halfway through their adjustment and potentially face a further 15pp drop in trade-weighted real terms versus DM, on top of the 13pp decline since early 2015. This would put EM exchange rates in real terms relative to DM currencies on par with their early 2000 levels (Figure 20).

There are arguments on both sides as to whether the 1990s example is too aggressive a benchmark

Are these 'early globalisation' benchmarks too aggressive or too conservative? There are good arguments in both directions. They may prove too aggressive, given that we are not forecasting the 'end of globalisation' and institutions in many EM have improved greatly since the early 2000s. Further, we are focused on *relative* EM performance and DM face their own challenge from the *Politics of Rage* (23 October 2016).

DM institutions, too, are seen to be under threat, but they start from a much higher level, and the Politics of Rage may be a bigger threat to international institutions than DM domestic institutions

Yet DM institutions are starting from a much higher plane of strength and robustness than EM (Figure 5). As is clear in Figures 22-25, variations in DM risk spreads appear unrelated to the modest differences in institutional strength, suggesting that beyond a (relatively high) threshold level, institutional strength matters less for risk pricing. Further, the focus of the Politics of Rage in DM has been on strengthening popular representation in domestic governments and weakening the power of *external* institutions and transnational agreements; it is not clear that it represents a threat to *internal* institutions.

While we are not forecasting the 'end of globalisation', EM economies at the end of the 1990s were bailed out by globalisation's surge; with no clear new growth model on the horizon, EM's downside could be larger this time

Although we are not forecasting the end of globalisation, we are forecasting a substantial challenge to the growth model of most EM and a shift in globalisation that would favour DM economies. In that sense, it is not extraordinarily different from the technology-driven DM growth spurt of the 1990s, suggesting that the 'early globalisation' experience is not an inappropriate benchmark for what we can expect in relative performance this time. Indeed, one could argue that in the earlier period, because technology and the improvement in EM institutions — under pressure from markets and international institutions that increasingly have been supplanted or rejected by EM in the last decade and are under threat now from the Politics of Rage in DM — created the conditions for a trough and rebound in relative EM performance, that without development of a 'new growth model' the relative underperformance of EM assets could be *greater* this time.

[18] Argentina, Brazil, Colombia, Mexico, Peru, Russia, Turkey, India, Indonesia, Philippines, and Thailand.

Life's rich pageant: Dispersion and exceptions

But not all EM are the same; we identify three characteristics that may prove exceptional

Yet not all EM economies are the same or face the same opportunity set. The technology-driven trends that we observe likely will have differential effects based on the individual characteristics of each economy, leading to increased dispersion within EM. We identify three key characteristics that may prove exceptional for some EM economies:

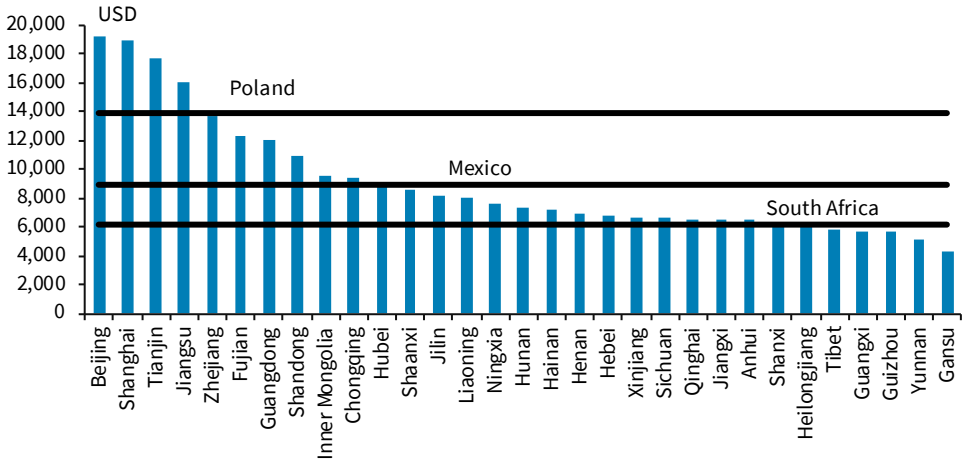
- **Size**: If an EM economy is a large enough market, it likely will continue to attract significant FDI to access its consumer market, particularly if the population continues to grow at a relatively high pace or already is middle income on a per capita basis.
- **Human capital and technological prowess**: EM economies with relatively high levels of human capital and technical knowhow are more likely to be able to participate in the knowledge economy and to continue to attract higher rates of FDI.
- **Local integration in major economies**: EM that are locally integrated into DM supply chains, especially if within a customs union or free trade area, also likely will continue to attract FDI.

China is a clear standout that may fit all three categories of exception: size, sophistication and local (internal) integration.

Several economies stand out as potential exceptions to the REM thesis, based on these characteristics, China first among them. It arguably fits into all three categories: it is the world's second-largest economy (in PPP terms); it now has, at least in certain regions, one of the most educated and technically sophisticated workforces in the world; and its poorer regions are integrated into the richer, more sophisticated regions by language, culture and, most importantly, a strong central government. Figure 28 illustrates China's provincial diversity with the richest four provinces at the top of the EM income spectrum, several more in the higher middle income ranges, and roughly half at the bottom of middle income ranges.

FIGURE 28

Per capita income of Chinese provinces relative to selected other EM economies



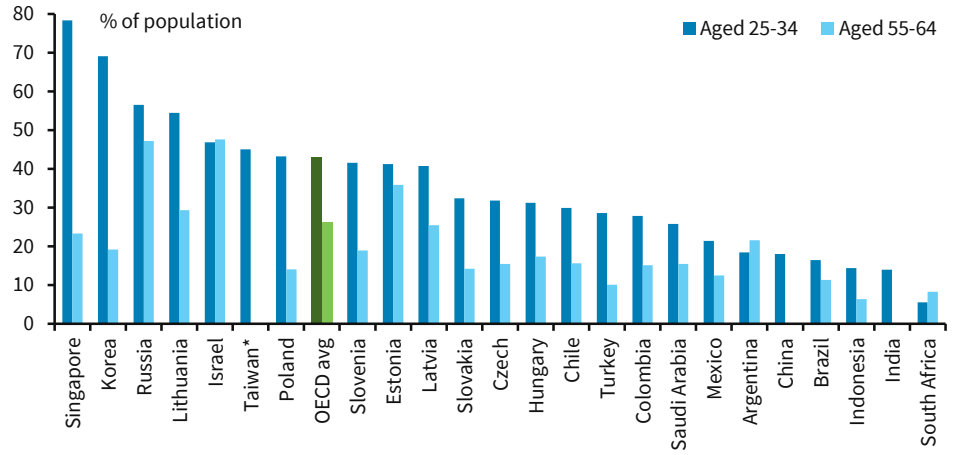
Source: China Bureau of National Statistics, Haver Analytics

Brazil and India have size, but fall short in other dimensions

India and Brazil are large and, especially the former, growing markets and, thus, fit the first criteria. But both are significantly behind other EM economies in terms of educational attainment and human capital (Figure 29) and face challenges to their institutions.

FIGURE 29

Tertiary education rates by age group, selected EM countries and OECD averages



Note: *Average 25-64. Source: 'Education at a Glance' OECD, 2018 for all countries but Taiwan; 'Higher Education Crisis in Taiwan', Chia-Ming Hsueh, *Inside Higher Ed*, 5 August 2018.

The NICs and Israel are highly educated and technologically sophisticated, but may not be large enough and have declining populations

The NICs and Israel, as illustrated by their high rates of inbound FDI, clearly fit the second criteria, having high levels of human capital and technological sophistication. Figure 29 displays for EM countries (and the OECD average for comparison) the shares of population, old and young, with a tertiary (university or technical post-secondary) education. The NICs, Israel and several Eastern European countries are standouts with rates at or above the OECD average. However, with the exception of Hong Kong and the EU members discussed below, all are small markets that are not locally integrated into a larger economy, albeit the other NICs could potentially locally integrate with either China or Japan.

Eastern European countries have high levels of human capital and are locally integrated into the EU single market, but are in population decline and attached to the slowest-growing major economy

The final set of countries that may prove exceptional is the CEE economies. Levels of human capital, as noted above, are high and they are both locally and deeply integrated into the EU supply chain within the common market itself. As an illustration of what we mean by 'locally integrated' Austria, the Czech Republic, Germany, Hungary, and Poland are contiguous and well connected by redundant rail, road and waterway transportation networks, linking 148 million people contained within 926,000 square kilometres of land that is no wider than 1,280 kilometres. By comparison, the Great Lakes Basin, the manufacturing heartland of the United States and Canada, links 98 million people in eight US states and one Canadian province, spanning 1,682,000 square kilometres that is 2,230,000 kilometres at its widest point. Furthermore, unlike the NAFTA agreement unifying the US and Canada, the five European countries all are share a common customs union without costly non-tariff border checks. The main problems faced by the CEE countries are that they have negative population growth, are tied to the slowest growing of the world's major economies and recently have had some deterioration in institutions.

And I feel fine…Dispersion likely to increase

The potential of these economies for exceptionalism highlights the secondary implication of the REM thesis: increasing dispersion is likely

Beyond the primary implication of the REM thesis – expected trend underperformance of EM as an asset class – the secondary implication, which is obvious from its causal mechanisms, is an increase in the dispersion of performance within the asset class. In the previous decade and the first half of the current one, EM economies and asset classes tended to move in lockstep: a rising or falling tide lifted or felled all boats. But in the past few years, performance across EM has been increasingly dispersed. The idiosyncratic deterioration in several countries' institutions, cited earlier, is a clear illustration of the different stresses and 'cracking points' that EM face amid the technological challenge we outline.

Diverse strengths and weaknesses across EM economies likely will foster greater growth and asset price dispersion

Diverse cultures, rates of educational attainment, geographies, demographics, and income levels and dispersion all create unique susceptibilities and strengths that likely will continue to differentiate how EM economies react to the changing nature of globalisation. The same is likely to be true of their ability to attract FDI and re-orient themselves towards new growth models under the relentless pressure of technological progress that shifts production away from globalisation towards 'localisation'.

Dispersion will benefit absolute return EM managers, but benchmarked ones likely will face a tougher time amid a trend relative decline in EM asset prices

The implied growth in dispersion among EM offers a silver lining to the REM thesis for EM-dedicated investors: those with flexible tracking error or absolute return mandates should benefit from increased levels of volatility and more diversified investment performance, while those tied to strict benchmarks likely will suffer from the trend decline in relative performance (and market capitalisation) for their mandated asset class.

CHAPTER 4

From scarcity to abundance: Implications of the new US energy economy

Michael Cohen
+1 212 526 3606
michael.d.cohen@barclays.com
BCI, US

Aroop Chatterjee*
+1 212 526 9617
aroop.chatterjee@barclays.com
BCI, US

Blerina Uruçi
+1 202 452 4774
blerina.uruci@barclays.com
BCI, US

Brahim Razgallah*
+ 44 (0) 20 3555 4762
brahim.razgallah@barclays.com
Barclays, UK

**This author is a debt research analyst in the Fixed Income, Currencies and Commodities Research department and is neither an equity analyst nor subject to all of the independence and disclosure standards applicable to analysts who produce retail debt research reports under US FINRA Rule 2242.*

US tight oil growth has shifted energy markets from a mode of scarcity to abundance over the past decade. The US transition from a giant net importer of energy towards becoming a net exporter has boosted the economy, up-ended oil markets, influenced global currencies and capital flows, recast US energy diplomacy, and dislodged geopolitical alignments. Increased energy production has spurred US growth through trade as well as investment and employment. The shift to net energy exporter should boost the USD's fair value, while muted oil price levels and higher oil price volatility are likely to constrain global capital flows, particularly to emerging markets.

Primary conclusions

- In the next 2-3 years, US shale and other non-OPEC supply are likely to keep pace with demand growth, keeping oil prices within a $70-80/b range. We think the commodity supercycle is dead, and oil price volatility in the long term ought to decline. Supply and demand are becoming more elastic, meaning boom/bust cycles are likely to become less frequent and less violent.
- However, oil price volatility may persist in the interim due to the market's inability to accurately anticipate the supply and demand response to price levels, in our view. Our analysis shows that while OPEC's spare capacity dampens volatility when markets are tight, it actually adds to volatility when markets are loose.
- Using a growth accounting framework, we find that the increase in US energy production has boosted US economic growth by about 20-25bp per year over the past decade through an improved trade balance and higher investment.
- Over the next five years, we see the US energy trade balance flipping from a slight deficit to a more than $150bn surplus. We estimate the direct effect on economic growth via trade at 10bp per year, with indirect gains through increased employment, investment and a boost to consumer purchasing power. The overall economic effect is akin to the experience of the past decade.
- The shift in the energy trade balance has already increased the USD's fair value by 3-4% since 2010 and should raise it another 5% over the next five years under our baseline scenario. We expect negative USD-oil correlations to flip to positive in coming years.
- Muted oil-price increases and periodic bouts of oil volatility are likely to constrain global capital flows, boosting risk premia on EM assets. We find non-FDI flows to EM are positively related to oil prices, while oil price volatility is negatively correlated with FDI flows.
- Energy abundance is already influencing US foreign policy by enabling a harder line with adversaries and reducing military involvement in the Middle East. Saudi Arabia and other key OPEC exporters' continued reliance on oil revenues implies difficult trade-offs between fiscal consolidation and increased financing; with both consistent with higher risk premia.

From energy scarcity to energy abundance

EIA estimates that tight oil resources could last another 92 years; the increase in crude and product exports means the US now supplies 10% of global oil exports, from just 3% a decade ago

The shale revolution is here to stay. Over the past decade, the combination of hydraulic fracturing and horizontal drilling has shifted the oil market from supply scarcity to abundance. The Energy Information Administration (EIA) estimates that technically recoverable resources could last another 92 years. US oil production has increased by 1 million barrels per day each year on average, making it the largest producer of oil in the world. Only Saudi Arabia has ever added more supply in one year than the US did in 2018. The increase in crude and product exports means the US now supplies 10% of global oil exports, from just 3% a decade ago. The US energy revolution has also changed global gas markets and delivered a windfall to US consumers. In 2018 alone, the US added almost 10 Bcf/d of gas supply, while natural gas prices averaged below $3/mmcf. To put that in context, it took Qatar, one of the world's largest gas producers, a decade to increase its supply that much.

Markets have been slow to react to the tight oil development, leading to spikes in volatility

This revolution has shifted energy trade flows, suppressed energy prices, reduced US import dependency, recast geopolitical relations and changed the investment strategy of key market players. But markets have sometimes been slow to react, leading to spikes in volatility. We think episodes of volatility will not disappear, but may be fewer and further between. That said, when they do happen, they will have implications for asset prices, capital flows, the US economy and geopolitics.

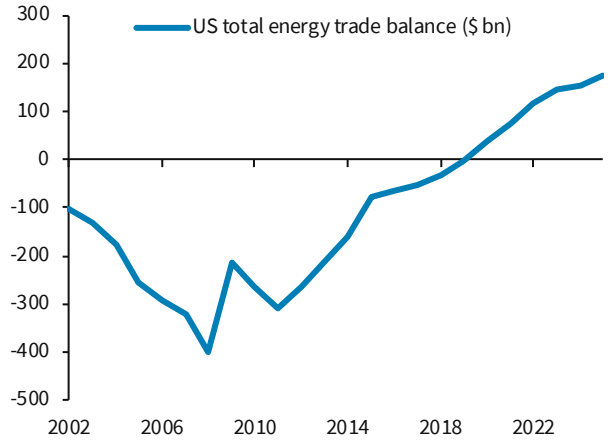
Net energy export scenarios and price outlook

In the next 2-3 years, US shale and other non-OPEC supply are likely to increase, keeping prices within $70-80/b (see *Oil Special Report: Resisting Temptation*, 3 September 2018). The marginal cost of this new short-cycle resource should, in theory, set the market price at a gradually higher level than current prices. If OPEC targets this range, its current spare capacity of 2-2.5 mb/d is likely to increase, as it would be forced to cut supply to maximize its revenues.

In *Energy: Predicting the Permian: the impact of budget cuts on growth outlooks* (14 February 2019), our Equities Research analysts estimated that large-cap exploration & production companies (which account for 40-45% of the Permian) should experience a fair amount of price elasticity, which in our modelling offset other declines outside of the US and in OPEC countries in 2022-25. For example, they expect the production gap between the high-price

FIGURE 1

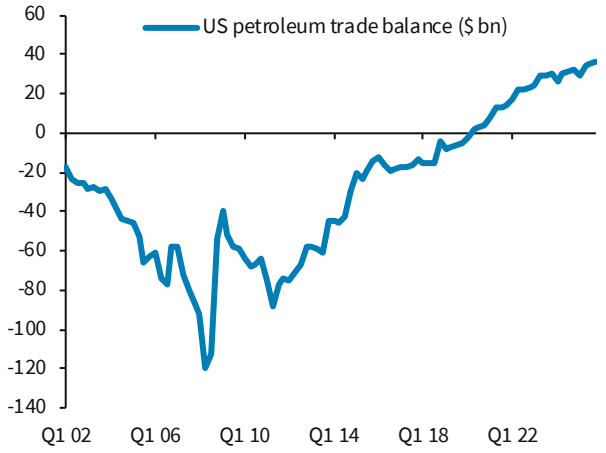
The tide is set to turn for the US energy trade balance…



Source: EIA, Barclays Research

FIGURE 2

… driven primarily by shrinking net crude oil and petroleum product imports



Source: EIA, Barclays Research

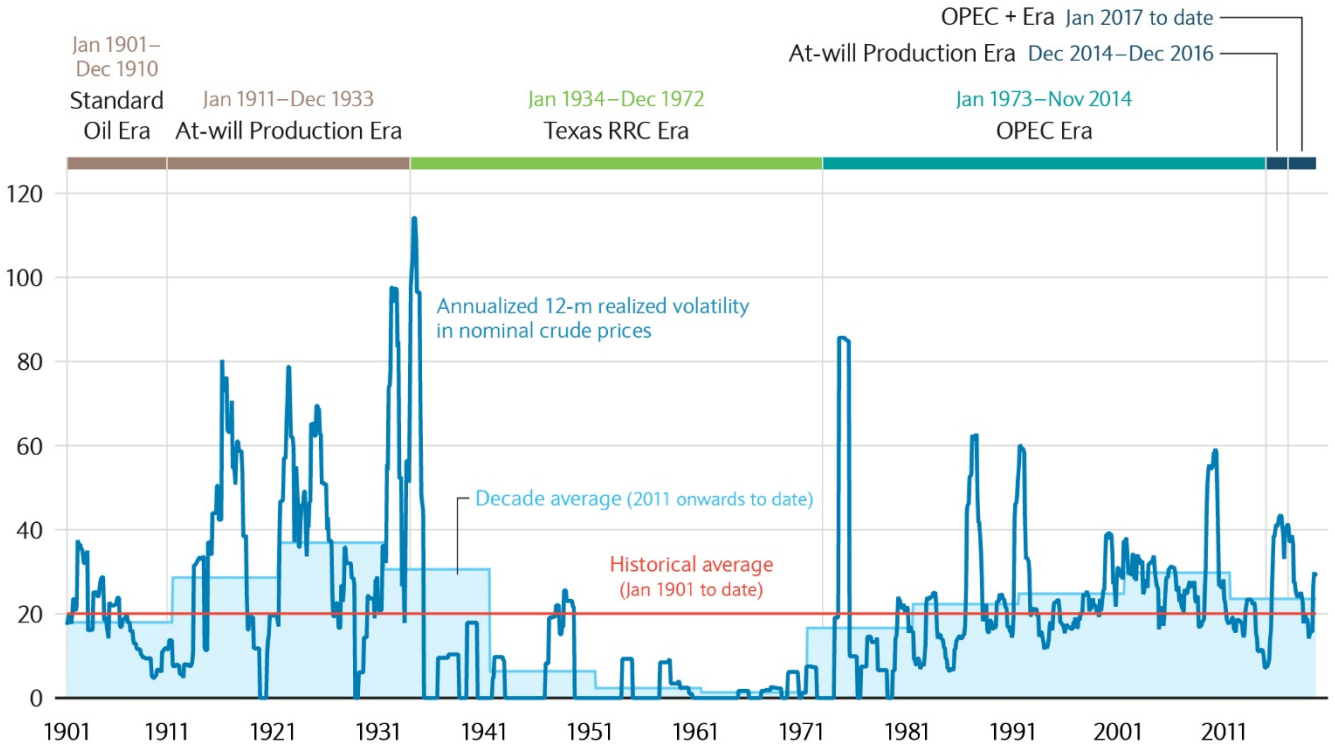
scenario ($60 WTI) and a $50 WTI case to widen 18-21% in 2021-22. Small cap E&Ps, however, will be far more susceptible to investor demands for capital discipline, which will restrain production growth from some companies even in a higher oil price environment.

Prices need to increase to $70-80/b (Brent) to facilitate enough growth in tight oil to meet demand

Thus, for US tight oil to continue to fill the gap between rising demand growth and natural declines, the call on US tight oil would need to average 0.8 mb/d y/y over the medium term. Assuming a reduction in the trend to outspend cash flow (see *Oil Special Report: Resisting Temptation*, 3 September 2018), we estimate that prices will still need to increase to $70-80/b to facilitate such growth. In our base case, we expect net energy exports to increase to $178bn by 2025, on par with the rate of growth in 2013-18, driven by increased waterborne and pipeline oil and gas exports.

FIGURE 3

Oil market volatility has evolved depending on who is managing the market; despite recent market management, volatility remains above average



Source: Rapidan Energy Group for historical price series from January 1901 to December 1988 and Bloomberg from Jan uary1989 onwards, Barclays Research

Has the elasticity of US shale made markets more volatile?

Dampening market volatility is a priority for producing and consuming countries, for a variety of economic reasons

Many market participants believe that the oil market will remain volatile for the foreseeable future, that shale has arguably contributed to that volatility, and that OPEC's efforts to mitigate volatility actually add to it.[1] The most recent downward swing in Brent prices from over $85/b to as low as $50/b within a span of less than three months perpetuates this view. We take a contrarian view, at least over the longer run.

Higher spare capacity and increased demand and supply elasticity should reduce volatility

We think volatility ought to decline long term because of an expectation of higher spare capacity and increased demand and supply elasticity. Our argument is based on two key findings. One: the elasticity of both supply and demand has been increasing over the past few years, as shown in Figures 4 and 5. Two: our analysis shows that all else equal, higher OPEC spare capacity means lower volatility in oil prices. Given the rapid growth in non-OPEC supplies, the need for OPEC oil is not expected to grow significantly over the medium term. Roughly 80% of the incremental demand over the medium term is met by growing non-OPEC supplies (see *Oil Special Report: Resisting Temptation*, 4 September 2018).

OPEC does not always drive volatility lower; demand-adjusted inventory cover is also a significant factor

Counterintuitively, our analysis also shows that as inventory cover rises, volatility rises as well. We employed an auto-regressive conditional heteroscedasticity (ARCH) model to study the drivers of oil price volatility and found that OPEC does not always drive it lower. Our results indicate that OPEC's spare capacity does dampen oil price volatility, so higher spare capacity results in lower oil price volatility, all else equal, but it is not the only factor. Demand cover,[2] an indication of tight or loose physical market conditions, also affects oil price volatility significantly. Our analysis also indicates that volatility rises with growing days of OECD inventory cover (vs. the five-year seasonal average), and vice versa. This is largely driven by the uncertainty about OPEC's stance on rebalancing a loosening market, in our view.

OPEC has an asymmetric effect on oil prices: when physical markets are loose, uncertainty about OPEC action drives up volatility

This means that OPEC is far more effective at dampening volatility at high rather than low prices. OPEC's spare capacity does shield oil prices from higher volatility in tighter market conditions. But when physical market conditions are loosening, uncertainty about whether the group will intervene and about the magnitude of such intervention drives up volatility. OPEC's effect on oil price volatility is, thus, asymmetric. It is more effective when prices are high and its supply is needed than when prices are low and there is uncertainty about whether it will cut.

Oil price volatility should trend lower over the medium term as long as the OPEC+ members (led by Saudi Arabia and Russia) stick to their task of keeping oil markets balanced

Oil price volatility should remain subdued as long as OPEC+ cohesion is sustained and its reaction function is clear. We conclude that oil-price volatility should trend lower over the medium term as long as the OPEC+ members (led by Saudi Arabia and Russia) stick to their task of keeping oil markets balanced. One variable is how the group behaves in the event of any potential global macroeconomic downturn. If it returns to a market-share preservation strategy, as in 2014-16, oil price volatility could spike materially, as it would not only loosen the physical market significantly but also reduce spare capacity.

The market continued to underestimate the increase in elasticity of both supply and demand with the evolution of shale, the removal of many subsidies, and the new concentration of oil demand growth in non-OECD countries

The market's ability to determine supply and demand responses accurately is also likely to improve over time. The market continues to underestimate the extent of supply and demand elasticity, and this has been the most significant source of volatility of late, as we noted in *The Blue Drum: Wake of the Flood*, 29 March 2019. The reason for these effects stems from the increase in elasticity of both supply and demand with the evolution of shale, the removal of many energy subsidies, and the new concentration of oil-demand growth in non-OECD countries. As shown in Figures 4 and 5, the elasticity of shale is almost twice that of oil sands producers and several orders of magnitude more than supply in other parts of the world. In our view, as market participants learn that prices can have a more immediate and forceful effect on oil supply and demand, each subsequent instance of volatility should decrease in amplitude and duration.

[1] See Robert McNally, *Crude Volatility - The History and the Future of Boom-Bust Oil Prices*, Columbia University Press, 2017.
[2] Measured by total OECD inventory days of demand (both OECD and non-OECD) excess to the seasonal 5-year average

The risks to a less volatile future

Admittedly, there are some significant risks to our baseline of lower oil price volatility medium term.

The role of private operators and US E&P company capital discipline will make the reaction function of shale less clear and could lead to more volatility

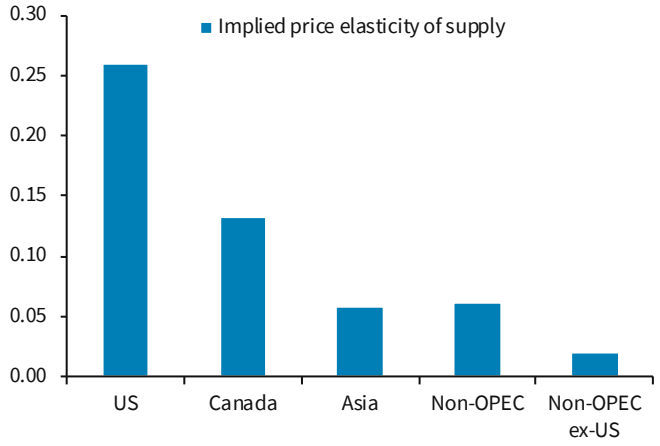
The role of private operators in the Permian region. Although short-cycle supply sources such as US light tight-oil should, in theory, dampen volatility, the reality may differ. US tight oil producers are heterogeneous, with many companies of varying market caps, asset base sizes and access to takeaway capacity. In our *Special Report: Resisting Temptation* (3 September 2018) we broke producers in the Permian basin into three categories and found that depending on the size of the producer, each group had a different plowback ratio (defined as capital expenditures as a percent of cash flow from operations). We found that private companies operate more than 20% of the region's output but their actions fly under the radar: there is limited public information about their activity levels and output plans. They are also the most price-sensitive, and nimble. They were primarily behind the outperformance (or forecasting error) of US tight oil output in 2018. We expect the share of these operators to decline over the medium term, on continued consolidation, but to remain a blind spot in global supply monitoring.

How OPEC plans to respond (and at what price level) to US sanctions and other supply and demand-related market developments remains unclear

The response function of OPEC+ to any sanctions. Market participants do not know the extent of pressure the Trump administration will put on Venezuela or Iran via sanctions. This adds to volatility since it is unclear how much of OPEC's spare capacity it will use. If OPEC really wants to decrease volatility, it might be better served by holding less of a spare capacity cushion and engaging in less market intervention. The problem is that the opposite is likely as OPEC's members pursue revenue maximization (see the box below for details of Saudi Arabia's fiscal challenges).

FIGURE 4

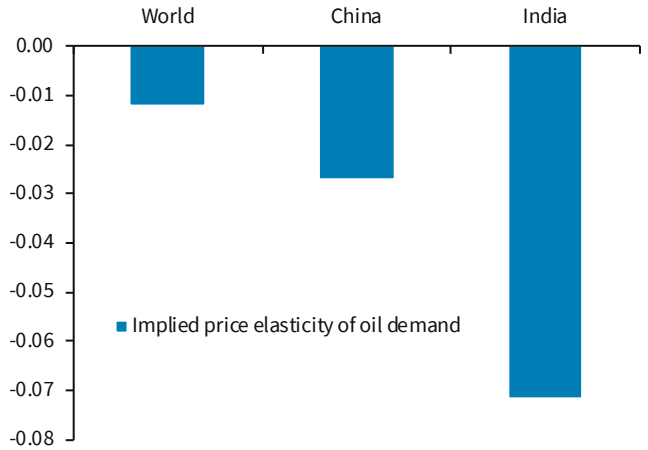
US tight oil is increasing the elasticity of the supply stack…



Source: Barclays Research

FIGURE 5

…while China and India are the source of higher elasticity on the demand side



Source: Barclays Research

Data lags and reliability continue to create problems

Data quality and reliability are significant sources of volatility

On the demand side, there is a significant dearth of reliable data on China's oil consumption and strategic reserves program. The best estimates of apparent consumption are based on imprecise refinery runs, product supply and inventory changes numbers. The government's SPR numbers are also understated, in our view. This lack of transparency in one of the largest and fastest-growing oil consumers in the world poses a significant risk of forecasting error, which could lead to higher volatility.

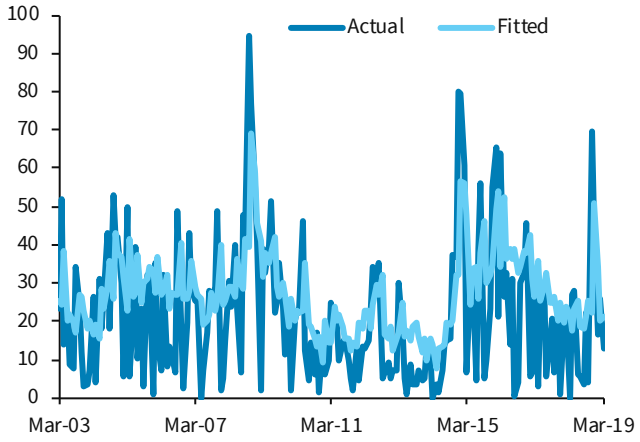
A lag in credible data, especially from non-OECD countries including China and OPEC members, can lead to poor policy decisions

The effect of forecasting errors is exaggerated by a lag in the availability of credible data on supply, demand and stock levels. Most credible data on these critical market parameters is delayed by at least two months, which reduces the effectiveness of volatility-suppressing agents (OPEC or market forces). The most recent examples include OPEC's overachieving on its 'rebalancing' agenda in early 2018 and then Saudi Arabia going too far to offset the loss in Iranian supplies due to sanctions.

Data lags are the primary reason why market participants, such as OPEC, Saudi Arabia, and Russia, will lack precise forecasts (or even current information) about how to alter production policy as the market shifts. In the future, such misinformation may even lead to a poor use of strategic stockpiles. In this environment, in an effort to reduce volatility, OPEC+ faces an even higher probability of over- or undershooting in its supply response, especially when the market perceives that it has substantial swing capacity at its disposal.

FIGURE 6

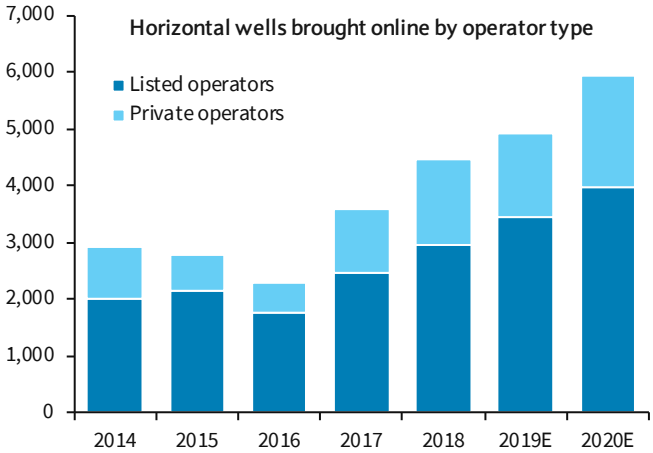
Brent 1-m realized volatility vs. our model output



Source: Barclays Research

FIGURE 7

Private companies will continue to play a significant role in the Permian region and are most elastic to price changes



Source: DrillingInfo, Barclays Research

An energy boost for the US economy

Increased shale energy production has benefited the US economy through…

The dramatic changes in the energy sector over the past decade have affected more than just global oil markets. They have also left an imprint on the US economy visible across trade, investment, industrial production and employment. We take a national accounts approach and find that the increase in US energy production has helped lift economic growth by 20-25bp per year over the past decade, mainly through increased exports and investment. Our estimates are consistent with other literature in the field that uses different approaches.

…an improved trade balance, higher employment and investment

As production and imports grow over the next five years, we expect the US petroleum trade balance to be in surplus for the first time since the mid-1990s. We estimate that the nominal petroleum trade surplus as share of GDP will reach 0.5% by 2025, from its current deficit of 0.1% of GDP, implying the direct effect from trade alone is likely to be 10bp per year. However, the indirect gains through increased employment, investment and a boost to consumer purchasing power mean that the overall effect is likely to be higher (close to 20bp per year), in line with the experience over the past decade.

The energy revolution has left an imprint on the US economy

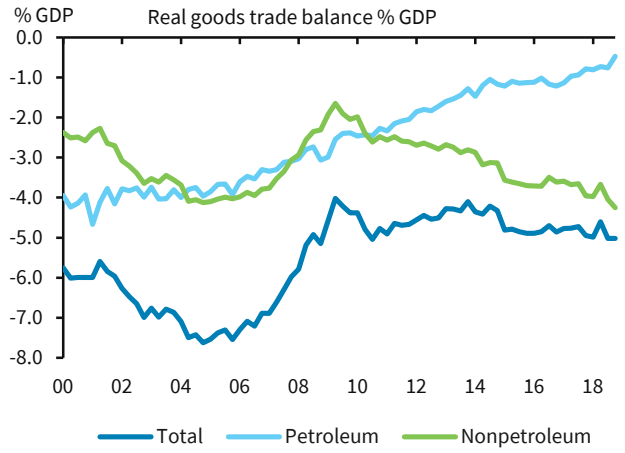
The energy trade deficit has narrowed significantly, and we expect it to turn into surplus in the coming years

The effect of increased shale production has been most notable on US trade. In the past two decades, the real trade deficit in petroleum products is expected to narrow from 4.0% of GDP in 2000 to 0.5% by the end of 2018 (Figure 8). The nominal trade deficit has narrowed even further, to 0.1% of GDP. By the end of 2018, energy imports were roughly half that of a decade earlier. In addition, energy exports have accelerated significantly since 2015, when the 40-year ban on US crude exports was lifted. Furthermore, the improvement in the real petroleum trade balance stands in contrast to the deterioration in the non-petroleum trade deficit and underlines the importance of the US's newly found energy abundance to the overall economy.

Business investment spending has been another beneficiary of this energy revolution. For example, since 2000, investment related to the energy sector increased fourfold, with the growth rate averaging about 20% per year. As a result, energy-related investment as a share of GDP increased to 1.28% in 2014, six times higher than in 2000. Although it has most recently settled at a somewhat more modest share of 0.71% (Figure 10), the share of energy-related investment remains higher than the historical average. The relative share of oil and gas extraction in industrial production has also risen to 12.8% in recent years, though it sits below the peak levels reached in 2015 (16.2%).

FIGURE 8

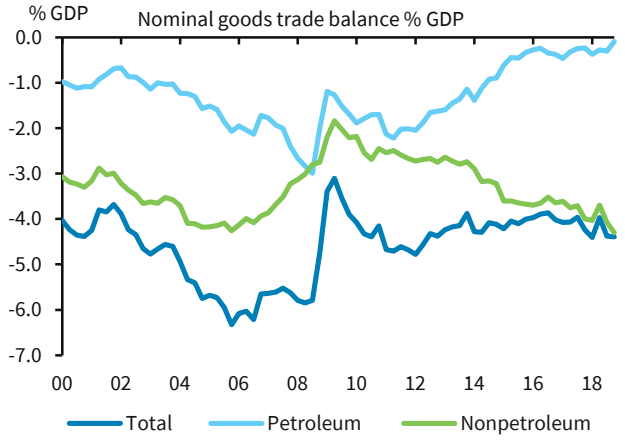
Real and nominal goods trade deficit supported by…



Source: Census Bureau, BEA, Haver Analytics

FIGURE 9

… a shrinking petroleum deficit



Source: Census Bureau, BEA, Haver Analytics

Direct employment in the extracting industries remains modest on aggregate, but once supporting industries are included, the benefits become clearer

The benefits of the expansion of the energy sector on employment are less clear cut. For one, jobs created in one sector imply less employment in another when the economy is at maximum employment. Additionally, the aggregate number of workers employed by energy-related sectors is relatively small. For instance, employment directly involved in oil and gas extraction stands at a paltry 150k (Figure 11) versus total private nonfarm employment of 128 million. Admittedly, this excludes employment in support sectors; jobs in support activities and in pipeline construction total 285k and 188k respectively. Neither does it include employment in linked sectors such as petrochemicals, excluding pharmaceuticals and consumer toiletries, which employ an additional 437k workers. As such, workers employed directly in the oil and gas extracting sector make up only 15-25% of the overall employment that one could attribute to the boom in the energy sector. But the total still adds up to only slightly in excess of 1 million workers.

The indirect effects from the increased energy production are harder to estimate…

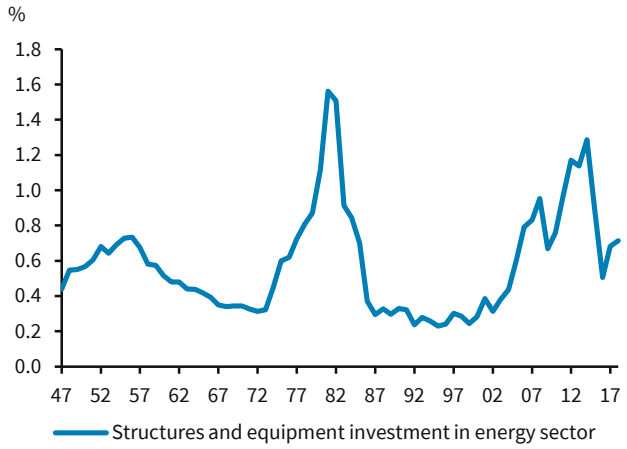
Other potential indirect effects of US energy abundance on activity are harder to document. For example, lower energy prices as a result of rising supply, all else equal, give households and businesses more money to spend on other things. These cost savings for firms and households free up cash to be spent elsewhere or saved (and spent in the future). We cannot tell which dollar saved on energy is spent where, but the cost savings increase households' standard of living and boost business profitability by lowering input costs.

… they could benefit consumers through higher purchasing power from cheaper energy…

One way to gauge the benefit of lower energy prices for the consumer is to look at episodes of energy price shocks and estimate the subsequent change in personal consumer spending. Declines in headline CPI inflation outside of recessions are relatively rare; over the past three decades, they have occurred in only four quarters: Q2 03, Q4 06, Q2 10 and Q4 2014 (the four circles on Figure 12). In each, real consumer spending picked up notably from its previous pace, rising 4.5% in Q2 03, 3.9% in Q4 06, 3.2% in Q2 10 and 3.5% in Q1 2015 (Figure 13).

FIGURE 10

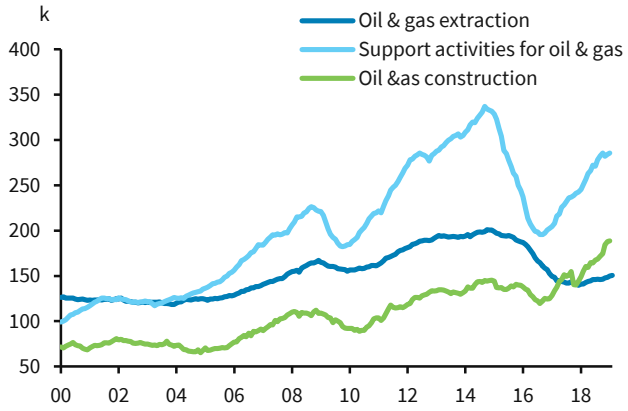
Mining structures investment has increased as a share of GDP as rig count rises



Source: BEA, Haver Analytics, Barclays Research

FIGURE 11

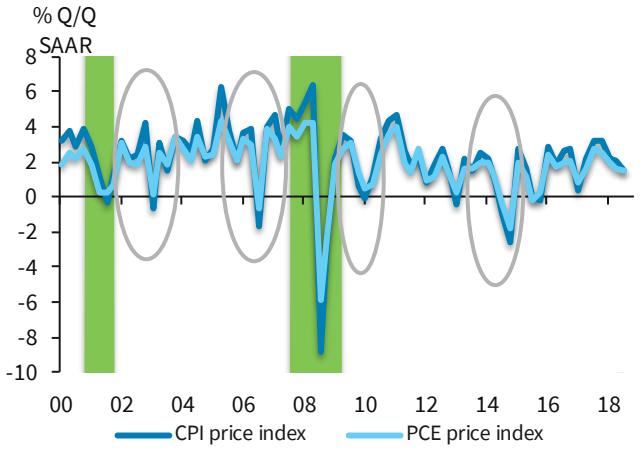
Total employment attributed to oil and gas extraction



Source: BEA, Haver Analytics, Barclays Research

FIGURE 12

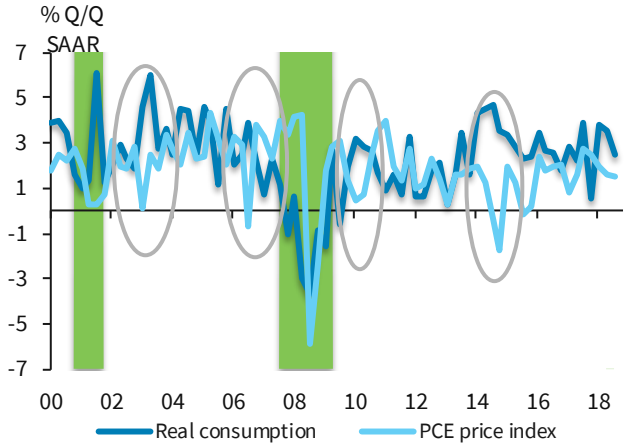
Declines in consumer prices outside of recession…



Source: BLS, BEA, Haver Analytics, Barclays Research

FIGURE 13

… provide a boost to consumer spending



Source: BLS, BEA, Haver Analytics, Barclays Research

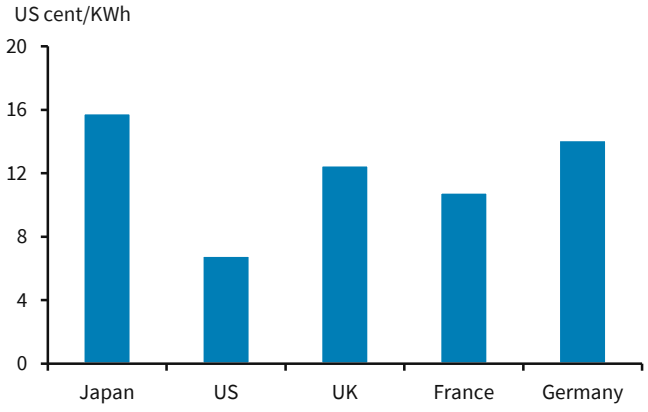
It is clear from these episodes that better real consumer income translated into stronger real consumer spending relatively quickly. For instance, during 2015, when prices of consumer energy goods and services fell 20%, US real consumer spending growth accelerated about 200bp relative to its trend immediately before and after the shock. Similarly, in the late 1990s, the decline in energy prices associated with weak global growth during the Asian financial crisis was a key factor driving strong US consumer spending and GDP growth. By this admittedly simplistic estimate, a 10% exogenous decline in oil prices could increase US real consumer spending by 100bp and translate into a 70bp boost to US GDP growth.

… and firms through lower energy input cost

Additionally, cost advantages associated with the lower domestic energy prices may induce firms to locate production in the US that otherwise would have occurred elsewhere. This is likely more important for natural gas than oil given that natural gas markets are not yet globalized. We think that the indirect benefit to growth from these sources is relatively modest. For one, as Figure 14 shows, energy prices in the US are already significantly lower than in other large industrialised economies. Some firms in those industries that use energy heavily on the margin are more likely to locate facilities in the US than elsewhere. However,

FIGURE 14

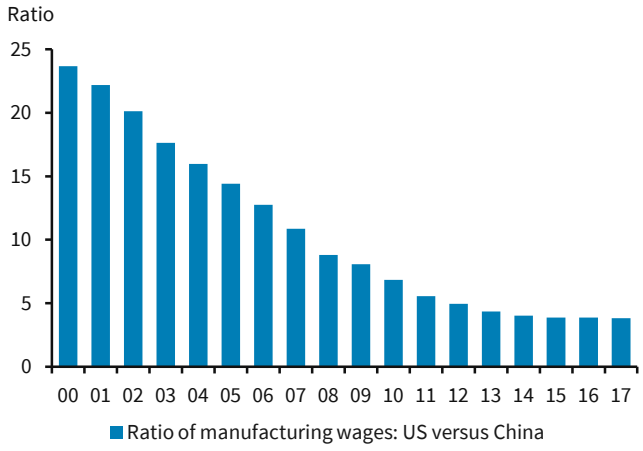
Comparison of energy prices paid by private businesses



Source: Japan Agency for Natural Resources and Energy, IEA, Barclays Research

FIGURE 15

The manufacturing labor cost differential between the US and China



Source: BLS, Ministry of Labor and Social Security, Haver Analytics, Barclays Research

it is not possible to measure how much of this incremental shifting in production has taken place without a proper accounting of additional factors that drive firm decisions such as labour-cost differentials and the pool of skilled labour. On the former, although large manufacturing economies such as China have been closing the wage gap differential, labour costs remain relatively more expensive in the US (Figure 15).

Bringing it all together: How the contributions to growth add up

We estimate that the increased shale energy production has boosted growth 20-25bp per year on average

The narrowing of the petroleum trade balance implies a boost of almost 20bp per year to growth over the past ten years. We find the direct long-term effect from investment spending to be more modest, especially following the negative oil price shock of 2015, when the share of energy investment in GDP fell dramatically. By our calculations, energy investment has likely boosted growth only by about 5bp per year. Taken together, these two channels point to a meaningful positive contribution of 20-25bp from the energy sector on the overall economy, on average over the past decade.

Our estimates are consistent with other studies, which find significant positive benefits of the energy revolution on activity, employment and wages (Figure 16). For instance, a study by the Dallas Fed used a Dynamic Stochastic General Equilibrium (DSGE) model to try to capture the overall effects from the energy production boom on prices, consumption, investment and net trade.[3] They found that through 2010-15, the surge in oil production boosted GDP growth by about 20bp per year, not very different from our estimates.

At a more micro level, Feyer *et al*[4] found substantial effects of an exogenous shock from increased fracking activity on country-level income and employment. Finally, a study by the American Petroleum Institute presented a potential upper-bound estimate of the overall contribution of the oil and natural gas industry at 7.6% of GDP in 2015.[5] As a result, we think that our growth-accounting approach, which primarily accounts for the trade and investment implications of the shale revolution, should be viewed as a conservative base case.

FIGURE 16

Different methodologies point to a significant effect of the energy revolution on the economy

Study estimates of the effect of oil revolution on the economy	Methodology	Source
Narrowing in trade deficit due to higher oil production, reduced imports and increased exports. Boost investment in energy-related infrastructure and equipment	Growth accounting	Barclays Research
The increase in US oil production in 2015, relative to 2010, boosts US real GDP by more than 1.0% versus 2010 levels; translates to one-tenth of the total GDP growth between 2010 and 2015	Two-country DSGE model	Federal Bank of Dallas (Melek *et al*, 2017)
Supply chain multiplier: every new production job creates three jobs in the supply chain and another six in the broader economy. Every dollar of GDP created in the oil and gas sector generates two dollars in the supply chain.	Supply chain analysis	IHS Markit
Estimates contribution of the oil & natural gas industry to 2015 GDP in level terms. Total contribution is estimated at $1.3trn, or 7.6% of 2015 GDP.	Input-output accounting focusing on employment and capital investment	American Petroleum Institute
Every $1.0mn of oil and gas extracted produces $66k in wage income, $61k in royalty payments, and 0.78 jobs within the county. Within 100 miles of the new production, $1.0mn generates $243k in wages, $117k in royalties, and 2.49 jobs.	County-level analysis of effect on wages and employment	NBER working paper (Feyrer *et al*, 2015)

Source: American Petroleum Institute, Federal Bank of Dallas, HIS, NBER, Barclays Research

[3] Nida Cakir Melek, Michale Plance, Mine Yucel (2017), *The US shale oil boom, the oil export ban and the economy: A general equilibrium analysis*, Dallas Fed working paper 1708.
[4] James Feyrer, Erin Masur, Bruce Sacerdote (2015), *Geographic dispersion of economics shocks: Evidence from the fracking revolution,* NBER working paper 21624.
[5] *Impacts of the oil and natural gas industry on the US economy in 2015*, American Petroleum Institute.

Is there a productivity effect?

Productivity growth in the extractive sector has risen significantly since the energy revolution…

In thinking about the effects of additional oil and natural gas production on output and jobs in the US, it is useful to consider two situations. When the economy is short of full employment, the increased output is likely to boost aggregate GDP and employment through both direct and indirect effects. However, once the economy is at full employment, increased energy activity is likely to come at the expense of other activities, unless it raises the overall level of productivity. This is because as the increased activity helps push the economy above full employment, the Fed gradually needs to reduce accommodation to guide the economy back to full employment to prevent inflation from rising above target.

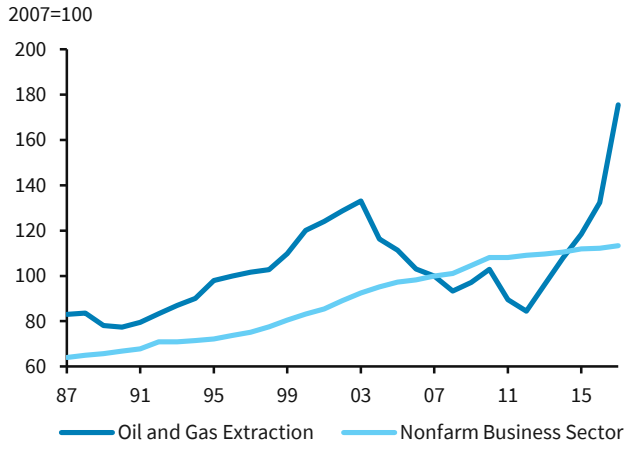
Thus, when the economy is at full employment, the rise of shale drilling technology is perhaps best thought of in the same vein as other technology shocks. They increase productivity as firms figure out ways to take advantage of lower-cost methods of doing business. Similar to other productivity shocks, this is likely to allow the economy to grow somewhat faster without generating inflation than it would without the shock. However, it is not necessarily the case that this will lead to an increase in aggregate productivity growth, which is the sum of not only this shock, but also many other technological shocks.

… and has significantly outpaced overall productivity growth

So far, it is clear that shale energy development has significantly boosted productivity for the oil and gas extraction sector (Figure 17): over the past five years of available data output per hours worked in this sector rose 15% per year on average, compared with 1.0% for the non-farm business sector as a whole. However, its small share in the gross value add of the economy (about 1%) has meant that its contribution to productivity growth has been about 0.15% per year. That said, this is not an insignificant contribution when compared with overall productivity growth that has average only around 1% per year over the past decade (Figure 18).

FIGURE 17

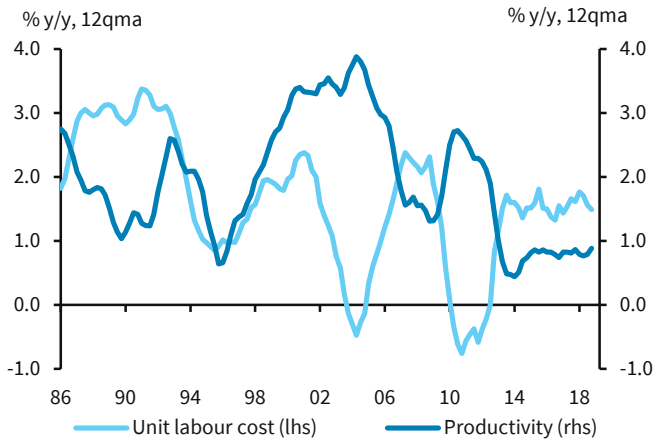
Oil and gas extraction productivity growth has…



Source: BLS, Haver Analytics, Barclays Research

FIGURE 18

… significantly outpaced the overall economy since 2012



Source: BLS, Haver Analytics, Barclays Research

Support for a higher USD fair value

New energy economy likely to boost the USD fair value and dampen negative USD-oil correlations

The new energy economy also has implications for currency markets. We estimate that it has already boosted the USD's fair value by 3-4% since 2011 and may potentially raise it a further 5% over the next five years under our forecasts for oil and the US energy sector. Additionally, we expect a net energy trade surplus in the coming years, alongside the rising importance of supply-side factors in the oil market, to further dampen negative USD-oil correlations over time, potentially flipping them to positive.

A stronger USD on rising terms of trade and higher relative productivity

The effect on the USD can be estimated via the effect on medium-term macro factors…

The effect of the new energy economy on the USD's fair value is largely via the US's terms of trade and relative productivity. Although over extremely long horizons, real exchange rates tend to revert towards long-term averages under a model of relative PPP, fundamentals such as terms of trade, relative productivity differentials, etc. have been found to matter over intermediate time horizons (see *Currency valuation from a macro perspective*, 14 June 2011). These fundamentals capture persistent trends in real exchange rates that constitute a different macroeconomic equilibrium.

…which appear to explain long cycles in the USD

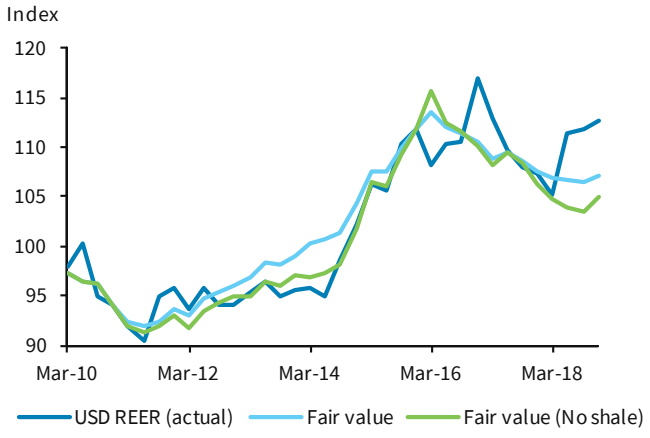
We fit one such fair-value model for USD real effective exchange rates (using trade weights in manufacturing sectors) using a commodity terms-of-trade index, productivity differentials, relative government consumption levels and the country's net foreign asset position. Figure 19 shows that although the USD has gone through extended cycles relative to its long-term average, these are largely explained by macroeconomic variables (ie., the fair value tracks closely the REER). Much of the fluctuations of the USD's fair value are, in fact, explained by shifting terms of trade, with additional contributions from the other variables.

The USD fair value is now 3-4% higher than what would have been if the shale revolution had not happened

We consider a partial equilibrium approach of what USD fair value level would have prevailed if US oil production and net energy exports had remained at pre-Shale (pre-2011) levels. Specifically, we estimate the effect that the status quo would have implied in terms of slower growth in US relative productivity (versus trading partners) and for the US's terms of trade (under a simplifying assumption that global oil prices had evolved exogenously). Extrapolating from estimates by researchers at the Fed that the shale boom added nearly 1% to US GDP in 2010-15,[6] we project that US relative productivity would have been 1.5-

FIGURE 19

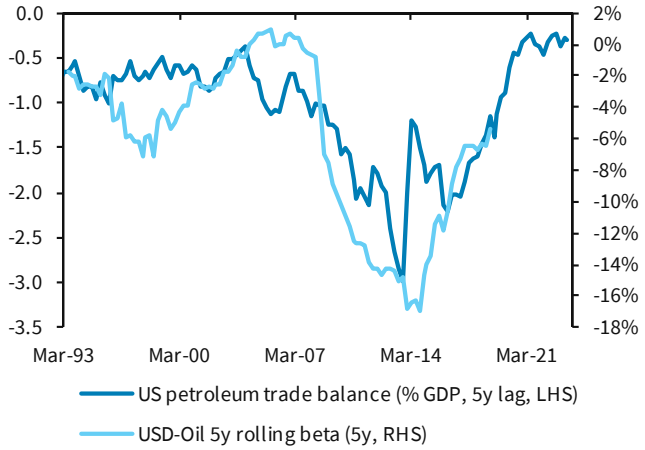
USD fair value vs. counterfactual levels if US energy exports and imports remained at 2010 levels (as a share of total)



Source: Barclays Research

FIGURE 20

USD-oil sensitivity has tracked moves in the US petroleum balance



Source: Haver Analytics, Barclays Research

[6] Melek, Nida Çakir, Michael Plante, and Mine K. Yücel. The US shale oil boom, the oil export ban, and the economy: A general equilibrium analysis. No. w23818. National Bureau of Economic Research, 2017.

2pp lower if the new energy economy had not developed as it has since 2010. Additionally, we estimate that the US terms of trade would have also been 2-3pp lower, reflecting the higher energy imports that existed in 2010, with the simplifying assumption that oil prices would have evolved the same way since that time. However, this likely biases down our estimates for the terms of trade boost and, hence, the effect of the shale boom on the USD versus the counterfactual. Overall, we estimate that the USD's fair value would have been 3-4% lower if the shale revolution had not happened (Figure 19).

Our baseline scenario for oil and US energy sector implies another 5% boost to the USD's fair value over the next five years…

We expect continued investment in the energy sector, alongside increased US net energy exports, to continue to support the USD in the years to come. Our expectations are for energy exports to rise nearly 10% per year, versus a 1% annual drop for energy imports, and for the energy trade balance to swing to a surplus of 0.6% of GDP in five years. As such, we expect this dynamic, along with our forecast for modestly higher oil prices ($80/bbl in five years), to boost the terms of trade more than 3-4%. Further, we expect additional development of the new energy economy to add upwards of 1% in terms of per capita GDP on an incremental basis. Overall, we see the USD's fair value rising roughly 5% over the next five years as a result.

…supporting additional USD appreciation as long as favourable cyclical factors remain

That is not to say that the USD needs to appreciate 5%, however. Starting points matter, and the USD remains 5-10% overvalued at current levels, helped by cyclical factors such as the US's outperformance versus the rest of the world and high cost of carry that makes it punitive to short. A move higher in the USD's fair value would allow additional USD appreciation as long as favourable cyclical factors remain.

Towards a positive USD-oil correlation

We believe the new energy economy has implications for the USD's sensitivity to oil prices. A 5-year regression beta shows that the USD's sensitivity to oil prices has fluctuated a lot (Figure 20). For much of the late 1990s and 2005-13, the USD's beta to oil had been strongly negative, implying that higher oil prices corresponded with a lower USD. However, over the past five years or so, these relationships seem to have become weaker.

USD-oil correlation has become less negative, alongside the US becoming less of an energy importer

We believe this may have something to do with US net energy exports. Figures 20 and 21 point to a potential relationship between US net oil trade and the USD's correlation with oil prices. As the US has become less of an energy importer, higher oil prices have been less of a drag on its external balances and, hence, imply a less negative relationship with the exchange rate.

The energy trade balance has a modulating effect on the link between oil and the USD

We establish the importance of the oil trade balance in modulating the effect of oil prices on the USD via a series of regressions. Figure 21 shows different regression specifications for explaining returns for the USD REER using its lag and changes in real oil prices. We find that although real oil prices have had a significant negative effect on the USD, its relationship is dependent on the US net energy trade balance. Specifications that include the energy balance interacting with the change in real oil prices are found to have a positive and statistically significant effect on the USD (see specifications [3] and [4] in Figure 21). This implies that, as the net energy balance shifts to positive over the coming years, the effect of oil price increases on USD is likely to become positive.

FIGURE 21

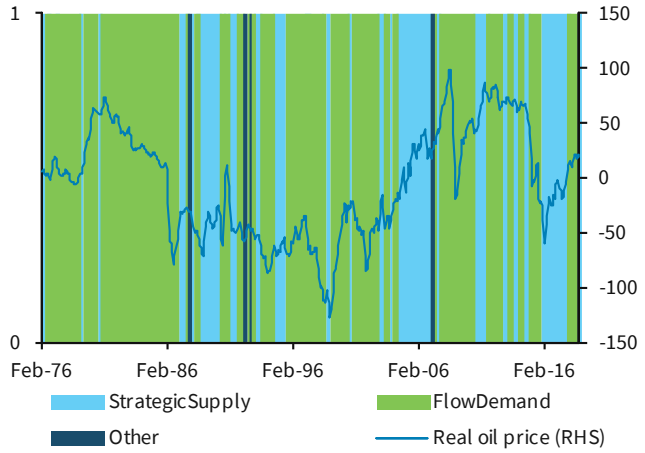
Regressions of USD REER returns on real oil price moves suggest the importance of the net energy trade balance (TB)

	[1]	[2]	[3]	[4]
USD REER (-1)	0.36***	0.34***	0.33***	0.32***
Energy TB	-0.02	-0.02	-0.03	-0.02
Real Oil Price		-0.02***		
Energy TB * Real Oil Price			0.02***	
Energy TB * Strategic Supply				0.03***
Energy TB * Accomm Supply				0.01
Energy TB * Flow Demand				0.02***
Energy TB * Spec Demand				-0.01
Constant	Y	Y	Y	Y
Adj. R-squared	13%	13%	15%	15%

Note: We regress USD REER returns as a function of the energy trade balance and other drivers. Specification [1] includes only TB; specifications [3] and [4] add interactive terms of TB with different drivers of the real oil price (strategic supply, accommodative supply, flow demand and speculative demand) recovered from a structural VAR similar to Killian and Murphy (2014) and Alvarez and Di Nino (2017). See Appendix for details. Source: Barclays Research

FIGURE 22

Oil price movements have been largely demand driven, but supply has become increasingly important



Source: Barclays Research

Not all oil price movements are the same, of course. For example, Buetzer *et al* (2012) show that oil price movements that are demand driven typically have a positive effect on oil exporter exchange rates relative to importers.[7] Noting that the USD may not behave as a typical oil-exporting currency, we investigate the USD-oil relationship conditioned on the underlying structural drivers in the oil market.

Our structural VAR (SVAR) model for the oil market follows the framework established by Killian and Murphy (2014),[8] who identified market shocks using sign restrictions. Our approach most closely resembles the work by Alvarez and Di Nino (2017) by explicitly taking into account OPEC's supply behaviour.[9] In the SVAR, we identify two supply regimes – one where OPEC decides to protect market share (strategic approach) and another where it targets a desired oil-price level (accommodative approach) – along with two demand-side regimes: the first where oil prices respond to flow (driven by current activity), and the second where prices reflect speculative (responding to expectations of activity) components.

Although demand-side factors have been historically more important in the oil market, supply factors have gained in importance of late

Figure 22 shows that although demand-side factors have been far and away more important in explaining oil price levels and market volatility, supply shocks have become significant in recent years. With increasing US production, the model points to increasing importance of OPEC's pursuit of market share, rather than maximizing revenue via maintaining a high oil price. Behar *et al* (2016) show using a theoretical model that a market share or 'strategic approach' strategy is OPEC's rational response in the face of slowing oil demand, increased non-OPEC production and reduced OPEC cohesiveness.[10] This implies that OPEC's consideration of reverting to a strategic approach (captured as strategic supply shocks in the model) may continue to be a key driver of prices over the medium-term if the above conditions remain in place. In the near term, however, OPEC is likely poised to opt to maximize revenue instead, due to fiscal constraints.

[7] Buetzer, et al (2012), *Global exchange rate configurations: Do oil shocks matter*, ECB working Paper Series.
[8] Kilian and Murphy (2013), "*The role of inventories and speculative trading in the global market for crude oil*," Journal of Applied Econometrics.
[9] Alvarez and Di Nino (2017), "*The oil market in the age of shale oil*," ECB Economic Bulletin.
[10] Behar et al (2016), *An analysis of OPEC's strategic actions, US share growth and the 2014 oil price crash*, IMF Working Paper.

Regressions that explicitly take into account the nature of the oil shock in its effect on the USD are shown in Figure 21. Both strategic supply and flow demand shocks are found to have a significant effect on the USD, again modulated by the net energy trade balance. As such, we expect the influence of oil price increases on the USD to become positive in the coming years, representing a major shift in asset market correlations.

Flight to quality in global capital flows negative for EMs

Muted oil price gains and periodic fluctuations are potential negatives for global capital flows

A moderation in oil prices, alongside potentially more oil market volatility, implies a flight to quality of oil investment flows. We believe this will likely have an adverse effect, particularly for external capital flows to EM energy producers, as well as other implications for EMs. Lower oil prices negatively affect the debt capacity of EM energy producers and make them less attractive as destinations for international capital, particularly non-FDI flows. Risk premia are likely to rise in both external and local markets, with knock-on negative effects on the real economy. Increased oil-price volatility should reduce the attractiveness of financing long-term projects and is likely to impede net FDI into EM.

Capital flows to EM are more tightly linked to higher commodity prices, including oil

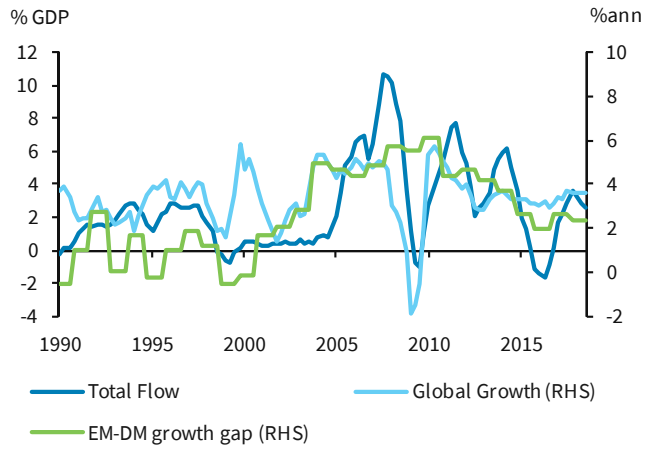
The rapid increase in international capital flows towards EM since the late 1990s has been well documented. Alongside a backdrop of improving institutions (rule of law, governance etc) and increasingly independent central banks, including the adoption of inflation targeting, opening of capital accounts and the adoption of flexible exchange rates, this period coincided with EM economic outperformance and increased capital inflows (Figure 23). However, international capital flows to EM seem more tightly linked to higher commodity prices, including oil (Figure 24).

Higher oil and other commodity prices increase the ability of EMs to obtain financing

That there is a close relationship between oil and other commodity prices with EM capital flows may reflect their importance in obtaining financing. In relatively underdeveloped capital markets, the existence of tangible/hard assets is critical in establishing a financing relationship. Fisman and Love (2003)[11] and Braun (2003)[12] show that sectors with more collateralizable assets are able to access external financing in countries with weaker financial institutions. Firms with more easily verifiable revenue and hard assets, such as those engaged in external trade and commodities production, are able to borrow in external

FIGURE 23

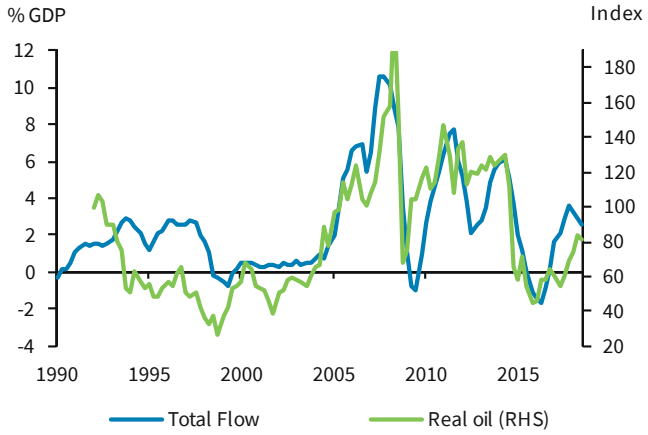
EM capital flows reflect global and relative EM growth prospects



Note: Total EM capital flows calculated by aggregating balance of payments data. Source: Barclays Research

FIGURE 24

…but have a strong positive relationship with real oil prices



Source: Barclays Research

[11] Fisman, Raymond, and Inessa Love. "Trade credit, financial intermediary development, and industry growth." The Journal of finance 58, no. 1 (2003): 353-374.

[12] Braun, Matias. "Financial contractability and asset hardness." Available at SSRN 2522890 (2005).

capital markets. Furthermore, changes in the value of collateral directly affect borrowing constraints (Kiyotaki and Moore (1997)).[13] A booming oil/commodity market increases debt capacity and the value of the firm's hard assets and, as such, may explain the positive correlation between oil and commodity prices and capital flows.

Capital flows to DM and EM show differences in terms of their drivers

We explore this relationship further by comparing capital flow drivers to EM versus those to DM. Figure 25 presents panel regressions of different types of net capital flows on real oil prices and oil volatility, controlling for global growth, relative productivity and the capital control regime. We find that whereas capital flows to DM are largely explained by global growth and relative productivity measures, the capital flows to EM are sensitive to oil price and volatility. Particularly, we find that non-FDI flows are positively related to real oil prices, while FDI flows are negatively related to oil price volatility.

Externally financed EMs are likely to be especially sensitive

Within an environment of weaker oil prices and higher oil price volatility, capital flows to EM are likely to be constrained. We expect external financing-dependent countries, which are especially sensitive to these factors, to be negatively affected by these developments. Given that domestic credit booms are normally preceded by large capital inflows (Kaminsky and Reinhart (1999)),[14] reduced international capital flows are likely to increase risk premia in both external and local assets.

This implies increased risk premia on LatAm oil economies, as well as potentially the Middle East, in the years to come

Risk premia are likely to rise in countries for which external financing flows have tended to be oil-linked, such as Colombia, Mexico and Venezuela but also for those that will need to attract capital inflows in years to come, eg, in the Middle East. A higher risk premium on external capital flows implies higher borrowing costs, weaker FX and lower equity valuations over the medium term.

FIGURE 25

Oil price levels and volatility show up as determinants of capital flows to EM vs. DM

	Total	Non-FDI	Portfolio	FDI	Debt	Equity	Other
			DM (10 countries, Q1 1985 - Q3 2018)				
Global GDP (%q/q)	1.752***	1.680***	0.236**	0.013	-0.013	0.237***	1.430***
Relative productivity	-0.055***	-0.066***	0.010	0.025***	0.004	0.000	-0.052***
Capital controls	-2.245***	-2.097**	-1.668***	-0.365	-0.809***	-1.258***	-0.061
Real oil prices (%q/q)	0.021*	0.023*	0.008	0.002	0.000	0.008	0.006
Oil volatility	-0.019	-0.025	0.004	-0.001	0.004	0.002	-0.010
			EM (19 countries, Q1 1985 - Q3 2018)				
Global GDP (%q/q)	0.398***	0.389***	0.054	-0.002	0.034*	0.040	0.237***
Relative productivity	-0.076	-0.008	0.043*	-0.009	0.014	0.022	-0.014
Capital controls	-0.084	0.056	-0.260***	-0.104**	-0.041	-0.183**	0.304***
Real oil prices (%q/q)	0.029***	0.024***	0.005	0.001	0.001	0.004	0.008*
Oil volatility	-0.006	0.020	0.005	-0.011***	0.000	0.007	-0.001

Note. We run unbalanced panel regressions using quarterly data. Estimations use panel EGLS with cross-section weights. The set of DM countries is the US, the euro area, the UK, Japan, Canada, Sweden, Norway, Switzerland, Australia and New Zealand. The set of EM countries is Brazil, Chile, China, Colombia, the Czech Republic, Hungary, Indonesia, India, Israel, Korea, Mexico, Malaysia, Philippines, Poland, Romania, Russia, Thailand, Turkey, Taiwan and South Africa. Source: Barclays Research

[13] Kiyotaki, Nobuhiro, and John Moore. "Credit cycles." Journal of Political Economy 105, no. 2 (1997): 211-248.
[14] Kaminsky, Graciela L., and Carmen M. Reinhart. "The twin crises: the causes of banking and balance-of-payments problems." *American Economic Review* 89, no. 3 (1999): 473-500.

Can US energy abundance stymie clean energy progress?

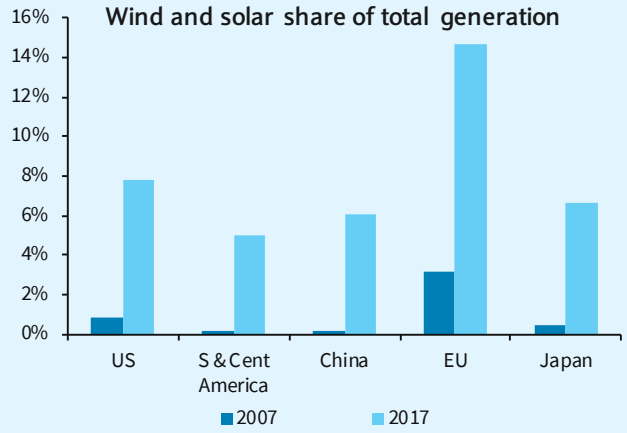
As the world continues to demand more energy, the energy industry is likely to face mounting investor and environmental pressures to decarbonize or reduce the carbon and GHG emissions intensity of its energy production. On the face of it, the rapid increase in US oil and gas production seems to fly in the face of such global aspirations. Though growing shale production has lowered energy prices and encouraged higher consumption, in other ways, the energy abundance provides some clean energy benefits. Despite a perceived shift in energy policy by the Trump administration from the Obama administration, the US has maintained a formidable presence on a global scale in renewable-energy generation and as a destination for clean energy investment. Furthermore, the increase in natural gas supply in the US, as well as the export of it, has helped decarbonize the power mix by reducing coal-fired generation.

First, the increase in hydrocarbons production and exports in the US has not come at the expense of renewable energy. As a share of total electricity consumption, solar and wind's share has increased threefold, to 8% of the power mix from 2010 to 2018 (Figure 27). During the last ten years in the US, the seven percentage point increase in solar and wind's penetration, to 7.8%, has outpaced the growth in China and has been second only to the European Union's roughly 10pp gain (Figure 26).

And the increase in natural gas supply has reduced greenhouse gas (GHG) emissions by displacing coal generation in the United States, as well as in places that are now the recipients of US LNG. The increase in natural gas-fired power generation has helped reduce the emissions intensity of the power sector, since each unit of energy produced with natural gas is roughly half as carbon-intensive as a unit of energy produced from coal. Based on IEA estimates, US LNG exports could supply 5% of global gas consumption by 2030, up from 1% currently.

FIGURE 26

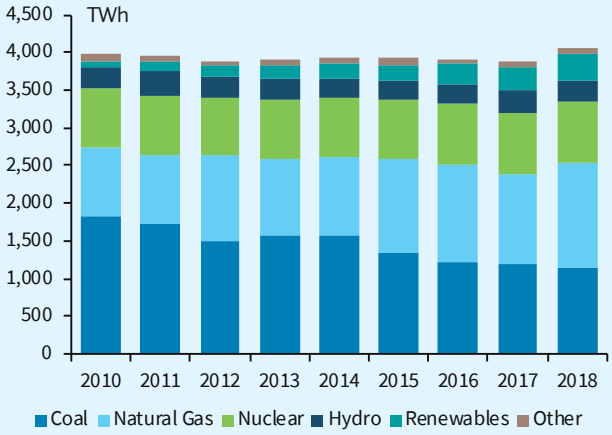
US share of wind and solar generation has increased significantly over the past decade



Source: BP, Barclays Research

FIGURE 27

Most of the increase has come at the expense of coal



Source: EIA, Barclays Research

Third, clean energy investment in the US has accelerated in the past several years and now accounts for roughly 20% of the global total, second only to China. Despite the apparent change in focus from the Trump administration, clean energy investment in the US has grown at a rate of almost 7% since 2016, compared with an average 4% under Obama. The composition of investments is also important. Although China has outpaced the US in terms of solar and wind, which account for 80% of the $330bn invested in clean energy in 2018, the US leads in terms of other clean energy investments. Despite a lack of cohesive national policy, investment at the state, local, and corporate level is making a difference.

Although these macro figures reinforce that the fact that US energy abundance reduces fuel prices, low prices will delay the adoption of more efficient and less carbon-intensive vehicles. SUV sales have only increased as a share of global passenger vehicle sales in the past four years, which has stopped the declining trend in fuel economy. Even the perception of energy abundance has encouraged the Trump administration to weaken planned increases in fuel economy standards. At the same time, China has solidified its role as the clear leader in EV sales. There, EVs now account for 7% of the country's new car sales and those sales accounted for almost half of the EVs sold in the world, twice the share of the US.

The geopolitics of energy abundance

"With these incredible resources, my administration will seek not only American energy independence that we've been looking for so long, but American energy dominance. And we're going to be an exporter — exporter. We will be dominant. We will export American energy all over the world, all around the globe. These energy exports will create countless jobs for our people, and provide true energy security to our friends, partners, and allies all across the globe." --President Donald Trump, 29 June 2017

Tight oil has blunted countries' use of energy as a way to achieve foreign-policy goals directly; energy abundance has shifted geopolitical alignments and encouraged countries to use their energy leverage differently

Perhaps no other major asset class is as entangled with geopolitics as energy. The critical events of the previous century mostly took place from a mindset of energy scarcity.[15] Now, greater energy abundance due to US shale is altering how countries handle the relationship between energy and geopolitics. Energy abundance in the US has shortened the industry's investment cycle, and oil- and gas-market liquidity has blunted the use of energy as a weapon to achieve foreign-policy goals directly (by large energy exporters). Abundance has also shifted the strategies of national oil companies (NOCs) and investment flows, fundamentally altered the structure of the market, institutions such as OPEC, and its member country relationships and has exposed new vulnerabilities and strengths that were not present in an age of energy scarcity.

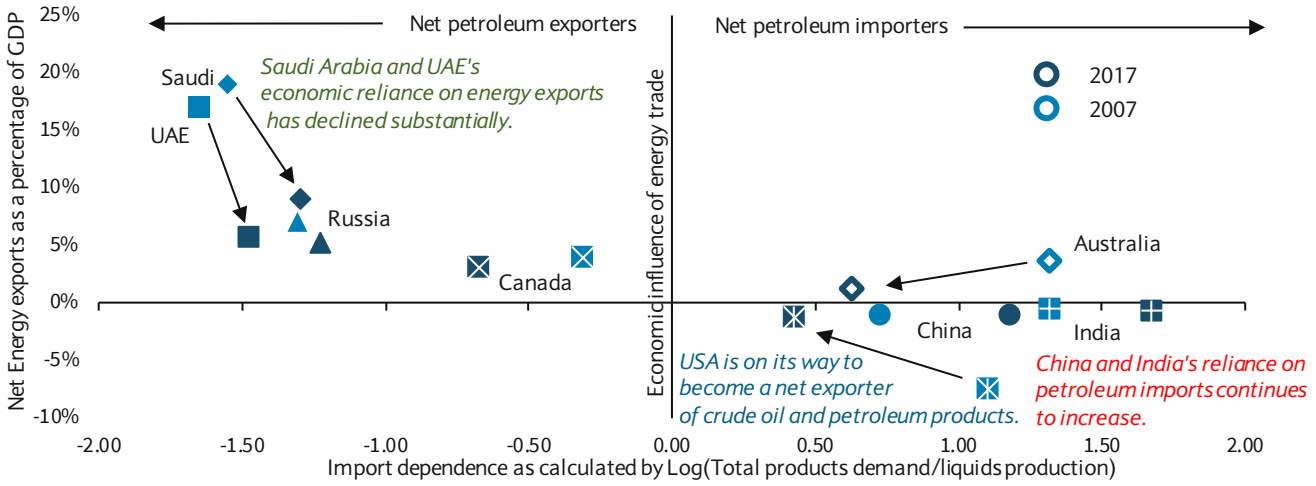
Augmented US sources of soft and hard power

Energy abundance has augmented US soft power and fuelled a perception that the US is scaling back on its presence in the Middle East

Energy abundance has augmented US sources of soft and hard power. Today, countries including the US are benefiting from the perception that their energy abundance shields them from disruptions of energy imports, which helps the US's ability to influence world events and shepherd international consensus on common security concerns.[16] As a result, US policymakers feel comfortable scaling back military capabilities in the Middle East to redirect resources to threats posed by Russia and China. But this leaves other countries in the region questioning the US's level of commitment to their security.[17]

FIGURE 28

In the last decade, the shift from scarcity to abundance has changed the degree of reliance from an import security and economic perspective



Source: IMF, World Bank, BP Statistical Review, IEA, Barclays Research

[15] For multiple examples of this scarcity ideology, see Robert Bryce, "*$40 oil and the twilight of 'scarcity ideology'*" Manhattan Institute. 25 April 2016.
[16] See Meghan O'Sullivan. *Windfall*. Harvard Belfer Center Press, 2017.
[17] Karlin, Mara and Tamara Wittes. "*America's Middle East Purgatory*." Foreign Affairs. Jan/Feb 2018. Vol. 98:1.

There are many examples of US economic statecraft that would not have occurred without the shift to energy abundance. In a recent speech at a major industry conference, Secretary of State Mike Pompeo noted that the US energy abundance has "widened our toolbox."[18] It has driven the House of Representatives to pass legislation making it illegal for OPEC to manipulate supply (see *House Judiciary Committee passes NOPEC bill*, 7 February 2019); allowed the Trump Administration to leave the P5+1 Joint Comprehensive Plan of Action, thereby reducing Iran's oil exports; accelerate sanctions on Venezuela; and employ increased leverage in trade negotiations with China.

The US will not be immune to such volatility

American consumers will remain vulnerable to supply shocks elsewhere because the US transport sector remains 97% dependent on liquids fuels and will remain over 90% dependent until 2040, according to EIA projections

But that does not mean the US is permanently invulnerable to oil supply shocks. For example, American consumers will remain vulnerable to supply shocks elsewhere. That is because the US transport sector remains 97% dependent on liquids fuels and will remain over 90% dependent until 2040, according to EIA projections. Even in an accelerated EIA scenario, the heightened dependence that the US has on petroleum is unlikely to shift dramatically by even 2030. Also, the secure flow of oil via the Strait of Hormuz represents almost 20% of the word's consumption, and an inability to secure this, leading to higher energy prices, would threaten the economic viability of not only the US economy, but also its major trading partners and key economic heavyweights including China, Japan, South Korea, and Taiwan.

US/Saudi interdependency is unlikely to change in the next five or even 10 years no matter how much US tight oil is added, so long as global oil demand continues to increase

Moreover, abundance only goes so far. The singular ability of Saudi Arabia to influence prices because it holds the majority of the spare capacity in the world also gives it a cushion in its longstanding relationship with the United States.[19] The US, of course, needed Saudi Arabia to keep prices low while it was implementing Iran sanctions. President Trump stated, ""Saudi Arabia, if we broke with them, I think your oil prices would go through the roof. I've kept them down. They've helped me keep them down."[20] This interdependency will not change in the next five or even 10 years no matter how much US tight oil is added, so long as global oil demand continues to increase.

Abundance inserts volatility and exposes vulnerability

The energy abundance has also inserted new volatility into the market. It has created the perception that major producers and consumers can influence political outcomes at different price levels. For example, some news publications suggested that Saudi Arabia influenced the 2018 midterm elections by keeping oil prices from moving higher.[21]

Abundance has also strengthened U.S. leverage as it aims to influence world events in its own interest, and it sometimes enhances America's ability to shepherd international consensus on common security concerns.[22] US policymakers believe they have the ability to adopt strategies to benefit from perceived independence. As a result they are engaging in a scaling back of US military capabilities in the Middle East in order to redirect resources to threats posed by Russia and China, thus leaving other countries in the region questioning the US's level of commitment to their security.[23]

Mitigating market volatility has created new relationships. Furthermore, the shale-induced abundance created a bridge between Saudi Arabia and Russia that had not been present beforehand. The real or perceived notion that the US was reducing its exposure in the Middle East as a result of energy independence caused Russia to step into the power

[18] https://www.state.gov/secretary/remarks/2019/03/290303.htm
[19] See https://thehill.com/opinion/energy-environment/413598-khashoggi-affair-exposes-myth-of-us-energy-dominance
[20] https://www.cnbc.com/2019/01/07/mike-pompeo-oil-prices-dont-influence-us-response-to-khashoggi-crisis.html
[21] Krane, Jim and Bill Arnold. "Is Saudi Arabia Helping Trump in the Midterms?" *Politico*, 24 October 2018.
[22] See Meghan O'Sullivan. *Windfall*. Harvard Belfer Center Press, 2017.
[23] Karlin, Mara and Tamara Wittes. "America's Middle East Purgatory." *Foreign Affairs*. Jan/Feb 2018. Vol. 98:1.

vacuum.[24] Saudi Arabia made clear its unwillingness to cut supply on its own post-2014, so it built bridges with Russia to manage oil price volatility directly.

Price volatility exposes fiscal vulnerability. Shale's price influence has exposed fiscal vulnerabilities and exacerbated the instability of countries that are still reeling from the after-effects of the Arab spring. It has caused major Middle Eastern producers to diversify their sources of hydrocarbon revenues, enhancing bilateral ties with different consumers and their investors. The IMF calculated recently that commercial activity between China and the GCC countries accelerated from $9.8bn in 2000 to $175bn in 2014.[25]

How vulnerable is Saudi Arabia to lower oil prices?

Following a few years of fiscal consolidation, the Kingdom's reliance on higher oil prices has increased again, making it able to rebalance social stability with the needed long-term adjustment in oil markets. Elevated financing needs, including for the war in Yemen, have pushed Saudi officials to seek a higher floor on crude prices and a long-term agreement with non-aligned producers. We believe its oil policy is increasingly influenced by domestic fiscal pressure, with expenditure on an upward trend despite fiscal consolidation efforts since 2015. Although the 2018 budget deficit has narrowed to its lowest level since the oil price correction, fiscal policy remains highly exposed to oil price volatility. In fact, the five-fold increase in the oil price required to balance the budget between 1999 and 2014 has considerably increased fiscal rigidities, in our view. For example, the adjustment following the oil price correction was largely facilitated by a 58% drop in capital expenditure in 2014-16, compared with a 15% cut to current expenditures. Future downward adjustments to capex, in case of lower oil prices, would likely be more challenging this time.

The adoption of the largest budget ever this year is a good example of how the Kingdom's focus has shifted toward easing near-term social pressure. Although the budget is projected to be balanced by 2023, we believe such targets are unlikely to be reached. Moreover, the composition of public finances highlights growing risks to sudden and protracted shifts in oil prices. The oil price breakeven level to balance the 2019 budget has increased again above $80/bbl. To finance such deficits, the Kingdom will continue to rely on a combination of domestic and external debt issuance.

Should external debt markets experience excessive volatility, we think the Kingdom may delay any external debt issuance and rely on domestic resources. However, a sustained shift toward domestic debt issuance and the use of financial buffers will ultimately tighten domestic liquidity conditions at a time when credit growth has been anaemic since early 2017. Saudi Arabia's peg to the dollar means that lower oil prices would feed into the external balance and directly affect domestic liquidity conditions. A lower oil price would also reduce the pace of fiscal spending, notably via lower capex, which affects payments to contractors and, ultimately, the banking system. This happened in 2015-16, when the government was borrowing heavily from the domestic market and adding upward pressure on domestic rates. This time, however, credit growth is much weaker, and a new shock to domestic liquidity may prove more damaging and longer lasting. Such factors may ultimately prompt policymakers to support higher oil prices.

In our view, the Kingdom is increasingly facing a time trade-off, as domestic financing needs remain elevated in the coming years. The rapid increase in planned expenditure has kept the fiscal oil price breakeven elevated. We made some conservative assumptions about crude production, domestic energy consumption, and fiscal spending to assess the sensitivity of the budget to oil prices. Figure 29 shows how the fiscal oil price breakeven should increase closer to $100/b by 2025. If oil prices experience further weakness, that would bring about renewed OPEC/NOPEC cuts, and the Kingdom's fiscal oil price breakeven would increase to $114/b for an additional 1mb/d cut.

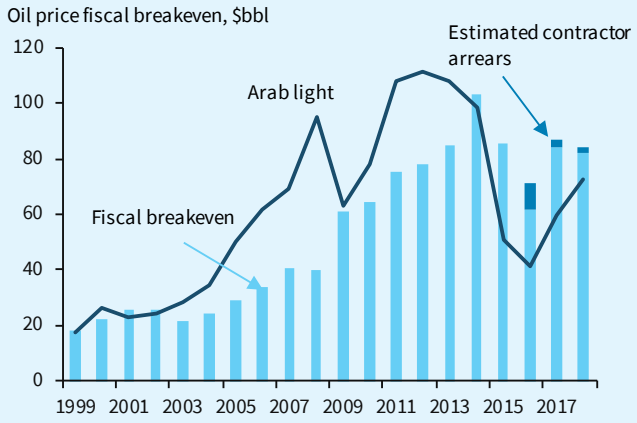
Obviously, the sensitivity analysis is based on a strong assumption of all else being equal, but a much tighter fiscal policy is likely to be implemented following any steeper decline in oil revenues. Still, Figure 30 highlights the importance of long-term Saudi cooperation with other major producers to reduce the burden on its fiscal policy. The table also points to the need for higher oil prices even under the unlikely scenario of Saudi crude production increasing to 11mb/d in the coming years. Oil prices needed to balance the budget will remain much higher than the breakeven of most US shale oil producers. Figure 30 suggests that the

[24] See for example, Liz Sly "In the Middle East, Russia is Back" *Washington Post*. 5 December 2018.
[25] See Karen Young. "The Gulf's Eastward Turn: The logic of Gulf-China Economic Ties." Feb. 2019, p. 6.

Kingdom's implicit acceptable oil price range will continue to increase unless fiscal consolidation accelerates further. However, the experience of 2015-16 shows how some unpopular measures (eg, cuts to bonuses to civil servants) were quickly reversed. In other words, the fiscal adjustment still has a long way to go, despite some progress in recent years.

FIGURE 29

The budget is reliant on higher oil prices



Source: Haver Analytics, Barclays Research

FIGURE 30

Oil price fiscal breakeven sensitivity

Production mb/d	2019*	2020*	2021*	2022	2023	2024	2025
8	105	108	113	118	124	130	137
9	89	91	95	99	104	109	114
10	77	79	82	85	89	93	98
11	68	69	72	75	78	82	85

* based on 2019 pre-Budget projections. Assumes expenditure and taxes to increase by 2.5% per year thereafter. Energy consumption is projected to accelerated by 2.5% per year

Source: Barclays Research, *Saudi Oil Policy: Adjusting to a new reality*, 7 December 2018

Energy abundance and Saudi Arabia

Saudi Arabia enjoys particular leverage but must balance multiple economic and strategic objectives

Saudi Arabia remains at the center of the global petroleum system. From a geopolitical angle, the new US energy abundance has forced Saudi Arabia to balance security and economic objectives. Price fluctuations have increased its need to placate consuming countries by not leveraging the oil price too high, especially in its upcoming role as head of the G20 in 2020. It likely feels pressure to maintain good relations with its partners within OPEC+, especially Russia, so that it can keep the OPEC+ structure in place in case of a more volatile future.

More still unites Washington and Riyadh than divides them

The US/Saudi relationship that weakened during the Obama administration has been weakened further in the aftermath of the Kashoggi murder in late 2018. Yet "more still unites Washington and Riyadh than divides them."[26] The US remains a key destination for Saudi oil exports, which are of particular quality and well suited to Aramco's own refinery stakes in the US Gulf Coast. And Saudi Arabia has welcomed Trump administration policies with open arms, especially those that pinch Iran's oil exports and check the Kingdom's primary regional adversary. From a military perspective as well, Saudi Arabia is entirely dependent on American and British support for its air fleet of F-15s, Apache helicopters, and Tornado aircraft.[27]

A disconnect is likely to emerge between Saudi Arabia's fiscal BE and the marginal cost of shale

Growing disconnect between Saudi Arabia's fiscal breakeven and the marginal cost of shale. But as explained in more detail in the box below, in our view, the Kingdom of Saudi Arabia is increasingly facing a time trade-off, as domestic financing needs remain elevated in the coming years. The rapid increase in planned expenditure has kept the fiscal oil price breakeven elevated, which we expect to increase closer to $100/b by 2025. On the other hand, we expect the marginal cost of shale to continue to decline for the next two years and that price level ultimately to set the global price of oil. Though the marginal cost will eventually start rising again in the mid-2020s as producers consolidate and move out of tier 1 acreage, a gap between Saudi Arabia's fiscal breakeven and global oil prices is likely to remain even by 2025.

[26] Greg, Gause. "*The Future of US-Saudi Relations*." Foreign Affairs. 13 June 2016.
[27] Bruce Reidel. "*After Kashoggi, US Arms Sales to the Saudis are essential leverage*." 18 October 2018. Brookings.

OPEC's justification has become increasingly unfounded as the elasticity of other forces of supply and demand has grown

Saudi Arabia and OPEC: one less tie that binds. The geopolitical imperative for OPEC countries to respond collectively to market shocks is not as strong with supply and demand having become more elastic. It is therefore not surprising that the bond between Qatar and Saudi Arabia has weakened, with Qatar leaving OPEC altogether. Today's existing OPEC+ members still see some benefit in their collective response mechanism, and no two countries are benefiting more than Saudi Arabia and Russia. What might happen if OPEC+ becomes less effective at supporting prices? A disintegration of OPEC+ would represent one fewer tie that binds Russia and Saudi Arabia.

Outlook: US energy abundance to continue to influence its foreign policy

Irrespective of the next president and in part because of US tight oil, the American public will continue to question the case for the same US presence in the Middle East

Since US energy abundance does not appear to be waning any time soon, we expect US policymakers to continue to use it to add to their geopolitical leverage. Even a new US president may find it difficult to ignore the American public's lack of appetite to intensify military presence, and the perception of energy abundance might serve as a catalyst for such a policy. Today, the shale revolution, in concert with a close partnership with the Saudis, enabled Secretary of State Pompeo to state at a recent energy conference that "we'll continue with sanctions until Iran behaves in the way normal nations do, without threatening assassination campaigns in Europe, conducting terror campaigns throughout Syria and Iraq, without underwriting Hizballah."[28] Since we think it is unlikely that Iran will behave in a way that meets the Trump administration's definition of 'normal,' Iran is likely to delay negotiations with the US that could lead to sanctions removal until someone else occupies the Oval Office.

The re-imposition of sanctions on Iran, sanctions on Venezuela, oil price volatility, and the perception that the US is playing a lesser role in the Middle East have reshaped the security and economic landscape for the Gulf. Energy abundance is already influencing US foreign policy by enabling a harder line with adversaries and reducing military involvement in the Middle East. New US oil and gas supplies have also directly influenced Russia's and Saudi Arabia's foreign policy as each country has formed a new bond with one another via OPEC+ and as each has been forced to reflect about how its own supplies fare in this new era of energy abundance. Saudi Arabia and other key OPEC exporters' continued reliance on oil revenues implies difficult trade-offs between fiscal consolidation and increased financing; with both consistent with higher risk premia. The shift from energy scarcity to abundance has facilitated most, if not all, of these developments and is a trend that that looks set to remain for the next several years.

[28]https://www.state.gov/secretary/remarks/2019/03/290303.htm?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosgenerate&stream=top

Appendix

Structural VAR for identifying oil market shocks

We estimate a VAR with five endogenous variables: monthly percentage change in OPEC crude oil production, monthly percentage change in non-OPEC crude oil production, growth rate of real economic activity in industrial commodity markets,[29] log real oil prices and monthly changes in global oil inventories (measured as changes in US inventories, but imputed using the ratio of OECD to US petroleum stocks). The VAR is estimated with 24 monthly lags and the reduced form representation is shown below:

$Y_t = A_0 + \sum_{i=1}^{24} A_i Y_{t-i} + e_t$where the vector Y_t includes the five endogenous variables and e_t is the vector of reduced-form innovations.

Following Killian and Murphy, we identify the structural shocks through sign restrictions. We recover smoothed time series for the structural shocks, which allow us to decompose changes in real oil prices as a function of each fundamental shock (Figure 22).

Then, we use the identified shocks/price decomposition as explanatory variables, coupled with the US energy trade balance, in different multivariate regressions that seek to explain the USD REER (specifications [1] to [4]) in Figure 21.

ARCH model for identifying factors affecting oil price volatility

We find that total inventories days of demand cover, defined as OECD total oil stocks (including both government and industry) divided by total oil demand (including both OECD and non-OECD) in excess to the 5-year seasonal average (abbreviated as TIDDE), along with the OPEC spare capacity as estimated by the EIA (abbreviated as OSC), act as a significant predictor of the volatility in oil prices. The estimation is based on 192 monthly observations from January 2003 to December 2018. The variance equation of the model employed is:

GARCH = C + C1*RESID(-1)^2 + C2*TIDDE + C3*OSC

The coefficients table below shows that the volatility in oil prices is dampened by the level of total inventory cover and inversely related to the amount of OPEC spare capacity. This implies that OPEC spare capacity does act as a significant shock absorber for volatility in oil prices. However, the effect of spare capacity is contingent on OPEC's strategy. If OPEC reverts to maximizing market share as it did between 2015 and 2016, it would raise volatility because it would lead to looser physical markets with significantly reduced spare capacity.

FIGURE 31
Oil price volatility model output

Coefficient	Description	Value
C	Constant	0.008267****
C1	ARCH effect	0.432529***
C2	Inventory effect	0.001341***
C3	Spare capacity effect	-0.001515****

Source: Barclays Research

[29] See Kilian, Lutz. "Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market." *American Economic Review* 99, no. 3 (2009): 1053-69 and the updated methodology in Kilian, Lutz, and Xiaoqing Zhou. "Modeling fluctuations in the global demand for commodities." *Journal of International Money and Finance* 88 (2018): 54-78.

CHAPTER 5

UK asset returns since 1899

Sreekala Kochugovindan
+44 (0)20 7773 2234
sreekala.kochugovindan@barclays.com
Barclays, UK

2018 proved to be a challenging year for investors, as negative real returns were seen across most assets. Global equities posted the weakest performance since the Great Financial Crisis, as trade tensions combined with global growth concerns to culminate in a sharp sell-off into year-end. UK assets broadly followed global trends; however, UK equities and IG credit managed to outperform Europe, while the performance of gilts into year-end proved more volatile, given increased Brexit concerns.

FIGURE 1
Real investment returns by asset class (% pa)

	2018	10 years	20 years	50 years	119 years*
Equities	-11.5	5.8	2.0	4.7	4.9
Gilts	-1.6	2.7	2.5	3.2	1.3
Corporate Bonds	-4.8	4.3			
Index-Linked	-1.0	4.1	3.0		
Cash	-2.1	-2.5	-0.1	1.1	0.7

Note: * Entire sample. Source: Barclays Research

In this chapter we analyse returns on equities, gilts and cash from end-1899 to end-2018. 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 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.

Following two years of strong real returns across risk assets, 2018 proved to be a much more challenging year for investors as global stock markets posted the weakest performance since the Great Financial Crisis. Tensions around US-China trade relations weighed on sentiment while in the final quarter, this was combined with global growth concerns as euro area and China activity slowed. Global equities (MSCI) struggled through the year to produce the weakest capital returns since the Great Financial Crisis, at -11%. UK equities followed global trends but performed marginally better than the Euro Stoxx 50, and in particular German equities, which underperformed the most because of the heavy exposure to autos. Brexit uncertainty weighed most heavily on domestically focused equities in the FTSE 250, which underperformed the more globally exposed FTSE 100.

Gilt yields followed the volatility in global fixed income as investors grappled with signals from economic data as well as the central banks, (in particular the Fed), shifting communique over the monetary policy stance. The BoE delivered a second interest rate hike at its August MPC meeting and maintained a hawkish tone; this had been widely expected by the market and did not lead to much change in market pricing of hikes. The global sell-off in fixed income markets was the main driver in the final quarter, with gilts proving more volatile than US Treasuries and German Bunds, as investors reacted to concerns about a 'crash-out Brexit'. Real yields led the sell-off during September and October, having traded within a fairly stable 20bp range until then. At the shorter end of the inflation linked curve,

where market focus tends to be more on inflation fundamentals, linker breakevens moved higher through H2, commensurate with concerns about the inflationary effects of a potentially disorderly Brexit.

Credit returns in the UK and Europe were negative, given high equity volatility and political uncertainty. Equity volatility is an important driver of investment grade spreads. Investors tolerance levels for risk deteriorated in 2018 relative to the previous year; IG credit had a positive real return of 0.7% in 2017, compared with -4.8% in 2018. Nonetheless, sterling IG outperformed European IG, which suffered from high issuance and weak demand as CSPP net purchases slowed. While sterling credit benefited relatively from strong pension fund LDI demand.

Figure 2 breaks down real asset returns for consecutive 10-year intervals. Equities have outperformed gilts over the past decade, with an average annualised return of near 6% since 2008, compared with the gilt return of just 2.7%. This was primarily due to the strength in equity returns during the recovery phase following the financial crash offsetting the weakness in 2018. 2009 real total returns were near 26% y/y, a sharp rebound from the -30% y/y precipitous drop in 2008. Cash, on the other hand, had the worst decade since the stagflationary 1970s.

FIGURE 2

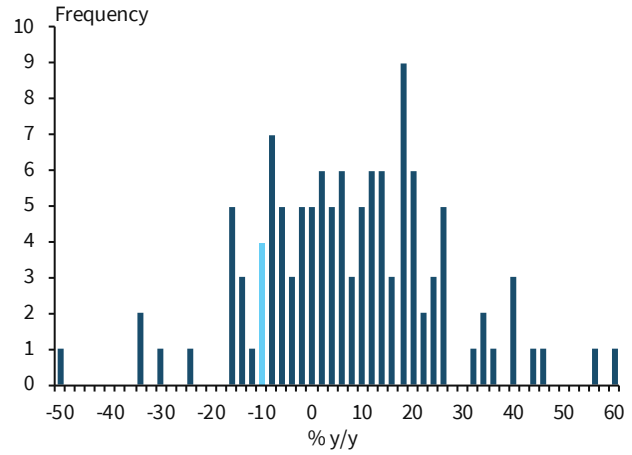
Real investment returns (% pa)

	Equities	Gilts	Index-linked	Cash
1908-1918	-3.5	-7.4		-4.8
1918-28	10.3	7.0		6.9
1928-38	3.6	6.7		2.4
1938-48	3.9	0.8		-2.6
1948-58	7.1	-4.5		-1.8
1958-68	11.0	-1.4		1.9
1968-78	-3.5	-3.3		-2.7
1978-88	12.4	5.8		3.8
1988-98	11.1	8.7		4.7
1998-2008	-1.5	2.4	1.9	2.4
2008-2018	5.8	2.7	4.1	-2.5

Source: Barclays Research

FIGURE 3

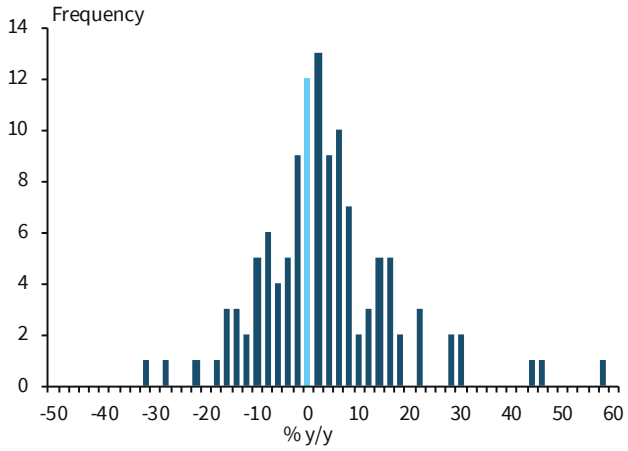
Distribution of real annual equity returns



Note: light blue represents current year. Source: Barclays Research

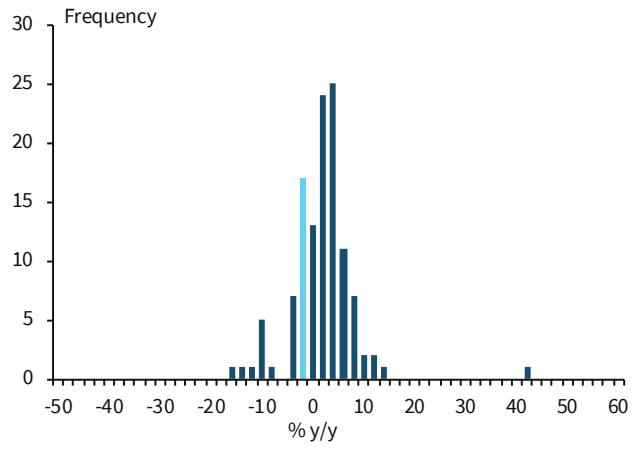
FIGURE 4

Distribution of real annual gilt returns



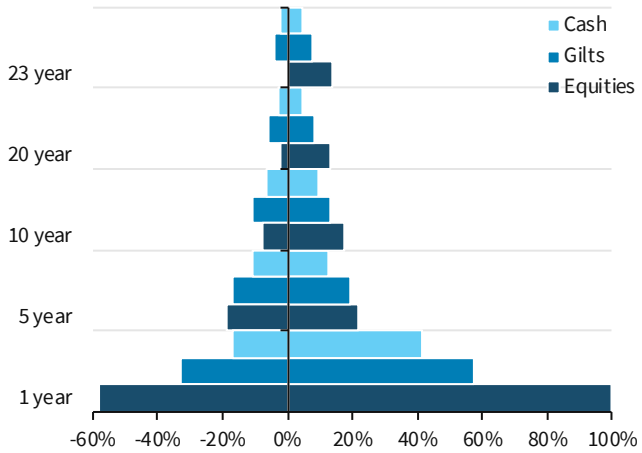
Note: light blue represents current year. Source: Barclays Research

FIGURE 5
Distribution of real annual cash returns



Note: light blue represents current year. Source: Barclays Research

FIGURE 6
Maximum and minimum real returns over various periods



Note: light blue represents current year. Source: Barclays Research

Ranking the annual real returns and placing them into deciles provides a clearer illustration of their historical significance. The results for 2018 are shown in Figure 7. The equity portfolio is ranked in the ninth decile since 1899, a sharp deterioration from 2017 which with an 8% y/y real return had ranked in the fifth decile; linkers and nominal gilts are ranked in seventh deciles, in line with performance compared with 2017. Cash returns improved marginally, one decile to the eighth decile following marginal increase in base rates while inflation slowed.

FIGURE 7
2018 performance ranked by decile (1899-2017)

	Decile
Equities	9
Gilts	7
Index-Linked	7
Cash	8

Note: Deciles ranking: 1 signifies the best 10% of the history, 10 the worst 10%. Index-linked returns since 1982.
Source: Barclays Research

Figures 3-5 illustrate the distribution of returns over the past 119 years. They show that equity returns have the widest dispersion, followed by gilts 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 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 five, 10 or 20 years and beyond.

Figure 6 highlights 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 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 81 out of 118 years; thus, the sample-based probability of equity outperformance is 69%. Extending the holding period to 10 years, this rises to 91%.

FIGURE 8
Equity performance

	Number of consecutive years				
	2	3	4	5	10
Outperform cash	81	83	85	87	100
Underperform cash	37	34	31	28	10
Total number of years	118	117	116	115	110
Probability of equity outperformance	69%	71%	73%	76%	91%
Outperform gilts	80	87	87	83	85
Underperform gilts	38	30	29	32	25
Total number of years	118	117	116	115	110
Probability of equity outperformance	68%	74%	75%	72%	77%

Source: Barclays Research

The importance of reinvestment

Figures 9 and 10 show how reinvestment of income affects the performance of the various asset classes. Figure 9 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 £173 in real terms without the reinvestment of dividend income; however, with reinvestment, the portfolio would have grown to £30,776. The effect on the gilt portfolio is smaller in absolute terms, but the ratio of the reinvested to non-reinvested portfolio is more than 600 in real terms.

FIGURE 9

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

	Nominal	Real
Equities	15,185	173
Gilts	63	0.71

Source: Barclays Research

FIGURE 10

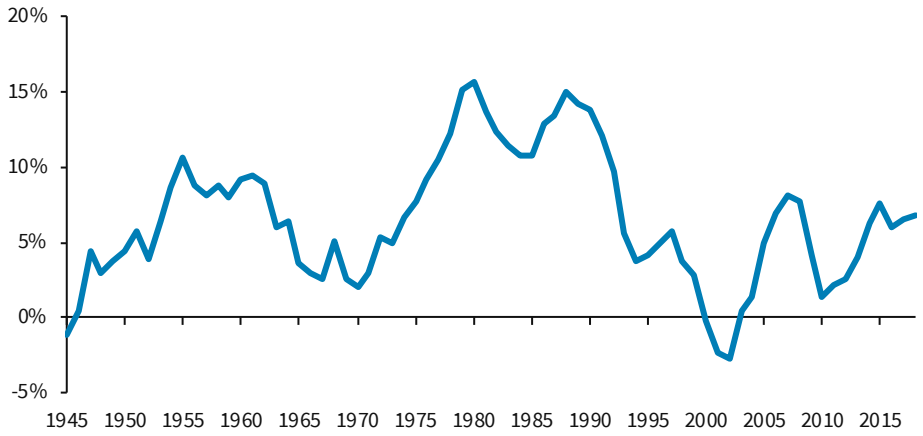
Today's value of £100 invested at the end of 1899, income reinvested gross, £

	Nominal	Real
Equities	2,706,467	30,776
Gilts	41,873	476
Cash	20,733	236

Source: Barclays Research

FIGURE 11

Five-year average dividend growth rates



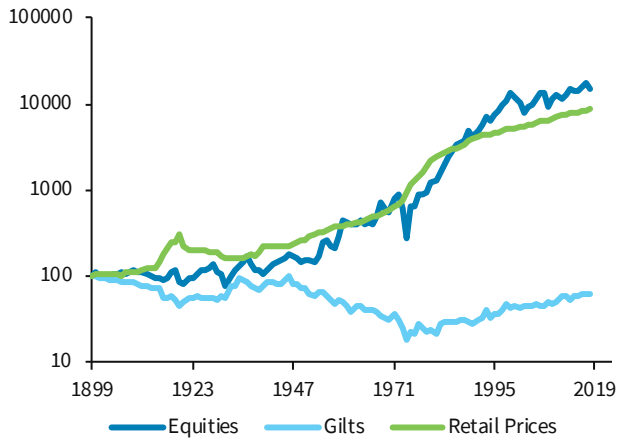
Source: Barclays Research

Turning to the dividend growth rate, the FTSE All-Share dividend rose 8% in 2018, following on from the strong pace of growth in 2017. Figure 11 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 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

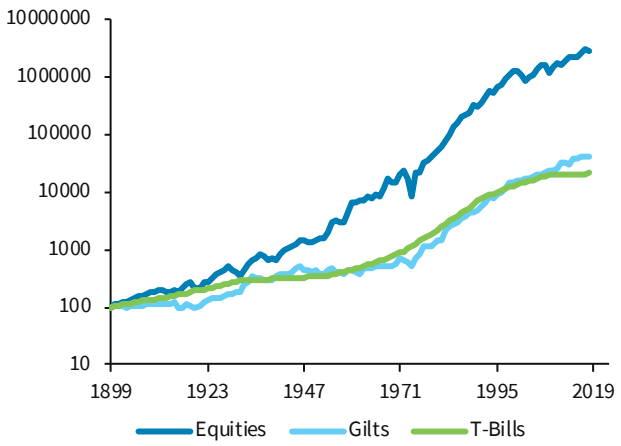
Barclays price indices – Nominal terms reinvested



Source: Barclays Research

FIGURE 13

Barclays total return indices – Nominal terms, gross income reinvested



Source: Barclays Research

FIGURE 14

Today's value of £100 invested at the end of 1945 without reinvesting income, £

	Nominal	Real
Equities	9,517	244
Gilts	68	1.75

Source: Barclays Research

FIGURE 15

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

	Nominal	Real
Equities	217,045	5,573
Gilts	8,991	231
Cash	6,349	163

Source: Barclays Research

FIGURE 16

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

	Nominal	Real
Equities	906	412
Gilts	884	402
Index-linked gilts	702	319
Treasury bills	304	138

Source: Barclays Research

CHAPTER 6

US asset returns since 1925

Sreekala Kochugovindan
+44 (0) 20 7773 2234
sreekala.kochugovindan@
barclays.com
Barclays, UK

Following two years of double digit returns, US risk assets delivered weak performance in 2018. Despite this, for long-term investors, both equities and corporate bonds enjoyed a strong decade. For those who invested at the end of 2008, equities returned an average of 10% per annum, well above the long-run average performance. Negative bond returns in 2018 reflect the backdrop of rate hikes and the hawkish tone maintained by the Fed last year, with the year-end risk-off sentiment partially reversing the effect of rising yields.

FIGURE 1
Real investment returns (% pa)

	2018	10 years	20 years	50 years	93 years*
Equities	-8.1	10.4	3.6	5.3	6.5
20y Government Bond	-2.3	2.0	3.8	3.7	2.5
TIPS	-7.6	3.3			
Long Corporate Bond	-9.0	5.7	4.0		
Cash	-0.2	-1.5	-0.42	0.7	0.4

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

We analyse returns on equities, government bonds, and cash with a total sample of 93 annual return observations. The construction of the series is explained in more detail in Chapter 7 ("Barclays Indices"). 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 calendar year 1926, representing money invested at the end of 1925 and its value at the end of 1926.

Figure 1 provides real annualised returns over various time horizons. US equities posted a very weak performance in 2018 compared with the double digit returns seen in the prior two years, including 18% real total return posted in 2017. Risk appetite heading into 2018 had been fuelled by the prospect of US tax cuts, while later in the year, strong US GDP growth of over 4% q/q annualised helped drive US equities to outperform global equities. However, by year-end, the rally had been completely eroded by prospects of fading US fiscal support for 2019, tightening financial conditions, and US-China trade tensions alongside global growth concerns.

Negative returns in 2018 for US bonds were driven primarily by interest rate hikes, and the Fed's hawkish rhetoric throughout the year. Following the US mid-term elections and a more divided Congress, with the Democrats taking control of the House and the Republicans in control of the Senate, expectations of additional fiscal stimulus faded. This preceded a rally in Treasuries into year-end that only partially helped improve returns by year-end.

The sell-off in long duration TIPS sell-off was particularly sharp during September and October, driven by a combination of strong growth and low inflation readings. Investment grade credit valuations were also hit particularly hard by the combination of Fed policy and subsequent yield curve inversion. A large universe of overleveraged BBB credit seen as vulnerable to being downgraded to high yield exacerbated the market's weakness, with spreads widening into year end. A number of large cap names were also downgraded from A to BBB.

FIGURE 2

Real investment returns (% pa)

	Equities	20y Government Bond	Long Corporate Bond	Cash
1928-38	-0.2	6.7		3.0
1938-48	2.0	-2.3		-5.0
1948-58	17.0	-0.8		-0.2
1958-68	8.6	-0.3		1.4
1968-78	-3.7	-1.6		-0.7
1978-88	9.5	4.6		3.0
1988-98	14.2	8.0	7.5	2.0
1998-2008	-2.7	5.7	2.3	0.6
2008-2018	10.4	2.0	5.7	-1.5

Source: CRSP, Barclays Research

Despite the sell offs across asset classes in 2018, equities and corporate bonds have enjoyed a strong decade. The 10-year total real return of 10% pa for equities is well above the long-run average performance of 6.5% since 1925. As was the case with UK equities, the strength was driven by the strong market recovery immediately following the financial crisis, with real equity returns of 28% in 2009. The best periods for equities occurred in the immediate aftermath of World War II and in the late 1980s and 1990s. Bond markets have enjoyed a decent performance as a result of the sustained disinflation since the late 1970s. However, over the past decade, average annual returns have declined to just 2%. The 10-year equity risk premium now stands at the highest level since 1999, just ahead of the bursting of the dot-com bubble.

Figure 3 ranks the relative performance of 2018 returns by deciles to provide a clearer indication of their historical significance. The US equity ranking has fallen sharply from the fourth decile in 2017 to the eighth decile in 2018. Bonds also fell, from the fifth to the eighth decile in 2017. Cash returns improved markedly following Fed hikes, rising from the eighth decile to sixth.

FIGURE 3

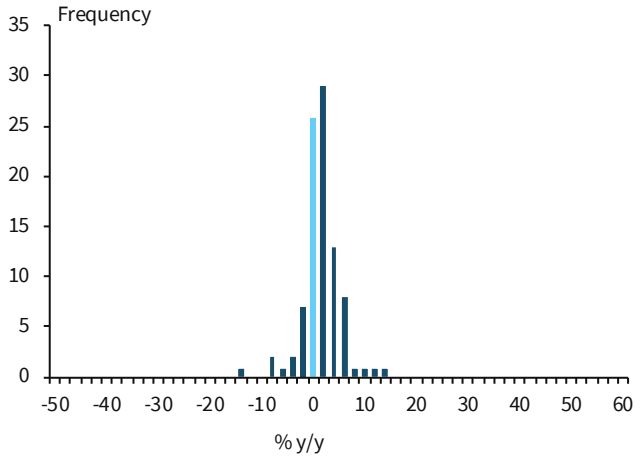
Comparison of 2018 real returns with historical performance ranked by decile

	Decile
Equities	8
20y Govt Bond	8
Cash	6

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

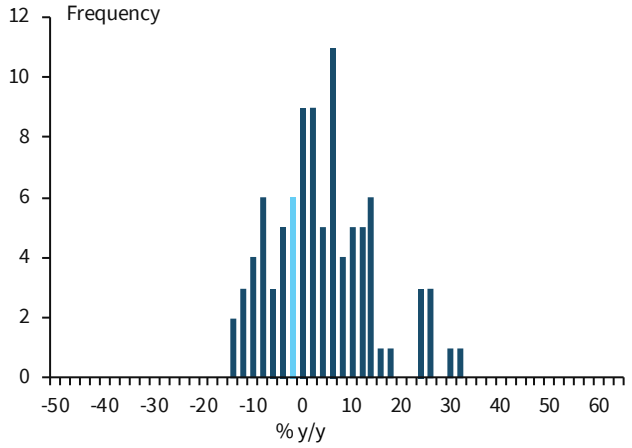
Figures 4-6 plot the sample distributions with identical maximum and minimum categories across each. These charts are useful in allowing readers to appreciate the volatility of each asset class while gaining an understanding of the distribution of the annual return observations. Clearly, cash exhibits the lowest volatility of each asset class overall, with bonds next and equities having the highest dispersion of returns.

FIGURE 4
Distribution of real annual cash returns (%)



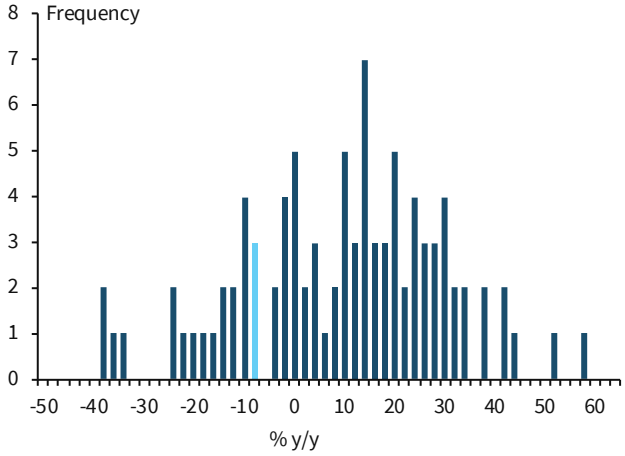
Note: light blue represents current year. Source: CRSP, Barclays Research

FIGURE 5
Distribution of real annual bond returns (%)



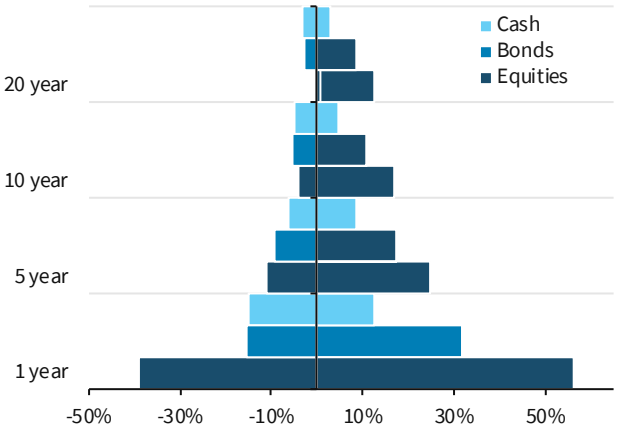
Note: light blue represents current year. Source: CRSP, Barclays Research

FIGURE 6
Distribution of real annual equity returns (%)



Note: light blue represents current year. Source: CRSP, Barclays Research

FIGURE 7
Maximum and minimum real returns over different periods



Note: light blue represents current year. Source: CRSP, Barclays Research

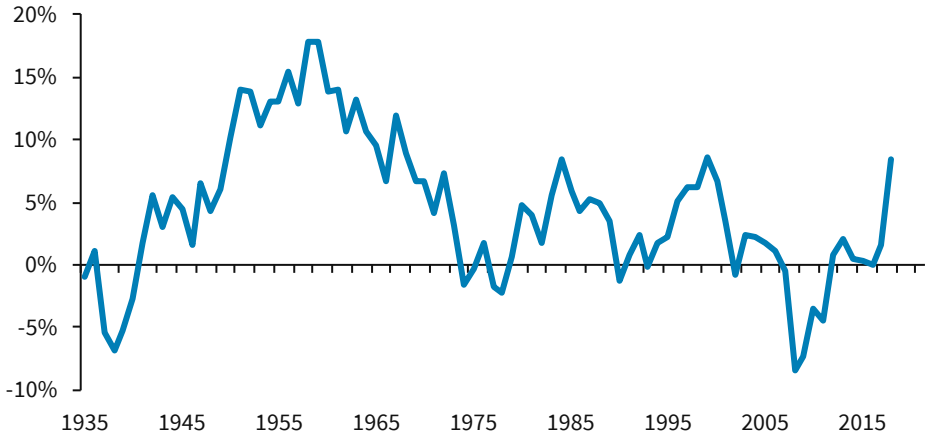
Figure 7 illustrates the extremes of the return distribution for various holding periods. The volatility of equities over very short horizons is clearly demonstrated in the maximum and minimum distribution of one-year returns. As we extend the holding period, the distribution begins to narrow. Over the 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 both experienced negative returns over 20-year investment horizons, 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 annualised excess return of equities over bonds has picked up again over the past year. Despite the negative returns in 2018, the 10y equity risk premium rose back to levels last reached in the late 1990s, just ahead of the dot-com crash.

FIGURE 8

Equity-risk premium – Excess return of equities relative to bonds (10y annualised)



Source: CRSP, Barclays Research

The importance of reinvestment

Figures 11 and 12 show the importance of reinvestment of income in the form of dividends on equity investments and coupons on government bonds.

FIGURE 9

Value of $100 invested at the end of 1925 without reinvesting income

	Nominal	Real
Equities	16,484	1,174
20y Govt Bonds	130	9

Source: CRSP, Barclays Research

FIGURE 10

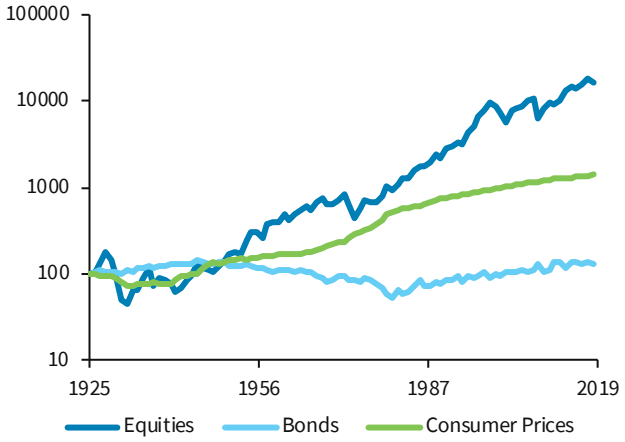
Value of $100 invested at the end of 1925 with income reinvested gross

	Nominal	Real
Equities	512,045	36,482
20y Govt Bonds	14,230	1,014
Cash	2,098	149

Source: CRSP, Barclays Research

FIGURE 11

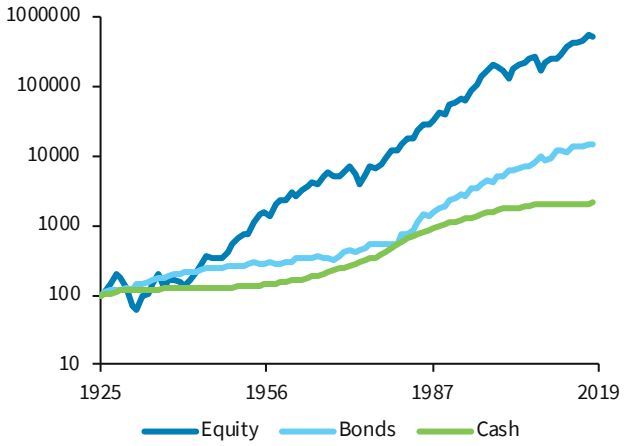
Barclays US price indices in nominal terms



Source: CRSP, Barclays Research

FIGURE 12

Barclays US total return indices in nominal terms with gross income reinvested



Source: CRSP, Barclays Research

CHAPTER 7

Barclays indices

Sreekala Kochugovindan
+44 (0)20 7773 2234
sreekala.kochugovindan@
barclays.com
Barclays, UK

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. 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; thus, we believe they accurately reflect the behaviour of an equity market. The Standard & Poor's indices are of this type and 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 1935-62. 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 Proprietary Mines Ltd	Unilever Ltd	ICI
North British & Mercantile Insurance	Tate & Lyle Ltd	Imperial Tobacco
Consett Iron Ltd	Alliance Assurance Company	International Stores
Eastern Extension Australasia * China Ltd	Boots Pure Drug Co Ltd	Leyland Motors
Nobel Dynamite Tst Ltd	Pearl Assurance Co	London Brick
Mysore Gold Mining Ltd	Marks & Spencer Ltd	Murex
Exploration Co	Cory (WM.) & Son	P&O Steam Navigation
Alliance Assurance Co	National Bank Of Egypt	Rolls-Royce
Aerated Bread Ltd	Consolidated Gold Fields Of South Africa	Swan Hunter
Howard & Bullough Ltd	Bass, Ratcliff & Gretton Ltd	Tate & Lyle
Sun Insurance Office	GeduldProp Mines Ltd	Tube Investments
New Jagersfontein Mining & Expl Ltd	Sun Insurance Office	Turner & Newall
Champion Reef Gold Mining	Bank Of Australasia	United Steel
National Telephone Ltd	British South Africa Co	Vickers
Northern Assurance	Chartered Bank Of India, Australia & China	WatneyMann
Phoenix Assurance Co	North Eastern Elec Supply Co	Woolworth

Source: Barclays Research

The Equity Index is a weighted arithmetic average. In it, 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 its 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 is 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 is 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 four decades and is capitalised at £720bn (compared with the £1.4trn 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 Bloomberg 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 cannot be representative of the market.

Barclays Building Society Fund

In previous editions of this study, we 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, 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

Analysis on the US indices used in this study is calculated (or Derived) based on data from Database Name ©201812 Centre for Research in Security Prices (CRSP®) at the University of Chicago Booth School of Business (2018 being the year the database was published). 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 that selects the bond that is closest to a 20-year bond in each month. The CRSP employs the same methodology to create the 30-day T-bill series.

US corporate bond performance is captured using the Bloomberg Barclays Investment Grade Corporate Long Index, which incorporates bonds with a maturity of 10 years or more. The Bloomberg Barclays US Inflation Linked 15-year Plus Index is used to represent the performance of TIPS until 2017, this series was discontinued given the lack of 15y supply and replaced with the 10-year Plus Index to capture the performance of long end TIPS.

Total returns

In this study, we show 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. 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. 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 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 2018 were 15,185 for equities, 62.7 for gilts, and 8794 for the cost of living.

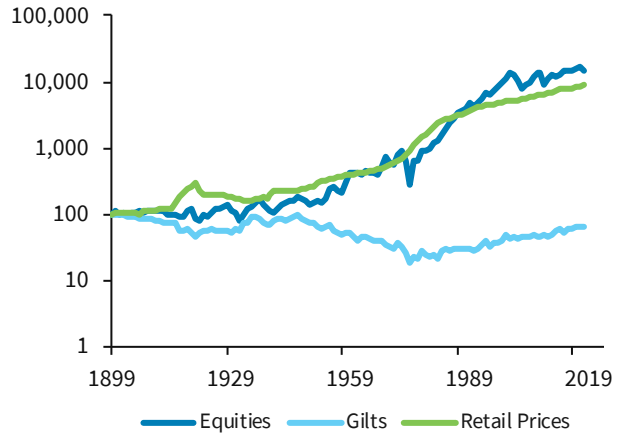
We then show the same capital indices adjusted for the increase in the cost of living since 1899. Figure 3 shows the end-2018 real equity price index at 173 with the real gilt price index at 0.71.

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 £2,706,467. The same investment in gilts was worth £41,873 and in T-Bills £20,733. When adjusted for inflation, the equity fund is worth £30,776, the gilt £476, and the cash fund £236.

FIGURE 2

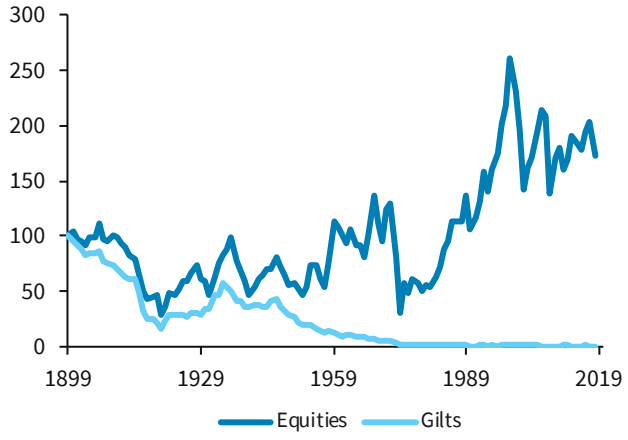
Barclays price indices in nominal terms



Source: Barclays Research

FIGURE 3

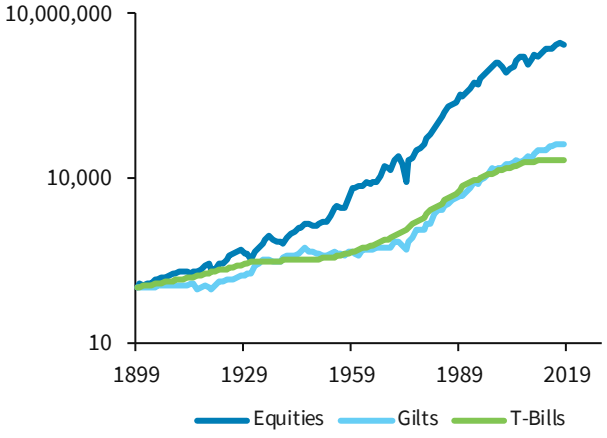
Barclays price indices in real terms



Source: Barclays Research

FIGURE 4

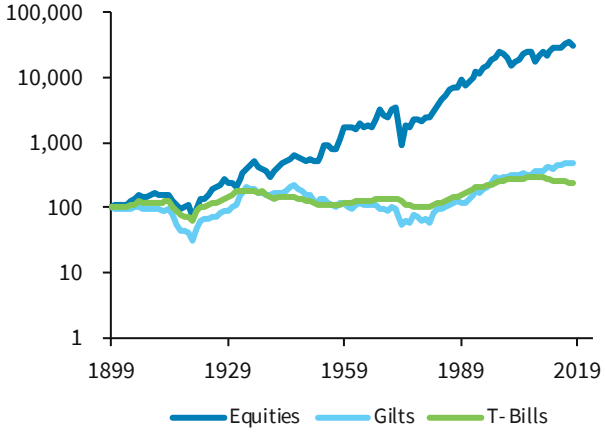
Barclays total return indices in nominal terms with gross income reinvested



Source: Barclays Research

FIGURE 5

Barclays total return indices in real terms with gross income reinvested



Source: Barclays Research

FIGURE 6
Barclays UK Cost of Living Index

Year	December (1899=100)	Change % In year	Change % 5y average	Year	December	Change % In year	Change % 5y average
1900	103.3	3.3		**1940**	216.9	12.7	5.8
1901	103.3	0.0		**1941**	223.6	3.1	5.9
1902	106.7	3.2		**1942**	222.5	-0.5	4.6
1903	106.7	0.0		**1943**	221.4	-0.5	5.0
1904	106.7	0.0	1.3	**1944**	223.6	1.0	3.0
1905	106.7	0.0	0.6	**1945**	225.8	1.0	0.8
1906	100.0	-6.2	-0.7	**1946**	226.9	0.5	0.3
1907	110.0	10.0	0.6	**1947**	234.2	3.2	1.0
1908	113.3	3.0	1.2	**1948**	245.7	4.9	2.1
1909	113.3	0.0	1.2	**1949**	254.3	3.5	2.6
1910	113.3	0.0	1.2	**1950**	262.4	3.2	3.0
1911	116.7	2.9	3.1	**1951**	294.0	12.0	5.3
1912	120.0	2.9	1.8	**1952**	312.7	6.3	6.0
1913	120.0	0.0	1.1	**1953**	316.0	1.1	5.2
1914	120.0	0.0	1.1	**1954**	328.5	4.0	5.3
1915	148.3	23.6	5.5	**1955**	347.7	5.8	5.8
1916	175.8	18.5	8.6	**1956**	358.3	3.0	4.0
1917	212.5	20.9	12.1	**1957**	374.9	4.6	3.7
1918	244.7	15.2	15.3	**1958**	381.8	1.8	3.9
1919	250.3	2.3	15.8	**1959**	381.8	0.0	3.1
1920	299.2	19.6	15.1	**1960**	388.7	1.8	2.3
1921	221.4	-26.0	4.7	**1961**	405.7	4.4	2.5
1922	200.2	-9.5	-1.2	**1962**	416.5	2.6	2.1
1923	196.9	-1.7	-4.3	**1963**	424.2	1.9	2.1
1924	201.3	2.3	-4.3	**1964**	444.6	4.8	3.1
1925	196.9	-2.2	-8.0	**1965**	464.5	4.5	3.6
1926	199.1	1.1	-2.1	**1966**	481.6	3.7	3.5
1927	188.0	-5.6	-1.3	**1967**	493.4	2.5	3.4
1928	186.9	-0.6	-1.0	**1968**	522.7	5.9	4.3
1929	185.8	-0.6	-1.6	**1969**	547.1	4.7	4.2
1930	172.4	-7.2	-2.6	**1970**	590.3	7.9	4.9
1931	164.6	-4.5	-3.7	**1971**	643.6	9.0	6.0
1932	159.1	-3.4	-3.3	**1972**	692.9	7.7	7.0
1933	159.1	0.0	-3.2	**1973**	766.2	10.6	7.9
1934	160.2	0.7	-2.9	**1974**	912.8	19.1	10.8
1935	163.5	2.1	-1.1	**1975**	1140.0	24.9	14.1
1936	168.0	2.7	0.4	**1976**	1311.8	15.1	15.3
1937	178.0	6.0	2.3	**1977**	1471.1	12.1	16.3
1938	173.5	-2.5	1.8	**1978**	1594.4	8.4	15.8
1939	192.4	10.9	3.7	**1979**	1869.3	17.2	15.4

Year	December (1899=100)	Change % In year	Change % 5y average	Year	December	Change % In year	Change % 5y average
1980	2151.9	15.1	13.5	**2000**	5302.3	2.9	2.7
1981	2411.2	12.0	12.9	**2001**	5339.2	0.7	2.3
1982	2541.6	5.4	11.6	**2002**	5496.3	2.9	2.2
1983	2676.7	5.3	10.9	**2003**	5650.2	2.8	2.2
1984	2799.3	4.6	8.4	**2004**	5847.3	3.5	2.6
1985	2958.5	5.7	6.6	**2005**	5976.6	2.2	2.4
1986	3068.6	3.7	4.9	**2006**	6241.4	4.4	3.2
1987	3182.0	3.7	4.6	**2007**	6493.9	4.0	3.4
1988	3397.6	6.8	4.9	**2008**	6555.5	0.9	3.0
1989	3659.5	7.7	5.5	**2009**	6712.5	2.4	2.8
1990	4001.4	9.3	6.2	**2010**	7032.8	4.8	3.3
1991	4180.0	4.5	6.4	**2011**	7371.5	4.8	3.4
1992	4287.8	2.6	6.1	**2012**	7599.3	3.1	3.2
1993	4369.3	1.9	5.2	**2013**	7802.6	2.7	3.5
1994	4495.6	2.9	4.2	**2014**	7928.8	1.6	3.4
1995	4640.3	3.2	3.0	**2015**	8024.3	1.2	2.7
1996	4754.2	2.5	2.6	**2016**	8224.4	2.5	2.2
1997	4926.6	3.6	2.8	**2017**	8563.1	4.1	2.4
1998	5062.1	2.8	3.0	**2018**	8794.1	2.7	2.4
1999	5151.4	1.8	2.8				

Source: Barclays Research

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%

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	
1942	135	+12.9%	86	-4.5%	4.4	61	+13.4%	40	-4.0%
1943	144	+7.1%	86	-0.2%	4.1	65	+7.7%	40	+0.3%
1944	156	+8.3%	87	+0.4%	3.8	70	+7.3%	40	-0.6%
1945	160	+2.0%	88	+2.0%	3.8	71	+1.0%	40	+1.0%
1946	182	+13.9%	93	+4.9%	3.5	80	+13.3%	42	+4.4%
1947	170	-6.3%	107	+15.1%	4.3	73	-9.2%	47	+11.6%
1948	157	-7.7%	98	-7.7%	4.3	64	-12.1%	41	-12.1%
1949	141	-10.3%	103	+4.4%	5.0	55	-13.3%	42	+0.8%
1950	149	+5.6%	109	+5.6%	5.0	57	+2.3%	43	+2.3%
1951	153	+3.0%	121	+11.2%	5.4	52	-8.1%	42	-0.7%
1952	144	-5.9%	128	+6.3%	6.1	46	-11.5%	42	-0.0%
1953	170	+17.8%	134	+4.3%	5.4	54	+16.6%	44	+3.2%
1954	242	+42.4%	155	+16.0%	4.4	74	+36.9%	49	+11.6%
1955	256	+5.8%	179	+15.4%	4.8	74	-0.0%	53	+9.1%
1956	220	-13.9%	183	+2.2%	5.7	62	-16.5%	53	-0.8%
1957	205	-7.0%	188	+2.8%	6.3	55	-11.1%	52	-1.7%
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%

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	
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%
2016	16004	+12.5%	8095	+5.5%	3.5	195	+9.7%	102	+2.9%
2017	17444	+9.0%	9128	+12.8%	3.6	204	+4.7%	110	+8.3%
2018	15185	-13.0%	9872	+8.1%	4.5	173	-15.2%	116	+5.3%

Source: Barclays Research

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%

Year	Gilt Price Index December		Yield %	Gilt Price Index adjusted for cost of living	
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%
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%

Year	Gilt Price Index December		Yield %	Gilt Price Index adjusted for cost of living	
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%
2016	62.8	+9.0%	1.2	0.8	+6.3%
2017	62.9	+0.2%	1.2	0.7	-3.8%
2018	62.7	-0.3%	1.4	0.7	-2.9%

Source: Barclays Research

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%

Year	Treasury Bill Index December		Treasury Bill Index adjusted for cost of living	
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%
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%

Year	Treasury Bill Index December		Treasury Bill Index adjusted for cost of living	
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	20124	+0.5%	286	-4.1%
2011	20226	+0.5%	274	-4.1%
2012	20292	+0.3%	267	-2.7%
2013	20362	+0.3%	261	-2.3%
2014	20442	+0.4%	258	-1.2%
2015	20534	+0.4%	256	-0.7%
2016	20612	+0.4%	251	-2.1%
2017	20631	+0.1%	241	-3.9%
2018	20733	+0.5%	236	-2.1%

Source: Barclays Research

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%
2016	476.8	+19.2%	-1.8	0.7	147.3	+16.3%
2017	468.0	-1.8%	-1.8	2.3	138.9	-5.7%
2018	475.5	+1.6%	-1.8	0.8	137.4	-1.1%

Source: Barclays Research

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%

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	
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%
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%	6194	+0.5%	190	-4.1%
2012	147384	+12.1%	4379	+8.7%	7078	+4.8%	210	+1.6%	6214	+0.3%	185	-2.7%
2013	177620	+20.5%	5140	+17.4%	6569	-7.2%	190	-9.6%	6235	+0.3%	180	-2.3%
2014	179695	+1.2%	5118	-0.4%	7773	+18.3%	221	+16.4%	6260	+0.4%	178	-1.2%
2015	181676	+1.1%	5113	-0.1%	7815	+0.5%	220	-0.6%	6288	+0.4%	177	-0.7%
2016	211392	+16.4%	5804	+13.5%	8711	+11.5%	239	+8.7%	6312	+0.4%	173	-2.1%
2017	238690	+12.9%	6294	+8.4%	8901	+2.2%	235	-1.9%	6318	+0.1%	167	-3.9%
2018	217045	-9.1%	5573	-11.5%	8991	+1.0%	231	-1.6%	6349	+0.5%	163	-2.1%

Note: Original Investment of £100 December 1945, gross income reinvested.
Source: Barclays Research

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	**1986**	10.95	10.55	29.26
1947	0.51	6.36	45.00	**1987**	9.58	9.66	27.50
1948	0.51	6.36	45.00	**1988**	11.01	8.26	25.50
1949	0.52	6.36	45.00	**1989**	14.55	10.71	25.00
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	**2016**	0.37	0.10	20.00
1977	9.44	10.65	34.25	**2017**	0.11	0.10	20.00
1978	8.06	9.42	33.25	**2018**	0.50	0.10	20.00
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				

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.
Source: Barclays Research

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%
2016	1115	+19.5%	345	+16.6%
2017	1141	+2.3%	339	-1.7%
2018	1161	+1.7%	335	-1.0%

Source: Barclays Research

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%	5.3	189	+4.4%	176	+7.2%
1980	1030	+27.1%	910	+19.1%	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%	175	-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	4269	+32.5%	1876	+24.9%	2.4	498	+29.2%	216	+21.8%
1996	5070	+18.8%	1877	+0.0%	2.1	572	+14.9%	209	-3.2%
1997	6499	+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	9683	+23.6%	2308	+10.9%	1.3	1030	+20.4%	243	+8.0%
2000	8507	-12.1%	1687	-26.9%	1.1	875	-15.0%	172	-29.3%
2001	7448	-12.4%	1779	+5.4%	1.3	755	-13.8%	178	+3.8%
2002	5802	-22.1%	1660	-6.7%	1.6	574	-23.9%	162	-8.8%
2003	7588	+30.8%	2511	+51.3%	1.8	737	+28.4%	241	+48.5%
2004	8410	+10.8%	2970	+18.3%	2.0	791	+7.3%	276	+14.6%
2005	8863	+5.4%	2930	-1.4%	1.8	806	+1.9%	264	-4.6%
2006	10108	+14.0%	3474	+18.6%	1.9	897	+11.2%	305	+15.6%
2007	10638	+5.3%	3674	+5.7%	1.9	907	+1.1%	310	+1.6%
2008	6420	-39.7%	2639	-28.2%	2.3	547	-39.7%	222	-28.2%
2009	8223	+28.1%	3767	+42.8%	2.6	682	+24.7%	309	+39.0%
2010	9476	+15.2%	3692	-2.0%	2.2	774	+13.5%	298	-3.4%
2011	9181	-3.1%	3438	-6.9%	2.1	728	-5.9%	270	-9.6%
2012	10368	+12.9%	4719	+37.3%	2.5	808	+11.0%	364	+34.9%
2013	13238	+27.7%	5233	+10.9%	2.2	1017	+25.8%	397	+9.2%
2014	14328	+8.2%	5443	+4.0%	2.1	1092	+7.4%	410	+3.2%
2015	13785	-3.8%	5396	-0.9%	2.2	1043	-4.5%	404	-1.6%
2016	15185	+10.2%	6301	+16.8%	2.3	1126	+7.9%	462	+14.4%
2017	17946	+18.2%	6785	+7.7%	2.1	1303	+15.7%	487	+5.5%
2018	16484	-8.1%	6201	-8.6%	2.1	1174	-9.9%	437	-10.3%

Source: CRSP, Barclays Research

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%
2016	132	-1.9%	2.8	10	-3.9%
2017	135	+2.7%	2.6	10	+0.6%
2018	130	-4.0%	2.9	9	-5.8%

Source: CRSP, Barclays Research

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%

Year	Treasury Bill Index December		Treasury Bill Index adjusted for cost of living	
1971	247	+4.3%	108	+1.0%
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%
2016	2047	+0.19%	152	-1.8%
2017	2063	+0.79%	150	-1.3%
2018	2098	+1.71%	149	-0.2%

Source: CRSP, Barclays Research

CHAPTER 8

Total investment returns

Sreekala Kochugovindan
+44 (0)20 7773 2234
sreekala.kochugovindan@
barclays.com
Barclays, UK

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 pull-out 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 Bloomberg Barclays indices, as outlined in Chapter 8.

1960-2018

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

UK: 1899-2018
US: 1925-2018

- 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	2015	2016	2017
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)				
2016	5.4	5.5	5.7	5.4	5.8	5.7	6.0	5.6	4.9	5.4	5.8	5.3	5.2	6.4	8.8	7.2	7.7	7.1	7.3	7.6	7.4	7.6	7.2	6.7	6.2	5.9	5.4	5.5	5.5	4.8	5.8	5.4	4.9	4.1	4.8	4.1	3.7	2.9	2.5	1.5	2.1	3.3	5.7	4.8	4.5	3.3	2.5	2.7	7.8	5.4	4.8	7.6	7.3	4.1	6.5	13.5			
2017	5.4	5.6	5.7	5.5	5.8	5.8	6.1	5.6	5.0	5.5	5.9	5.3	5.3	6.4	8.8	7.2	7.7	7.1	7.3	7.6	7.4	7.6	7.2	6.8	6.3	6.0	5.5	5.6	5.6	4.9	5.9	5.5	5.1	4.3	4.9	4.3	3.9	3.2	2.8	1.9	2.5	3.6	5.8	5.1	4.8	3.7	3.0	3.2	7.9	5.8	5.4	7.7	7.5	5.2	7.1	11.0	8.4		
2018	5.1	5.2	5.4	5.2	5.5	5.4	5.7	5.3	4.7	5.1	5.5	4.9	4.9	6.0	8.2	6.7	7.2	6.6	6.8	7.1	6.9	7.0	6.6	6.2	5.7	5.4	4.9	5.0	5.0	4.3	5.2	4.8	4.4	3.6	4.2	3.6	3.2	2.4	2.0	1.1	1.7	2.7	4.7	3.9	3.6	2.5	1.7	1.8	5.8	3.7	3.1	4.8	4.1	1.6	2.2	2.9	(2.0)	(11.5)	

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have lost 2.5% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1963) would have given an average annual real return of 3.9%. Each figure on the bottom line of the table shows the average real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
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	100
2016	1855	1904	1947	1655	1834	1720	1858	1417	1014	1205	1346	1002	927	1425	3402	1704	1917	1447	1444	1518	1296	1279	1049	858	682	600	489	466	447	355	429	371	318	254	278	233	206	173	156	128	140	163	216	185	170	143	128	127	182	145	133	144	133	113	113	114
2017	2012	2064	2112	1794	1989	1865	2015	1537	1099	1306	1460	1086	1005	1545	3689	1848	2079	1569	1566	1646	1406	1387	1138	930	739	650	530	506	484	385	466	403	345	276	301	253	224	187	169	139	152	177	234	200	184	155	139	138	198	157	144	156	144	122	123	123	108
2018	1781	1828	1870	1589	1761	1652	1784	1361	973	1157	1293	962	890	1368	3266	1637	1841	1389	1386	1457	1245	1228	1007	824	655	576	469	448	429	341	412	357	305	244	267	224	198	166	150	123	135	156	207	177	163	137	123	122	175	139	128	138	127	108	109	109	96	89

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have fallen to £97 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £112 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
1961	(11.9)
1962	3.5	21.5
1963	2.9	11.2	1.8
1964	0.4	4.9	(2.6)	(6.7)
1965	0.3	3.6	(1.8)	(3.5)	(0.1)
1966	0.3	3.0	(1.2)	(2.2)	0.2	0.5
1967	0.3	2.5	(0.9)	(1.6)	0.2	0.3	0.1
1968	(0.8)	0.9	(2.1)	(2.9)	(1.9)	(2.5)	(4.0)	(7.8)
1969	(1.1)	0.3	(2.4)	(3.1)	(2.4)	(2.9)	(4.0)	(6.1)	(4.2)
1970	(1.4)	(0.2)	(2.6)	(3.2)	(2.6)	(3.1)	(4.0)	(5.4)	(4.1)	(4.0)
1971	0.1	1.4	(0.6)	(0.9)	(0.1)	(0.1)	(0.2)	(0.3)	2.4	5.9	16.8
1972	(0.9)	0.2	(1.7)	(2.1)	(1.5)	(1.7)	(2.0)	(2.4)	(1.0)	0.0	2.1	(10.7)
1973	(2.3)	(1.4)	(3.3)	(3.7)	(3.4)	(3.8)	(4.4)	(5.1)	(4.6)	(4.7)	(4.9)	(14.2)	(17.6)
1974	(4.4)	(3.8)	(5.7)	(6.4)	(6.3)	(7.0)	(7.9)	(9.0)	(9.1)	(10.1)	(11.6)	(19.4)	(23.4)	(28.8)
1975	(3.6)	(2.9)	(4.6)	(5.1)	(5.0)	(5.4)	(6.1)	(6.8)	(6.7)	(7.1)	(7.7)	(13.0)	(13.7)	(11.7)	9.5
1976	(3.4)	(2.8)	(4.4)	(4.8)	(4.7)	(5.1)	(5.6)	(6.2)	(6.0)	(6.3)	(6.6)	(10.7)	(10.7)	(8.3)	4.1	(1.1)
1977	(1.8)	(1.1)	(2.4)	(2.7)	(2.4)	(2.6)	(2.9)	(3.2)	(2.6)	(2.4)	(2.2)	(5.1)	(3.9)	(0.1)	11.8	13.0	29.1
1978	(2.2)	(1.6)	(2.9)	(3.2)	(2.9)	(3.1)	(3.4)	(3.8)	(3.3)	(3.2)	(3.1)	(5.7)	(4.8)	(2.1)	6.1	5.0	8.1	(9.4)
1979	(2.7)	(2.2)	(3.4)	(3.7)	(3.5)	(3.7)	(4.1)	(4.4)	(4.1)	(4.1)	(4.1)	(6.4)	(5.8)	(3.6)	2.4	0.7	1.3	(10.3)	(11.2)
1980	(2.3)	(1.8)	(2.9)	(3.2)	(3.0)	(3.2)	(3.4)	(3.7)	(3.4)	(3.3)	(3.2)	(5.2)	(4.5)	(2.5)	2.8	1.5	2.2	(5.5)	(3.4)	5.0
1981	(2.7)	(2.2)	(3.3)	(3.6)	(3.4)	(3.6)	(3.8)	(4.1)	(3.8)	(3.8)	(3.8)	(5.6)	(5.0)	(3.3)	1.0	(0.4)	(0.2)	(6.4)	(5.4)	(2.3)	(9.2)
1982	(0.9)	(0.4)	(1.4)	(1.5)	(1.2)	(1.3)	(1.4)	(1.5)	(1.0)	(0.8)	(0.5)	(1.9)	(1.0)	1.0	5.5	5.0	6.0	1.9	5.0	11.1	14.2	43.6
1983	(0.5)	0.1	(0.8)	(1.0)	(0.7)	(0.7)	(0.8)	(0.8)	(0.3)	(0.0)	0.3	(1.0)	(0.1)	1.9	6.0	5.6	6.6	3.2	6.0	10.8	12.8	25.7	10.0
1984	(0.4)	0.2	(0.7)	(0.8)	(0.5)	(0.5)	(0.6)	(0.6)	(0.2)	0.1	0.4	(0.8)	0.1	1.9	5.6	5.2	6.0	3.1	5.3	9.0	10.0	17.3	6.0	2.1
1985	(0.2)	0.4	(0.5)	(0.6)	(0.3)	(0.3)	(0.3)	(0.3)	0.1	0.4	0.7	(0.4)	0.5	2.2	5.6	5.2	5.9	3.3	5.3	8.3	9.0	14.1	5.7	3.6	5.0
1986	0.1	0.6	(0.2)	(0.3)	0.1	0.1	0.0	0.0	0.5	0.8	1.1	0.1	0.9	2.5	5.7	5.3	6.0	3.7	5.5	8.1	8.7	12.6	6.0	4.7	6.0	7.0
1987	0.5	1.0	0.3	0.2	0.6	0.6	0.6	0.6	1.1	1.4	1.7	0.8	1.6	3.2	6.2	5.9	6.6	4.5	6.2	8.6	9.1	12.5	7.2	6.5	8.0	9.5	12.1
1988	0.6	1.1	0.4	0.3	0.6	0.7	0.7	0.7	1.1	1.4	1.7	0.9	1.7	3.1	5.9	5.6	6.2	4.3	5.8	7.9	8.3	11.0	6.4	5.7	6.6	7.1	7.2	2.4
1989	0.5	1.0	0.3	0.2	0.5	0.6	0.6	0.6	1.0	1.3	1.6	0.8	1.5	2.8	5.4	5.1	5.6	3.8	5.1	6.9	7.1	9.4	5.2	4.4	4.9	4.8	4.2	0.4	(1.7)
1990	0.4	0.8	0.2	0.1	0.4	0.4	0.4	0.4	0.8	1.0	1.3	0.6	1.2	2.5	4.8	4.5	4.9	3.3	4.4	5.9	6.0	7.9	4.1	3.3	3.4	3.1	2.2	(0.9)	(2.5)	(3.4)
1991	0.8	1.2	0.6	0.6	0.8	0.9	0.9	0.9	1.3	1.6	1.9	1.2	1.8	3.1	5.3	5.1	5.5	4.0	5.1	6.6	6.7	8.4	5.1	4.5	4.9	4.8	4.4	2.6	2.6	4.8	13.8
1992	1.2	1.7	1.1	1.0	1.3	1.4	1.4	1.5	1.9	2.2	2.5	1.8	2.5	3.7	5.9	5.6	6.1	4.7	5.8	7.2	7.4	9.1	6.1	5.7	6.1	6.3	6.2	5.0	5.7	8.3	14.6	15.4
1993	1.9	2.4	1.8	1.8	2.1	2.2	2.3	2.3	2.8	3.1	3.4	2.8	3.5	4.7	6.8	6.7	7.2	5.9	7.1	8.5	8.8	10.4	7.8	7.6	8.2	8.6	8.9	8.3	9.5	12.5	18.4	20.8	26.4
1994	1.4	1.8	1.3	1.3	1.5	1.6	1.6	1.7	2.1	2.3	2.6	2.0	2.7	3.7	5.7	5.5	5.9	4.7	5.6	6.8	7.0	8.3	5.8	5.4	5.8	5.9	5.7	4.8	5.2	6.7	9.4	7.9	4.4	(13.8)
1995	1.8	2.2	1.7	1.7	2.0	2.0	2.1	2.1	2.5	2.8	3.1	2.6	3.2	4.2	6.1	6.0	6.4	5.2	6.2	7.4	7.5	8.8	6.5	6.2	6.6	6.8	6.7	6.1	6.6	8.1	10.5	9.7	7.9	(0.3)	15.3
1996	1.9	2.3	1.8	1.8	2.1	2.1	2.2	2.2	2.6	2.9	3.2	2.7	3.3	4.3	6.1	5.9	6.3	5.2	6.1	7.2	7.4	8.6	6.4	6.1	6.5	6.6	6.6	6.0	6.4	7.6	9.6	8.8	7.2	1.5	10.1	5.1
1997	2.2	2.6	2.1	2.1	2.4	2.5	2.6	2.7	3.0	3.3	3.6	3.1	3.7	4.7	6.5	6.3	6.7	5.7	6.6	7.7	7.8	9.0	7.0	6.8	7.1	7.3	7.3	6.9	7.4	8.6	10.4	9.8	8.8	4.7	11.8	10.1	15.3
1998	2.7	3.1	2.6	2.7	2.9	3.0	3.1	3.2	3.6	3.9	4.2	3.7	4.3	5.3	7.1	7.0	7.4	6.4	7.3	8.3	8.5	9.7	7.8	7.7	8.1	8.4	8.5	8.1	8.7	10.0	11.7	11.5	10.8	7.9	14.2	13.8	18.4	21.7
1999	2.5	2.9	2.4	2.4	2.7	2.8	2.9	2.9	3.3	3.6	3.8	3.4	4.0	4.9	6.6	6.4	6.8	5.9	6.6	7.6	7.8	8.8	7.0	6.8	7.2	7.3	7.4	7.0	7.4	8.3	9.7	9.2	8.4	5.6	10.0	8.7	9.9	7.4	(5.2)
2000	2.6	3.0	2.5	2.5	2.8	2.9	3.0	3.0	3.4	3.7	3.9	3.5	4.1	5.0	6.5	6.4	6.7	5.9	6.6	7.6	7.7	8.6	7.0	6.8	7.1	7.2	7.3	6.9	7.3	8.1	9.4	8.9	8.1	5.7	9.3	8.2	9.0	7.0	0.3	6.1
2001	2.5	2.9	2.5	2.5	2.7	2.8	2.9	3.0	3.3	3.6	3.8	3.4	3.9	4.8	6.3	6.2	6.5	5.6	6.4	7.2	7.3	8.2	6.6	6.5	6.7	6.8	6.8	6.4	6.8	7.5	8.5	8.0	7.2	5.0	8.1	6.9	7.3	5.3	0.4	3.3	0.6
2002	2.6	3.0	2.6	2.6	2.8	2.9	3.0	3.1	3.4	3.7	3.9	3.5	4.0	4.9	6.3	6.2	6.5	5.7	6.4	7.2	7.3	8.2	6.6	6.5	6.7	6.8	6.8	6.5	6.7	7.4	8.4	7.9	7.2	5.2	7.9	6.9	7.2	5.6	1.9	4.4	3.6	6.7
2003	2.5	2.9	2.5	2.5	2.7	2.8	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.7	6.1	5.9	6.2	5.4	6.1	6.8	6.9	7.7	6.3	6.1	6.3	6.3	6.3	6.0	6.2	6.8	7.6	7.1	6.4	4.6	6.8	5.8	5.9	4.4	1.3	3.0	2.0	2.7	(1.2)
2004	2.5	2.9	2.5	2.5	2.8	2.8	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.6	6.0	5.9	6.1	5.3	6.0	6.7	6.8	7.5	6.1	5.9	6.1	6.2	6.2	5.8	6.0	6.6	7.3	6.8	6.1	4.5	6.5	5.6	5.6	4.3	1.7	3.1	2.4	3.0	1.2	3.6
2005	2.6	3.0	2.6	2.6	2.8	2.9	3.0	3.0	3.4	3.6	3.8	3.4	3.9	4.7	6.0	5.9	6.1	5.4	6.0	6.7	6.7	7.5	6.1	6.0	6.1	6.2	6.2	5.8	6.0	6.5	7.2	6.8	6.1	4.6	6.5	5.6	5.7	4.5	2.3	3.6	3.1	3.7	2.8	4.8	6.0
2006	2.5	2.8	2.4	2.4	2.7	2.7	2.8	2.9	3.1	3.4	3.6	3.2	3.7	4.4	5.6	5.5	5.7	5.0	5.6	6.3	6.3	7.0	5.7	5.5	5.6	5.7	5.6	5.3	5.4	5.9	6.5	6.0	5.4	3.9	5.5	4.7	4.6	3.5	1.4	2.4	1.8	2.1	0.9	1.7	0.7	(4.4)
2007	2.4	2.8	2.4	2.4	2.6	2.7	2.7	2.8	3.1	3.3	3.5	3.2	3.6	4.3	5.5	5.4	5.6	4.9	5.4	6.1	6.1	6.7	5.5	5.3	5.4	5.5	5.4	5.1	5.2	5.6	6.1	5.7	5.1	3.7	5.2	4.4	4.3	3.3	1.4	2.3	1.7	1.9	1.0	1.5	0.9	(1.7)	1.2
2008	2.6	3.0	2.6	2.6	2.8	2.9	2.9	3.0	3.3	3.5	3.7	3.4	3.8	4.5	5.7	5.6	5.8	5.1	5.6	6.3	6.3	6.9	5.7	5.5	5.7	5.7	5.7	5.4	5.5	5.9	6.5	6.0	5.5	4.2	5.6	4.9	4.9	4.0	2.4	3.3	2.9	3.3	2.7	3.5	3.5	2.6	6.4	11.8
2009	2.5	2.8	2.5	2.5	2.7	2.7	2.8	2.9	3.1	3.3	3.5	3.2	3.6	4.3	5.4	5.3	5.5	4.8	5.3	5.9	6.0	6.5	5.4	5.2	5.3	5.3	5.3	5.0	5.1	5.4	5.9	5.5	4.9	3.7	5.0	4.3	4.3	3.4	1.9	2.6	2.2	2.4	1.8	2.3	2.1	1.1	3.0	4.0	(3.3)
2010	2.5	2.9	2.5	2.5	2.7	2.8	2.8	2.9	3.2	3.4	3.6	3.2	3.6	4.3	5.4	5.3	5.5	4.8	5.3	5.9	5.9	6.5	5.3	5.2	5.3	5.3	5.2	4.9	5.1	5.4	5.8	5.4	4.9	3.8	5.0	4.3	4.3	3.5	2.1	2.8	2.4	2.6	2.2	2.6	2.5	1.8	3.4	4.1	0.5	4.4
2011	2.8	3.1	2.8	2.8	3.0	3.1	3.1	3.2	3.4	3.6	3.8	3.5	3.9	4.6	5.7	5.5	5.7	5.1	5.6	6.2	6.2	6.8	5.7	5.5	5.7	5.7	5.6	5.4	5.5	5.8	6.3	5.9	5.5	4.4	5.6	5.0	5.0	4.3	3.1	3.8	3.6	3.9	3.6	4.2	4.3	4.0	5.8	6.9	5.4	10.0	15.8
2012	2.8	3.1	2.7	2.7	3.0	3.0	3.1	3.1	3.4	3.6	3.8	3.5	3.9	4.5	5.5	5.4	5.6	5.0	5.5	6.0	6.1	6.6	5.5	5.4	5.5	5.5	5.5	5.2	5.3	5.6	6.1	5.7	5.3	4.3	5.4	4.8	4.8	4.1	3.0	3.6	3.4	3.7	3.4	3.9	4.0	3.7	5.1	5.9	4.4	7.1	8.5	1.6
2013	2.5	2.8	2.5	2.5	2.7	2.7	2.8	2.8	3.1	3.3	3.4	3.1	3.5	4.1	5.1	5.0	5.2	4.6	5.0	5.5	5.6	6.0	5.0	4.9	4.9	4.9	4.9	4.6	4.7	5.0	5.3	5.0	4.5	3.5	4.5	3.9	3.9	3.2	2.1	2.6	2.4	2.5	2.1	2.5	2.4	1.9	2.8	3.1	1.5	2.7	2.1	(4.2)	(9.6)
2014	2.7	3.0	2.7	2.7	2.9	3.0	3.1	3.1	3.4	3.5	3.7	3.4	3.8	4.4	5.4	5.3	5.5	4.9	5.3	5.8	5.9	6.3	5.4	5.2	5.3	5.3	5.3	5.0	5.1	5.4	5.8	5.4	5.0	4.1	5.1	4.6	4.5	3.9	2.9	3.5	3.3	3.5	3.3	3.7	3.7	3.4	4.4	4.9	3.8	5.3	5.5	2.3	2.6	16.4
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)
2016	2.8	3.1	2.8	2.8	3.0	3.0	3.1	3.2	3.4	3.6	3.7	3.5	3.8	4.4	5.3	5.2	5.4	4.8	5.2	5.7	5.7	6.2	5.3	5.1	5.2	5.2	5.2	4.9	5.0	5.3	5.6	5.3	4.9	4.1	5.0	4.5	4.5	3.9	3.0	3.5	3.4	3.6	3.4	3.7	3.7	3.5	4.3	4.7	3.8	4.9	5.0	2.9	3.3	8.0	3.9	8.7
2017	2.7	3.0	2.7	2.7	2.9	2.9	3.0	3.1	3.3	3.4	3.6	3.3	3.7	4.2	5.2	5.0	5.2	4.7	5.1	5.5	5.5	6.0	5.1	4.9	5.0	5.0	4.9	4.7	4.8	5.0	5.4	5.0	4.6	3.8	4.7	4.2	4.2	3.6	2.8	3.2	3.1	3.2	3.0	3.3	3.3	3.1	3.8	4.0	3.2	4.0	4.0	2.1	2.2	5.4	2.0	3.3	(1.9)
2018	2.6	2.9	2.6	2.6	2.8	2.9	2.9	3.0	3.2	3.3	3.5	3.2	3.6	4.1	5.0	4.9	5.0	4.5	4.9	5.3	5.3	5.8	4.9	4.7	4.8	4.8	4.7	4.5	4.6	4.8	5.1	4.8	4.4	3.6	4.4	4.0	3.9	3.4	2.5	3.0	2.8	2.9	2.7	3.0	2.9	2.7	3.3	3.5	2.7	3.4	3.3	1.6	1.6	4.0	1.1	1.6	(1.7)	(1.6)

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have lost 11.9% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1963) would have given an average annual real return of 2.9%. Each figure on the bottom line of the table shows the average real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
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
2016	468	531	437	429	460	461	458	458	497	519	540	463	518	629	883	807	816	632	698	786	748	824	574	522	511	486	455	405	396	402	417	366	317	251	291	253	240	208	171	181	170	169	159	161	155	146	153	151	135	140	134	116	114	126	108	109
2017	459	521	429	421	452	452	450	449	488	509	530	454	508	617	867	792	801	620	685	771	734	808	563	512	501	477	446	398	388	395	409	359	311	246	286	248	236	205	168	177	167	166	156	158	152	144	150	148	133	137	131	113	112	123	106	107	98
2018	451	512	422	414	444	445	442	442	480	501	522	447	500	607	853	779	788	610	674	759	722	795	554	504	493	470	439	391	382	389	402	353	306	242	281	244	232	201	165	175	164	163	153	155	150	141	148	146	131	135	129	112	110	121	104	105	97	98

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have fallen to £88 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £109 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
1961	0.7
1962	1.3	1.8
1963	1.5	1.8	1.9
1964	1.0	1.1	0.8	(0.4)
1965	1.1	1.2	1.1	0.7	1.7
1966	1.3	1.5	1.4	1.2	2.0	2.4
1967	1.6	1.8	1.8	1.8	2.5	2.9	3.4
1968	1.6	1.7	1.7	1.7	2.2	2.4	2.4	1.4
1969	1.8	1.9	1.9	1.9	2.4	2.6	2.6	2.3	3.1
1970	1.6	1.6	1.6	1.6	1.9	2.0	1.9	1.4	1.3	(0.4)
1971	1.2	1.2	1.1	1.1	1.3	1.2	0.9	0.4	0.0	(1.5)	(2.6)
1972	0.9	0.9	0.8	0.7	0.8	0.7	0.4	(0.1)	(0.5)	(1.7)	(2.3)	(2.1)
1973	0.7	0.7	0.6	0.5	0.6	0.4	0.2	(0.4)	(0.7)	(1.6)	(2.0)	(1.7)	(1.4)
1974	0.3	0.2	0.1	(0.1)	(0.0)	(0.2)	(0.6)	(1.1)	(1.5)	(2.4)	(2.9)	(3.0)	(3.5)	(5.5)
1975	(0.6)	(0.7)	(0.8)	(1.1)	(1.1)	(1.4)	(1.8)	(2.4)	(3.0)	(4.0)	(4.7)	(5.2)	(6.2)	(8.5)	(11.3)
1976	(0.7)	(0.8)	(1.0)	(1.2)	(1.3)	(1.6)	(2.0)	(2.5)	(3.0)	(3.9)	(4.4)	(4.8)	(5.4)	(6.8)	(7.4)	(3.2)
1977	(0.8)	(0.9)	(1.1)	(1.3)	(1.4)	(1.6)	(2.0)	(2.5)	(2.9)	(3.7)	(4.1)	(4.4)	(4.8)	(5.7)	(5.7)	(2.8)	(2.4)
1978	(0.8)	(0.9)	(1.1)	(1.3)	(1.3)	(1.5)	(1.9)	(2.3)	(2.7)	(3.3)	(3.7)	(3.8)	(4.1)	(4.6)	(4.4)	(2.0)	(1.4)	(0.3)
1979	(0.9)	(1.0)	(1.2)	(1.4)	(1.4)	(1.7)	(2.0)	(2.4)	(2.7)	(3.3)	(3.6)	(3.7)	(4.0)	(4.4)	(4.2)	(2.3)	(2.0)	(1.8)	(3.2)
1980	(0.8)	(0.9)	(1.0)	(1.2)	(1.2)	(1.4)	(1.7)	(2.1)	(2.4)	(2.9)	(3.1)	(3.1)	(3.3)	(3.5)	(3.2)	(1.5)	(1.1)	(0.6)	(0.8)	1.8
1981	(0.7)	(0.8)	(0.9)	(1.0)	(1.1)	(1.3)	(1.5)	(1.8)	(2.1)	(2.5)	(2.7)	(2.7)	(2.8)	(2.9)	(2.5)	(1.0)	(0.5)	(0.1)	(0.0)	1.7	1.5
1982	(0.4)	(0.4)	(0.5)	(0.7)	(0.7)	(0.8)	(1.0)	(1.3)	(1.5)	(1.8)	(1.9)	(1.9)	(1.9)	(1.9)	(1.4)	0.1	0.6	1.2	1.6	3.3	4.0	6.6
1983	(0.2)	(0.2)	(0.3)	(0.4)	(0.4)	(0.5)	(0.7)	(0.9)	(1.1)	(1.4)	(1.5)	(1.4)	(1.3)	(1.3)	(0.8)	0.6	1.2	1.8	2.2	3.6	4.2	5.6	4.6
1984	0.0	0.0	(0.1)	(0.2)	(0.1)	(0.2)	(0.4)	(0.6)	(0.7)	(1.0)	(1.0)	(0.9)	(0.8)	(0.7)	(0.3)	1.1	1.6	2.2	2.6	3.8	4.4	5.3	4.7	4.8
1985	0.3	0.2	0.2	0.1	0.1	0.0	(0.1)	(0.3)	(0.4)	(0.6)	(0.6)	(0.4)	(0.3)	(0.2)	0.3	1.5	2.1	2.6	3.1	4.2	4.7	5.4	5.1	5.3	5.8
1986	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.1	0.0	(0.1)	(0.1)	0.0	0.2	0.3	0.8	2.0	2.6	3.1	3.6	4.6	5.0	5.7	5.5	5.9	6.4	7.0
1987	0.7	0.7	0.7	0.6	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.4	0.6	0.7	1.2	2.3	2.8	3.4	3.8	4.7	5.1	5.7	5.6	5.8	6.2	6.3	5.7
1988	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.5	0.5	0.4	0.4	0.6	0.8	0.9	1.4	2.4	2.9	3.4	3.8	4.6	5.0	5.5	5.3	5.4	5.6	5.5	4.8	4.0
1989	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.9	1.1	1.2	1.7	2.7	3.2	3.7	4.0	4.8	5.1	5.6	5.4	5.6	5.8	5.7	5.3	5.2	6.4
1990	1.2	1.2	1.2	1.1	1.2	1.2	1.1	1.0	1.0	0.9	1.0	1.2	1.4	1.5	2.0	2.9	3.4	3.8	4.2	4.9	5.2	5.6	5.5	5.6	5.8	5.8	5.5	5.4	6.2	6.0
1991	1.3	1.4	1.4	1.3	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.4	1.6	1.8	2.3	3.2	3.6	4.1	4.4	5.1	5.4	5.8	5.7	5.8	5.9	6.0	5.8	5.8	6.4	6.4	6.8
1992	1.5	1.5	1.5	1.5	1.6	1.6	1.5	1.5	1.5	1.4	1.5	1.7	1.9	2.1	2.5	3.4	3.8	4.2	4.6	5.2	5.5	5.8	5.8	5.9	6.0	6.1	5.9	6.0	6.5	6.5	6.8	6.7
1993	1.6	1.6	1.6	1.6	1.7	1.7	1.6	1.6	1.6	1.5	1.6	1.8	2.0	2.1	2.6	3.4	3.8	4.2	4.5	5.1	5.3	5.7	5.6	5.7	5.8	5.8	5.6	5.6	5.9	5.8	5.8	5.3	3.9
1994	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.6	1.6	1.5	1.6	1.8	2.0	2.2	2.6	3.3	3.7	4.1	4.4	4.9	5.1	5.4	5.3	5.4	5.5	5.4	5.2	5.2	5.4	5.2	5.0	4.3	3.2	2.4
1995	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.7	1.9	2.1	2.2	2.6	3.4	3.7	4.1	4.3	4.8	5.0	5.3	5.2	5.2	5.3	5.2	5.0	4.9	5.1	4.9	4.6	4.1	3.2	2.9	3.4
1996	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.7	1.7	1.7	1.8	2.0	2.1	2.3	2.6	3.4	3.7	4.0	4.3	4.7	4.9	5.2	5.1	5.1	5.1	5.1	4.9	4.8	4.9	4.7	4.5	4.0	3.3	3.2	3.5	3.6
1997	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	2.0	2.2	2.3	2.7	3.4	3.7	4.0	4.2	4.7	4.8	5.0	4.9	5.0	5.0	4.9	4.7	4.6	4.7	4.5	4.3	3.9	3.3	3.2	3.4	3.4	3.1
1998	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.1	2.3	2.4	2.8	3.4	3.7	4.0	4.3	4.7	4.8	5.0	4.9	5.0	5.0	4.9	4.7	4.7	4.7	4.5	4.4	4.0	3.6	3.5	3.8	3.9	4.1	5.0
1999	1.9	1.9	1.9	1.9	2.0	2.0	2.0	1.9	2.0	1.9	2.0	2.2	2.3	2.5	2.8	3.4	3.7	4.0	4.2	4.6	4.8	5.0	4.9	4.9	4.9	4.8	4.7	4.6	4.6	4.5	4.3	4.0	3.6	3.5	3.8	3.9	3.9	4.4	3.7
2000	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.4	2.5	2.8	3.4	3.7	4.0	4.2	4.6	4.7	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.3	4.2	3.9	3.5	3.5	3.7	3.7	3.8	4.0	3.4	3.2
2001	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.0	2.1	2.3	2.4	2.6	2.9	3.5	3.8	4.0	4.2	4.6	4.7	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.4	4.2	4.0	3.7	3.7	3.8	3.9	4.0	4.2	3.9	4.0	4.8
2002	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.0	2.0	2.0	2.1	2.2	2.4	2.5	2.8	3.4	3.7	3.9	4.1	4.4	4.5	4.7	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.1	4.0	3.7	3.4	3.4	3.5	3.5	3.5	3.6	3.2	3.0	2.9	1.1
2003	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.3	3.6	3.8	4.0	4.3	4.4	4.5	4.4	4.4	4.4	4.3	4.1	4.1	4.1	3.9	3.7	3.5	3.2	3.1	3.2	3.2	3.1	3.1	2.7	2.5	2.3	1.0	0.9
2004	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.3	2.4	2.7	3.2	3.5	3.7	3.8	4.1	4.2	4.4	4.3	4.2	4.2	4.1	4.0	3.9	3.9	3.7	3.5	3.3	3.0	2.9	3.0	2.9	2.9	2.8	2.5	2.2	2.0	1.0	1.0	1.1
2005	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.3	2.4	2.7	3.2	3.4	3.7	3.8	4.1	4.2	4.3	4.2	4.2	4.1	4.1	3.9	3.8	3.8	3.6	3.5	3.3	3.0	2.9	3.0	2.9	2.8	2.8	2.5	2.3	2.1	1.5	1.6	1.9	2.7
2006	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	1.9	2.0	2.1	2.3	2.4	2.6	3.1	3.3	3.5	3.7	3.9	4.0	4.1	4.0	4.0	4.0	3.9	3.7	3.6	3.6	3.5	3.3	3.1	2.8	2.7	2.8	2.7	2.6	2.5	2.2	2.0	1.8	1.3	1.3	1.4	1.6	0.4
2007	1.9	1.9	1.9	1.9	2.0	2.0	2.0	1.9	2.0	1.9	2.0	2.1	2.2	2.4	2.6	3.1	3.3	3.5	3.6	3.9	3.9	4.0	3.9	3.9	3.9	3.8	3.6	3.5	3.5	3.4	3.2	3.0	2.7	2.7	2.7	2.6	2.5	2.5	2.2	2.0	1.8	1.3	1.4	1.5	1.6	1.1	1.8
2008	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.4	2.7	3.1	3.3	3.5	3.6	3.9	4.0	4.0	3.9	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.1	2.8	2.8	2.8	2.7	2.7	2.6	2.4	2.2	2.1	1.7	1.9	2.0	2.3	2.1	3.0	4.2
2009	1.9	1.9	1.9	1.9	1.9	2.0	1.9	1.9	1.9	1.9	2.0	2.1	2.2	2.3	2.5	3.0	3.2	3.3	3.5	3.7	3.8	3.8	3.7	3.7	3.7	3.6	3.4	3.3	3.3	3.1	3.0	2.8	2.6	2.5	2.5	2.4	2.3	2.3	2.0	1.8	1.7	1.3	1.3	1.4	1.5	1.2	1.4	1.2	(1.7)
2010	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.9	2.0	2.1	2.3	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.4	3.4	3.4	3.3	3.1	3.0	2.9	2.8	2.6	2.4	2.2	2.1	2.1	2.0	1.9	1.8	1.5	1.3	1.1	0.7	0.6	0.6	0.5	0.1	0.0	(0.6)	(2.9)	(4.1)
2011	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.2	2.6	2.7	2.9	3.0	3.2	3.2	3.3	3.2	3.1	3.1	3.0	2.8	2.7	2.6	2.5	2.3	2.1	1.8	1.7	1.7	1.6	1.4	1.3	1.0	0.8	0.6	0.2	0.1	0.0	(0.1)	(0.6)	(0.8)	(1.5)	(3.3)	(4.1)	(4.1)
2012	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.6	1.7	1.8	2.0	2.4	2.6	2.7	2.8	3.0	3.0	3.1	3.0	2.9	2.9	2.7	2.6	2.5	2.4	2.2	2.1	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.8	0.6	0.3	(0.1)	(0.2)	(0.3)	(0.5)	(0.9)	(1.1)	(1.7)	(3.1)	(3.6)	(3.4)	(2.7)
2013	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.5	1.6	1.6	1.7	1.9	2.3	2.4	2.6	2.7	2.8	2.9	2.9	2.8	2.7	2.7	2.6	2.4	2.3	2.2	2.0	1.9	1.7	1.4	1.3	1.2	1.1	1.0	0.8	0.6	0.3	0.1	(0.2)	(0.4)	(0.5)	(0.7)	(1.1)	(1.3)	(1.8)	(3.0)	(3.3)	(3.0)	(2.5)	(2.3)
2014	1.4	1.4	1.4	1.4	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.5	1.6	1.6	1.8	2.2	2.3	2.5	2.6	2.7	2.8	2.8	2.7	2.6	2.5	2.4	2.3	2.1	2.1	1.9	1.7	1.5	1.3	1.2	1.1	1.0	0.9	0.7	0.5	0.2	0.0	(0.3)	(0.4)	(0.6)	(0.7)	(1.1)	(1.3)	(1.7)	(2.7)	(2.9)	(2.6)	(2.1)	(1.7)	(1.2)
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)
2016	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.2	1.3	1.4	1.4	1.5	1.7	2.0	2.2	2.3	2.3	2.5	2.5	2.5	2.4	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.5	1.3	1.1	1.0	0.9	0.8	0.6	0.5	0.2	0.0	(0.1)	(0.5)	(0.6)	(0.7)	(0.8)	(1.2)	(1.3)	(1.6)	(2.4)	(2.5)	(2.2)	(1.8)	(1.6)	(1.3)	(1.4)	(2.1)
2017	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.3	1.4	1.5	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.2	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.3	1.1	0.9	0.7	0.7	0.5	0.4	0.3	0.0	(0.2)	(0.4)	(0.7)	(0.8)	(0.9)	(1.1)	(1.4)	(1.5)	(1.9)	(2.5)	(2.6)	(2.4)	(2.1)	(2.0)	(2.0)	(2.2)	(3.0)	(3.9)
2018	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.5	1.8	1.9	2.0	2.1	2.2	2.2	2.2	2.1	2.0	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.0	0.8	0.6	0.6	0.4	0.3	0.2	(0.1)	(0.3)	(0.5)	(0.8)	(0.9)	(1.0)	(1.2)	(1.4)	(1.6)	(1.9)	(2.5)	(2.6)	(2.4)	(2.1)	(2.1)	(2.0)	(2.2)	(2.7)	(3.0)	(2.1)

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1963 would have lost 0.4% (allowing for reinvestment of income) in one year but over the first three years (up to the end of 1966) would have given an average annual real return of 1.2%. Each figure on the bottom line of the table shows the average real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
1961	101
1962	103	102
1963	104	104	102
1964	104	103	102	100
1965	106	105	103	101	102
1966	108	108	106	104	104	102
1967	112	111	109	107	108	106	103
1968	114	113	111	109	109	107	105	101
1969	117	116	114	112	113	111	108	105	103
1970	117	116	114	112	112	110	108	104	103	100
1971	114	113	111	109	109	107	105	101	100	97	97
1972	111	110	109	106	107	105	103	99	98	95	95	98
1973	110	109	107	105	105	104	101	98	97	94	94	97	99
1974	104	103	101	99	100	98	96	92	91	88	89	91	93	94
1975	92	91	90	88	88	87	85	82	81	78	79	81	83	84	89
1976	89	88	87	85	85	84	82	79	78	76	76	78	80	81	86	97
1977	87	86	85	83	83	82	80	77	76	74	74	76	78	79	84	94	98
1978	86	86	84	83	83	82	80	77	76	74	74	76	78	79	83	94	97	100
1979	84	83	82	80	80	79	77	75	74	71	72	74	75	76	81	91	94	96	97
1980	85	85	83	82	82	80	79	76	75	73	73	75	77	78	82	93	96	98	98	102
1981	86	86	84	83	83	82	80	77	76	74	74	76	78	79	83	94	97	100	100	103	102
1982	92	92	90	88	89	87	85	82	81	79	79	81	83	84	89	100	104	106	107	110	108	107
1983	96	96	94	92	93	91	89	86	85	82	83	85	87	88	93	105	108	111	111	115	113	111	105
1984	101	100	99	97	97	95	93	90	89	86	87	89	91	92	98	110	114	116	117	121	119	117	110	105
1985	107	106	104	102	103	101	99	95	94	91	92	94	96	98	103	116	120	123	124	128	126	124	116	111	106
1986	114	114	112	109	110	108	106	102	101	98	98	101	103	104	110	124	129	132	132	137	134	132	124	119	113	107
1987	121	120	118	116	116	114	112	108	106	103	104	106	109	110	117	132	136	139	140	144	142	140	131	125	120	113	106
1988	126	125	123	120	121	119	116	112	111	107	108	111	113	115	121	137	141	145	145	150	148	145	136	130	124	118	110	104
1989	134	133	130	128	128	126	123	119	118	114	115	118	120	122	129	145	150	154	155	160	157	155	145	139	132	125	117	111	106
1990	142	141	138	136	136	134	131	126	125	121	121	125	127	129	137	154	159	163	164	169	166	164	154	147	140	132	124	117	113	106
1991	151	150	148	145	145	143	140	135	133	129	130	133	136	138	146	165	170	174	175	181	178	175	164	157	150	141	132	125	120	113	107
1992	161	160	157	155	155	152	149	144	142	138	138	142	145	147	156	176	182	186	187	193	190	187	175	167	160	151	141	134	128	121	114	107
1993	168	166	164	161	161	158	155	150	148	143	144	148	151	153	162	183	189	193	194	200	197	194	182	174	166	157	147	139	133	125	118	111	104
1994	172	171	168	164	165	162	159	153	151	147	147	151	154	157	166	187	193	198	199	205	202	199	186	178	170	161	150	142	137	129	121	114	106	102
1995	178	176	173	170	171	168	164	159	156	152	152	156	160	162	171	193	200	205	205	212	209	205	193	184	176	166	155	147	141	133	125	117	110	106	103
1996	184	183	180	176	177	174	170	164	162	157	158	162	166	168	178	200	207	212	213	220	216	213	200	191	182	172	161	152	146	138	130	122	114	110	107	104
1997	190	188	185	182	182	179	175	170	167	162	163	167	171	173	183	207	214	219	220	227	223	220	206	197	188	178	166	157	151	142	134	126	118	113	111	107	103
1998	199	198	195	191	192	188	184	178	176	170	171	176	179	182	192	217	224	230	231	238	234	231	216	207	197	187	174	165	159	149	141	132	124	119	116	112	108	105
1999	207	205	202	198	199	195	191	185	182	177	177	182	186	189	200	225	233	238	239	247	243	239	224	214	205	193	181	171	165	155	146	137	128	123	120	116	112	109	104
2000	213	212	208	204	205	202	197	190	188	182	183	188	192	195	206	232	240	246	247	255	250	247	231	221	211	200	187	177	170	160	151	141	132	127	124	120	116	112	107	103
2001	224	222	218	214	215	211	206	200	197	191	192	197	201	204	216	243	251	258	258	267	262	258	242	232	221	209	195	185	178	167	158	148	138	133	130	126	121	118	112	108	105
2002	226	224	221	216	217	214	209	202	199	193	194	199	203	206	218	246	254	261	261	270	265	261	245	234	224	211	198	187	180	169	160	149	140	135	132	127	123	119	113	109	106	101
2003	228	227	223	218	219	216	211	204	201	195	196	201	205	208	220	248	257	263	264	273	268	264	247	237	226	213	200	189	182	171	161	151	141	136	133	128	124	120	114	110	107	102	101
2004	231	229	225	221	222	218	213	206	203	197	198	203	207	210	223	251	259	266	267	276	271	267	250	239	228	216	202	191	184	173	163	152	143	137	134	130	125	121	116	112	108	103	102	101
2005	237	235	231	227	228	224	219	212	209	202	203	209	213	216	229	258	267	273	274	283	278	274	257	246	235	222	207	196	189	177	167	157	147	141	138	133	129	125	119	115	111	106	105	104	103
2006	238	236	232	228	229	225	220	212	210	203	204	210	214	217	230	259	268	274	275	284	279	275	258	247	236	223	208	197	189	178	168	157	147	142	139	134	129	125	119	115	112	106	105	104	103	100
2007	242	240	236	232	233	229	223	216	213	207	208	213	218	221	234	264	272	279	280	289	284	280	263	251	240	226	212	200	193	181	171	160	150	144	141	136	132	128	121	117	113	108	107	106	105	102	102
2008	252	251	246	242	243	238	233	225	222	216	216	222	227	230	244	275	284	291	292	302	296	292	274	262	250	236	221	209	201	189	178	167	156	150	147	142	137	133	127	122	118	113	112	111	109	107	106	104
2009	248	246	242	238	238	234	229	222	218	212	213	218	223	226	240	270	279	286	287	297	291	287	269	257	246	232	217	205	197	186	175	164	154	148	144	140	135	131	124	120	116	111	110	109	108	105	104	102	98
2010	238	236	232	228	229	225	220	213	210	203	204	210	214	217	230	259	268	274	275	284	279	275	258	247	236	223	208	197	189	178	168	157	147	142	139	134	129	125	119	115	112	106	105	104	103	100	100	98	94	96
2011	228	227	223	218	219	216	211	204	201	195	196	201	205	208	220	248	257	263	264	273	268	264	248	237	226	213	200	189	182	171	161	151	141	136	133	128	124	120	114	110	107	102	101	100	99	96	96	94	90	92	96
2012	222	220	217	213	213	210	205	198	196	190	190	196	200	203	214	242	250	256	257	265	261	257	241	230	220	208	194	184	177	166	157	147	138	132	129	125	121	117	111	107	104	99	98	97	96	94	93	92	88	90	93	97
2013	217	215	212	208	209	205	200	194	191	185	186	191	195	198	210	236	244	250	251	259	255	251	235	225	215	203	190	180	173	162	153	143	134	129	126	122	118	114	109	105	102	97	96	95	94	92	91	90	86	87	91	95	98
2014	214	213	209	205	206	203	198	191	189	183	184	189	193	196	207	233	241	247	248	256	252	248	233	222	212	201	188	177	171	160	151	142	133	128	125	121	116	113	108	104	101	96	95	94	93	91	90	89	85	86	90	94	97	99
2015	213	211	208	204	205	201	196	190	187	182	182	187	191	194	205	232	239	245	246	254	250	246	231	221	211	199	186	176	169	159	150	141	132	127	124	120	116	112	107	103	100	95	94	93	92	90	89	88	84	86	89	93	96	98	99
2016	208	207	203	200	200	197	192	186	184	178	179	184	187	190	201	227	235	240	241	249	245	241	226	216	206	195	182	172	166	156	147	138	129	124	121	117	113	110	105	101	98	93	92	91	90	88	88	86	83	84	88	91	94	96	97	98
2017	200	199	195	192	193	189	185	179	176	171	172	176	180	183	193	218	225	231	232	239	235	232	217	208	198	187	175	166	159	150	142	132	124	119	117	113	109	106	100	97	94	90	89	88	87	85	84	83	79	81	84	88	90	92	93	94	96
2018	196	195	191	188	188	185	181	175	173	167	168	173	176	179	189	213	221	226	227	234	230	227	213	203	194	183	171	162	156	147	138	130	121	117	114	110	107	103	98	95	92	88	87	86	85	83	82	81	78	79	82	86	88	90	91	92	94	98

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1978 would have fallen to £97 (allowing for reinvestment of income and the effect of inflation) in one year but after four years (up to the end of 1982) would have reached £107 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
1961	1.4
1962	2.4	3.4
1963	2.9	3.6	3.9
1964	2.4	2.7	2.4	0.9
1965	2.3	2.5	2.2	1.4	1.9
1966	2.4	2.6	2.4	1.9	2.5	3.0
1967	2.7	3.0	2.9	2.6	3.2	3.8	4.7
1968	2.6	2.7	2.6	2.4	2.8	3.1	3.1	1.5
1969	2.7	2.8	2.8	2.6	2.9	3.2	3.2	2.5	3.5
1970	2.5	2.6	2.5	2.3	2.5	2.6	2.5	1.8	2.0	0.6
1971	2.2	2.2	2.1	1.9	2.0	2.1	1.9	1.2	1.1	(0.1)	(0.7)
1972	2.0	2.1	2.0	1.7	1.8	1.8	1.6	1.0	0.9	0.1	(0.1)	0.5
1973	1.8	1.8	1.7	1.5	1.6	1.5	1.3	0.7	0.6	(0.1)	(0.3)	(0.2)	(0.8)
1974	1.2	1.1	1.0	0.7	0.7	0.6	0.2	(0.4)	(0.7)	(1.5)	(2.0)	(2.4)	(3.8)	(6.8)
1975	0.3	0.2	(0.0)	(0.3)	(0.4)	(0.7)	(1.1)	(1.8)	(2.2)	(3.2)	(3.9)	(4.7)	(6.3)	(9.0)	(11.1)
1976	0.0	(0.1)	(0.3)	(0.6)	(0.7)	(1.0)	(1.4)	(2.0)	(2.4)	(3.3)	(3.9)	(4.5)	(5.7)	(7.3)	(7.6)	(3.8)
1977	(0.0)	(0.1)	(0.4)	(0.7)	(0.8)	(1.0)	(1.4)	(1.9)	(2.3)	(3.0)	(3.5)	(4.0)	(4.8)	(5.8)	(5.5)	(2.6)	(1.3)
1978	0.0	(0.1)	(0.3)	(0.6)	(0.7)	(0.9)	(1.2)	(1.7)	(2.0)	(2.6)	(3.0)	(3.3)	(3.9)	(4.5)	(3.9)	(1.4)	(0.2)	1.0
1979	(0.2)	(0.3)	(0.5)	(0.8)	(0.9)	(1.1)	(1.4)	(1.9)	(2.2)	(2.8)	(3.1)	(3.4)	(4.0)	(4.5)	(4.0)	(2.1)	(1.6)	(1.7)	(4.3)
1980	(0.2)	(0.3)	(0.5)	(0.8)	(0.9)	(1.0)	(1.3)	(1.8)	(2.0)	(2.5)	(2.8)	(3.1)	(3.5)	(3.9)	(3.4)	(1.7)	(1.2)	(1.2)	(2.2)	(0.1)
1981	(0.2)	(0.2)	(0.4)	(0.7)	(0.8)	(0.9)	(1.2)	(1.6)	(1.8)	(2.2)	(2.5)	(2.7)	(3.0)	(3.3)	(2.8)	(1.3)	(0.8)	(0.7)	(1.2)	0.3	0.8
1982	0.1	0.1	(0.1)	(0.3)	(0.4)	(0.5)	(0.7)	(1.1)	(1.3)	(1.6)	(1.8)	(1.9)	(2.1)	(2.3)	(1.7)	(0.3)	0.4	0.7	0.6	2.3	3.6	6.4
1983	0.3	0.2	0.1	(0.1)	(0.1)	(0.3)	(0.4)	(0.8)	(0.9)	(1.2)	(1.3)	(1.4)	(1.6)	(1.6)	(1.1)	0.3	0.9	1.3	1.3	2.8	3.8	5.3	4.1
1984	0.5	0.5	0.3	0.2	0.1	0.0	(0.1)	(0.4)	(0.5)	(0.8)	(0.9)	(0.9)	(1.0)	(1.0)	(0.4)	0.8	1.4	1.8	2.0	3.2	4.1	5.2	4.6	5.2
1985	0.7	0.6	0.5	0.4	0.3	0.3	0.1	(0.1)	(0.2)	(0.5)	(0.5)	(0.5)	(0.6)	(0.6)	0.0	1.2	1.8	2.2	2.4	3.5	4.3	5.1	4.7	5.0	4.8
1986	0.9	0.9	0.8	0.6	0.6	0.6	0.4	0.2	0.1	(0.1)	(0.1)	(0.0)	(0.1)	(0.0)	0.6	1.7	2.3	2.7	2.9	3.9	4.6	5.4	5.2	5.5	5.7	6.6
1987	1.1	1.0	1.0	0.8	0.8	0.8	0.7	0.5	0.4	0.3	0.2	0.3	0.3	0.4	0.9	2.0	2.6	3.0	3.2	4.2	4.8	5.5	5.3	5.6	5.7	6.2	5.7
1988	1.1	1.1	1.0	0.9	0.9	0.8	0.7	0.5	0.5	0.3	0.3	0.4	0.4	0.4	1.0	2.0	2.5	2.8	3.0	3.9	4.4	4.9	4.6	4.7	4.6	4.5	3.5	1.4
1989	1.1	1.1	1.0	0.9	0.9	0.9	0.8	0.6	0.6	0.4	0.4	0.5	0.5	0.6	1.1	2.0	2.5	2.8	3.0	3.7	4.2	4.6	4.4	4.4	4.3	4.1	3.3	2.1	2.8
1990	1.2	1.2	1.1	1.0	1.0	1.0	0.9	0.7	0.7	0.5	0.5	0.6	0.6	0.7	1.2	2.1	2.5	2.8	2.9	3.6	4.0	4.4	4.1	4.1	4.0	3.8	3.1	2.2	2.6	2.5
1991	1.3	1.3	1.2	1.1	1.1	1.1	1.0	0.9	0.8	0.7	0.7	0.8	0.8	0.9	1.4	2.2	2.6	2.9	3.1	3.7	4.1	4.4	4.2	4.2	4.1	3.9	3.4	2.8	3.3	3.6	4.6
1992	1.5	1.5	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.7	2.5	2.9	3.2	3.3	4.0	4.3	4.6	4.4	4.5	4.4	4.3	4.0	3.6	4.2	4.6	5.7	6.8
1993	1.5	1.5	1.4	1.3	1.4	1.3	1.3	1.1	1.1	1.0	1.0	1.1	1.2	1.3	1.7	2.5	2.9	3.1	3.3	3.8	4.1	4.4	4.2	4.2	4.1	4.1	3.7	3.4	3.8	4.0	4.5	4.5	2.2
1994	1.5	1.5	1.4	1.3	1.3	1.3	1.3	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.7	2.4	2.7	3.0	3.1	3.6	3.9	4.1	3.9	3.9	3.8	3.7	3.3	3.0	3.3	3.4	3.6	3.2	1.5	0.8
1995	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.6	2.3	2.6	2.9	3.0	3.4	3.7	3.9	3.7	3.7	3.5	3.4	3.0	2.7	2.9	2.9	3.0	2.6	1.2	0.7	0.7
1996	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.5	2.2	2.5	2.7	2.8	3.2	3.4	3.6	3.4	3.4	3.2	3.1	2.7	2.4	2.5	2.5	2.5	2.1	0.9	0.5	0.4	0.2
1997	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	1.0	1.0	1.1	1.5	2.1	2.4	2.5	2.6	3.0	3.2	3.4	3.2	3.1	2.9	2.8	2.4	2.1	2.2	2.1	2.1	1.7	0.6	0.3	0.1	(0.2)	(0.5)
1998	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.6	2.2	2.4	2.6	2.7	3.1	3.3	3.4	3.2	3.2	3.0	2.9	2.6	2.3	2.4	2.4	2.3	2.0	1.2	1.0	1.1	1.2	1.8	4.2
1999	1.5	1.5	1.4	1.3	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.3	1.6	2.2	2.5	2.6	2.7	3.1	3.3	3.4	3.2	3.2	3.0	2.9	2.6	2.4	2.5	2.4	2.4	2.2	1.5	1.4	1.5	1.8	2.3	3.7	3.3
2000	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.7	2.2	2.5	2.6	2.7	3.1	3.2	3.4	3.2	3.1	3.0	2.9	2.6	2.4	2.5	2.4	2.4	2.2	1.6	1.6	1.7	1.9	2.3	3.3	2.9	2.5
2001	1.6	1.6	1.5	1.4	1.5	1.4	1.4	1.3	1.3	1.2	1.3	1.3	1.4	1.4	1.8	2.3	2.5	2.7	2.8	3.1	3.3	3.4	3.2	3.2	3.1	3.0	2.7	2.5	2.6	2.6	2.6	2.4	1.9	1.9	2.0	2.2	2.7	3.5	3.3	3.2	4.0
2002	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.7	2.2	2.5	2.6	2.7	3.0	3.1	3.2	3.1	3.0	2.9	2.8	2.6	2.4	2.4	2.4	2.4	2.2	1.8	1.7	1.8	2.0	2.3	2.9	2.5	2.3	2.2	0.4
2003	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.7	2.2	2.4	2.5	2.6	2.9	3.0	3.1	3.0	2.9	2.8	2.7	2.5	2.2	2.3	2.3	2.3	2.1	1.6	1.6	1.7	1.8	2.0	2.5	2.1	1.8	1.6	0.5	0.5
2004	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.6	2.1	2.3	2.5	2.5	2.8	2.9	3.0	2.9	2.8	2.7	2.6	2.4	2.2	2.2	2.2	2.1	2.0	1.6	1.5	1.6	1.7	1.9	2.2	1.9	1.6	1.4	0.6	0.6	0.7
2005	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.3	1.3	1.4	1.6	2.1	2.3	2.4	2.5	2.8	2.9	3.0	2.8	2.8	2.6	2.5	2.3	2.1	2.2	2.1	2.1	1.9	1.6	1.5	1.6	1.7	1.8	2.2	1.9	1.6	1.5	0.8	1.0	1.2	1.7
2006	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.6	2.0	2.2	2.3	2.4	2.6	2.8	2.8	2.7	2.6	2.5	2.4	2.2	2.0	2.1	2.0	2.0	1.8	1.5	1.4	1.4	1.5	1.7	1.9	1.6	1.4	1.2	0.7	0.7	0.8	0.8	(0.1)
2007	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.2	1.2	1.2	1.3	1.6	2.0	2.2	2.3	2.3	2.6	2.7	2.8	2.6	2.5	2.4	2.3	2.1	1.9	2.0	1.9	1.9	1.7	1.4	1.3	1.4	1.4	1.6	1.8	1.5	1.3	1.1	0.7	0.7	0.8	0.8	0.3	0.7
2008	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.3	1.5	1.9	2.1	2.2	2.3	2.5	2.6	2.6	2.5	2.4	2.3	2.2	2.0	1.9	1.9	1.8	1.8	1.6	1.3	1.3	1.3	1.3	1.4	1.6	1.4	1.1	1.0	0.6	0.6	0.6	0.6	0.2	0.3	(0.1)
2009	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2	1.4	1.8	2.0	2.1	2.1	2.3	2.4	2.5	2.3	2.3	2.1	2.0	1.8	1.7	1.7	1.6	1.6	1.4	1.1	1.0	1.1	1.1	1.2	1.3	1.0	0.8	0.6	0.2	0.2	0.1	0.0	(0.4)	(0.5)	(1.1)	(2.1)
2010	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.2	1.6	1.8	1.9	1.9	2.1	2.2	2.2	2.1	2.0	1.9	1.8	1.6	1.4	1.4	1.3	1.3	1.1	0.8	0.7	0.7	0.7	0.7	0.8	0.6	0.3	0.1	(0.3)	(0.4)	(0.5)	(0.7)	(1.2)	(1.5)	(2.2)	(3.2)	(4.4)
2011	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.1	1.4	1.6	1.7	1.7	1.9	2.0	2.0	1.9	1.8	1.6	1.5	1.3	1.1	1.1	1.1	1.0	0.8	0.5	0.4	0.4	0.4	0.4	0.5	0.2	(0.1)	(0.3)	(0.7)	(0.8)	(1.0)	(1.3)	(1.7)	(2.1)	(2.8)	(3.6)	(4.4)	(4.4)
2012	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	1.0	1.3	1.5	1.5	1.6	1.8	1.8	1.8	1.7	1.6	1.5	1.4	1.2	1.0	1.0	0.9	0.8	0.6	0.3	0.2	0.2	0.2	0.2	0.2	(0.0)	(0.3)	(0.5)	(0.9)	(1.0)	(1.2)	(1.5)	(1.9)	(2.2)	(2.8)	(3.4)	(3.9)	(3.6)	(2.8)
2013	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.9	1.2	1.4	1.4	1.5	1.6	1.7	1.7	1.6	1.5	1.3	1.2	1.0	0.9	0.8	0.8	0.7	0.5	0.2	0.1	0.1	0.0	0.0	0.1	(0.2)	(0.4)	(0.7)	(1.0)	(1.2)	(1.3)	(1.6)	(2.0)	(2.2)	(2.7)	(3.2)	(3.5)	(3.2)	(2.6)	(2.4)
2014	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.5	1.4	1.3	1.1	0.9	0.8	0.7	0.7	0.6	0.4	0.1	0.0	0.0	(0.0)	(0.0)	(0.0)	(0.3)	(0.5)	(0.7)	(1.1)	(1.2)	(1.3)	(1.5)	(1.9)	(2.1)	(2.5)	(2.9)	(3.1)	(2.7)	(2.2)	(1.9)	(1.3)
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)
2016	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.7	1.0	1.1	1.2	1.2	1.4	1.4	1.4	1.3	1.2	1.1	1.0	0.8	0.6	0.6	0.5	0.4	0.3	(0.0)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)	(0.4)	(0.6)	(0.8)	(1.1)	(1.3)	(1.4)	(1.6)	(1.8)	(2.0)	(2.3)	(2.6)	(2.7)	(2.4)	(2.0)	(1.8)	(1.5)	(1.6)	(2.3)
2017	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.1	1.0	0.9	0.8	0.6	0.5	0.4	0.3	0.3	0.1	(0.2)	(0.3)	(0.3)	(0.4)	(0.4)	(0.4)	(0.6)	(0.8)	(1.0)	(1.3)	(1.4)	(1.6)	(1.7)	(2.0)	(2.2)	(2.5)	(2.7)	(2.8)	(2.6)	(2.3)	(2.2)	(2.1)	(2.4)	(3.1)	(3.9)
2018	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.5	0.8	0.9	1.0	1.0	1.1	1.2	1.2	1.0	0.9	0.8	0.7	0.5	0.4	0.3	0.2	0.2	(0.0)	(0.3)	(0.4)	(0.4)	(0.4)	(0.5)	(0.5)	(0.7)	(0.9)	(1.1)	(1.4)	(1.5)	(1.6)	(1.8)	(2.1)	(2.2)	(2.5)	(2.7)	(2.8)	(2.6)	(2.3)	(2.2)	(2.2)	(2.4)	(2.9)	(3.2)	(2.5)

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the annual rate of return is calculated. Reading the top figure in each column diagonally down the table gives the real rate of return in each year since 1960. The table can be used to see the real rate of return over any period; thus a purchase made at the end of 1960 would have grown by 1.4% (allowing for reinvestment of income) in one year, but over the first three years (up to the end of 1963) would have given an average annual real return of 2.9%. Each figure on the bottom line of the table shows the average real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
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
2016	158	156	151	145	144	141	137	131	129	125	124	125	124	125	135	151	157	160	158	165	165	164	154	148	141	134	126	119	117	114	112	107	100	98	97	96	96	97	93	90	88	84	84	83	83	81	82	81	81	83	87	91	93	95	97	98
2017	152	150	145	140	139	136	132	126	124	120	119	120	120	121	129	146	151	153	152	159	159	158	148	142	135	129	121	114	113	110	107	102	96	94	93	93	92	93	89	86	84	81	81	80	80	78	78	78	78	80	83	87	90	92	93	94	96
2018	148	146	141	136	135	132	129	123	121	117	116	117	117	118	126	142	148	150	148	155	155	154	144	139	132	126	118	112	110	107	105	100	93	91	91	90	90	91	87	84	82	79	79	78	78	76	76	76	76	78	81	85	87	89	91	92	94	97

The dates along the top are those on which each portfolio starts. Those down the side are the dates to which the change in real value is calculated. Reading the top figure in each column diagonally down the table gives the growth in each year since 1960. The table can be used to see the real growth over any period; thus an investment of £100 made at the end of 1960 would have grown to £101 (allowing for reinvestment of income and the effect of inflation) in one year but after three years (up to the end of 1963) would have reached £109 in real terms. Each figure on the bottom line of the table shows the real growth up to December 2018 from the year corresponding to that column.

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	2015	2016	2017
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)			
2016	3.7	4.0	4.0	4.3	4.4	4.5	4.4	4.3	4.7	4.8	4.5	3.9	4.6	4.4	4.4	4.2	3.5	3.5	3.7	4.1	4.0	4.0	4.0	3.7	4.3	4.6	5.5	5.9	6.0	4.4	5.4	8.7	6.1	16.6		
2017	3.5	3.8	3.8	4.2	4.2	4.2	4.2	4.1	4.4	4.6	4.2	3.6	4.3	4.1	4.1	3.9	3.2	3.2	3.4	3.7	3.6	3.6	3.5	3.3	3.8	4.0	4.7	4.9	4.8	3.3	3.9	6.0	3.4	7.0	(1.7)	
2018	3.4	3.6	3.7	4.0	4.0	4.1	4.0	3.9	4.2	4.4	4.0	3.5	4.1	3.9	3.9	3.6	3.0	3.0	3.2	3.4	3.3	3.3	3.2	2.9	3.4	3.5	4.1	4.2	4.1	2.7	3.1	4.6	2.3	4.3	(1.3)	(1.0)

Real Value of £100 Invested

GROSS INCOME RE-INVESTED

INVESTMENT TO END YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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			
2016	345	360	353	374	365	355	333	313	328	326	285	240	268	247	238	217	186	180	180	183	174	167	160	149	153	151	154	149	142	124	123	128	113	117		
2017	339	354	347	368	359	349	327	308	322	320	280	236	264	243	234	214	183	177	177	180	171	165	157	147	150	148	151	147	139	122	121	126	111	115	98	
2018	335	350	344	364	356	345	324	305	319	317	278	234	261	241	232	212	181	175	175	178	169	163	155	146	149	147	150	145	138	120	120	125	110	113	97	99

UK real return on equities - gross income re-invested

(annual average rates of return between year ends)

INVESTMENT FROM END YEAR

| INVESTMENT TO END YEAR | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 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 | 2015 | 2016 | 2017 | INVESTMENT TO END YEAR |
|---|---|---

UK real capital value of equities

(annual average rates of return between year-ends)

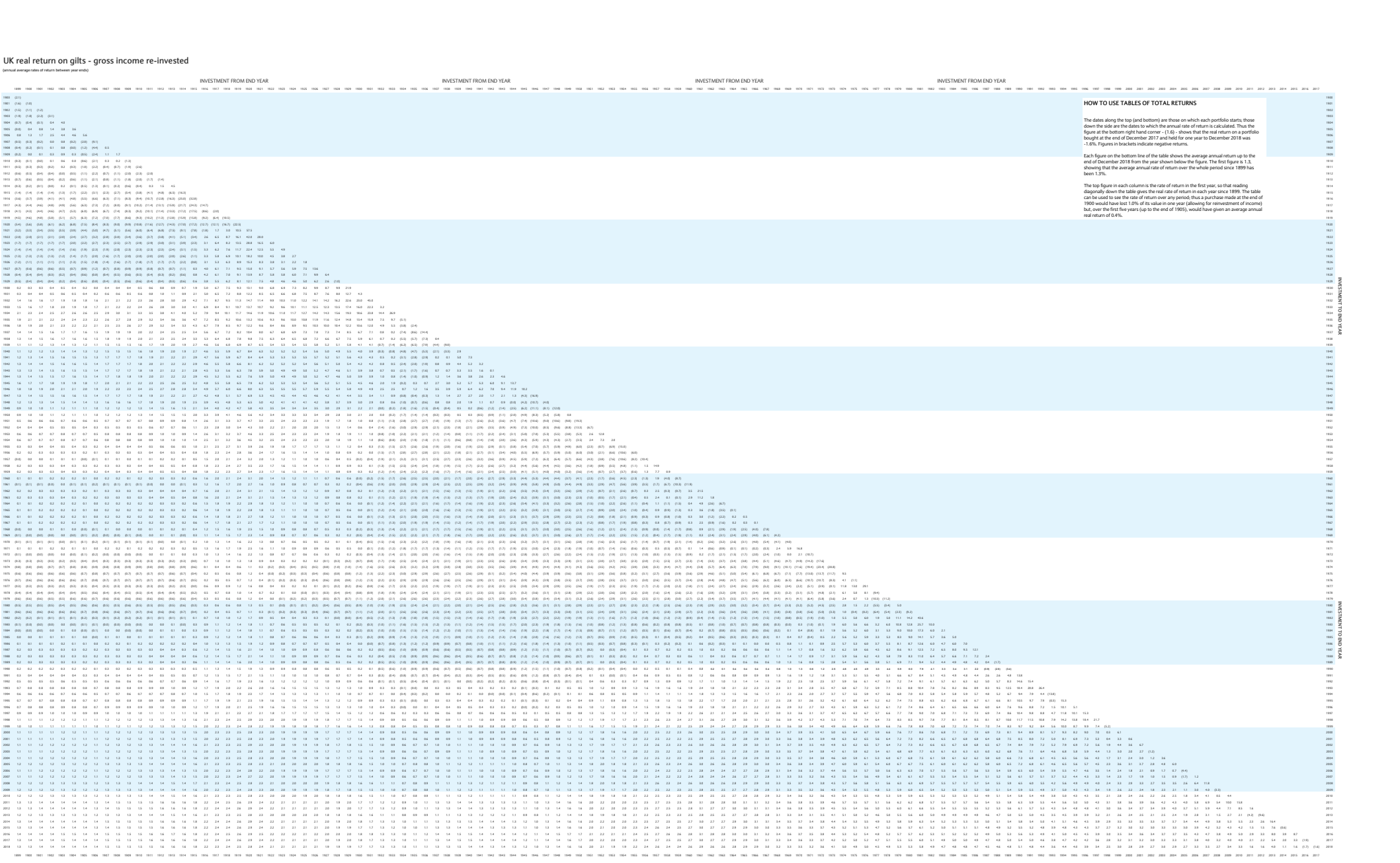
INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR

| | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 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 | 2015 | 2016 | 2017 | |
|---|---|---

UK real return on gilts - gross income re-invested

(annual average rates of return between year ends)



HOW TO USE TABLES OF TOTAL RETURNS

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. Thus the figure at the bottom right hand corner - (1.6) - shows that the real return on a portfolio bought at the end of December 2017 and held for one year to December 2018 was -1.6%. Figures in brackets indicate negative returns.

Each figure on the bottom line of the table shows the average annual return up to the end of December 2018 from the year shown below the figure. The first figure is 1.3, showing that the average annual rate of return over the whole period since 1899 has been 1.3%.

The top figure in each column is the rate of return in the first year, so that reading diagonally down the table gives the real rate of return in each year since 1899. The table can be used to see the rate of return over any period; thus a purchase made at the end of 1900 would have lost 1.0% of its value in one year (allowing for reinvestment of income) but, over the first ten years (up to the end of 1909), would have given an average annual real return of 0.4%.

US real return on equities - gross income re-invested

(annual average rates of return between year ends)

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR

| | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 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 | 2015 | 2016 | 2017 | |
|---|---|---

US real return on bonds - gross income re-invested

(annual average rates of return between year ends)

INVESTMENT FROM END YEAR

INVESTMENT TO END YEAR

| | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 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 | 2015 | 2016 | 2017 |
|---|---|---

Analyst Certification
We, Jeffrey Meli, Ajay Rajadhyaksha, Adam Kelleher, Jonathan Millar, Christian Keller, Michael Pond, CFA, Marvin Barth, Marek Raczko, Nikolaos Sgouropoulos, Wen Yan, Aroop Chatterjee, Michael Cohen, Brahim Razgallah, Blerina Uruçi and Sreekala Kochugovindan, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

Each research report excerpted herein was certified under SEC Regulation AC by the analyst primarily responsible for such report as follows: I hereby certify that: 1) the views expressed in this research report accurately reflect my personal views about any or all of the subject securities referred to in this report and; 2) no part of my compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

Important Disclosures:
Barclays Research is produced by the Investment Bank of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays").
All authors contributing to this research report are Research Analysts unless otherwise indicated. The publication date at the top of the report reflects the local time where the report was produced and may differ from the release date provided in GMT.

Availability of Disclosures:
For current important disclosures regarding any issuers which are the subject of this research report please refer to https://publicresearch.barclays.com or alternatively send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 13th Floor, New York, NY 10019 or call +1-212-526-1072.

Barclays Capital Inc. and/or one of its affiliates does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays Capital Inc. and/or one of its affiliates regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). Barclays trading desks may have either a long and / or short position in such securities, other financial instruments and / or derivatives, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, Barclays fixed income research analysts regularly interact with its trading desk personnel regarding current market conditions and prices. Barclays fixed income research analysts receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the Investment Banking Department), the profitability and revenues of the Markets business and the potential interest of the firm's investing clients in research with respect to the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not necessarily represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. Barclays Research Department produces various types of research including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations and trade ideas contained in one type of Barclays Research may differ from those contained in other types of Barclays Research, whether as a result of differing time horizons, methodologies, or otherwise.
In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to *https://publicresearch.barcap.com/S/RD.htm*. In order to access Barclays Research Conflict Management Policy Statement, please refer to: *https://publicresearch.barcap.com/S/CM.htm*.

All pricing information is indicative only. Prices are sourced from Refinitiv as of the last available closing price at the time of production of the research report, unless another time and source is indicated.

Types of investment recommendations produced by Barclays FICC Research:
In addition to any ratings assigned under Barclays' formal rating systems, this publication may contain investment recommendations in the form of trade ideas, thematic screens, scorecards or portfolio recommendations that have been produced by analysts in FICC Research. Any such investment recommendations produced by non-Credit Research teams shall remain open until they are subsequently amended, rebalanced or closed in a future research report. Any such investment recommendations produced by the Credit Research teams are valid at current market conditions and may not be otherwise relied upon.

Disclosure of other investment recommendations produced by Barclays FICC Research:
Barclays FICC Research may have published other investment recommendations in respect of the same securities/instruments recommended in this research report during the preceding 12 months. To view all investment recommendations published by Barclays FICC Research in the preceding 12 months please refer to *https://live.barcap.com/go/research/Recommendations*.

The MSCI sourced information is the exclusive property of MSCI Inc. (MSCI). Without prior written permission of MSCI, this information and any other MSCI intellectual property may not be reproduced, redisseminated or used to create any financial products, including any indices. This information is provided on an "as is" basis. The user assumes the entire risk of any use made of this information. MSCI, its affiliates and any third party involved in, or related to, computing or compiling the information hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability or fitness for a particular purpose with respect to any of this information. Without limiting any of the foregoing, in no event shall MSCI, any of its affiliates or any third party involved in, or related to, computing or compiling the information have any liability for any damages of any kind. MSCI and the MSCI indexes are services marks of MSCI and its affiliates.

Legal entities involved in producing Barclays Research:
Barclays Bank PLC (Barclays, UK)
Barclays Capital Inc. (BCI, US)
Barclays Bank Ireland PLC, Frankfurt Branch (BBI, Frankfurt)
Barclays Bank Ireland PLC, Paris Branch (BBI, Paris)

Barclays Bank Ireland PLC, Milan Branch (BBI, Milan)
Barclays Securities Japan Limited (BSJL, Japan)
Barclays Bank PLC, Hong Kong branch (Barclays Bank, Hong Kong)
Barclays Capital Canada Inc. (BCCI, Canada)
Barclays Bank Mexico, S.A. (BBMX, Mexico)
Barclays Securities (India) Private Limited (BSIPL, India)
Barclays Bank PLC, India branch (Barclays Bank, India)
Barclays Bank PLC, Singapore branch (Barclays Bank, Singapore)

Disclaimer:
This publication has been produced by Barclays Research Department in the Investment Bank of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays"). It has been prepared for institutional investors only and not for retail investors. It has been distributed by one or more Barclays affiliated legal entities listed below. It is provided to our clients for information purposes only, and Barclays makes no express or implied warranties, and expressly disclaims all warranties of merchantability or fitness for a particular purpose or use with respect to any data included in this publication. To the extent that this publication states on the front page that it is intended for institutional investors and is not subject to all of the independence and disclosure standards applicable to debt research reports prepared for retail investors under U.S. FINRA Rule 2242, it is an "institutional debt research report" and distribution to retail investors is strictly prohibited. Barclays also distributes such institutional debt research reports to various issuers, media, regulatory and academic organisations for their own internal informational news gathering, regulatory or academic purposes and not for the purpose of making investment decisions regarding any debt securities. Media organisations are prohibited from re-publishing any opinion or recommendation concerning a debt issuer or debt security contained in any Barclays institutional debt research report. Any such recipients that do not want to continue receiving Barclays institutional debt research reports should contact debtresearch@barclays.com. Barclays will not treat unauthorized recipients of this report as its clients and accepts no liability for use by them of the contents which may not be suitable for their personal use. Prices shown are indicative and Barclays is not offering to buy or sell or soliciting offers to buy or sell any financial instrument.
Without limiting any of the foregoing and to the extent permitted by law, in no event shall Barclays, nor any affiliate, nor any of their respective officers, directors, partners, or employees have any liability for (a) any special, punitive, indirect, or consequential damages; or (b) any lost profits, lost revenue, loss of anticipated savings or loss of opportunity or other financial loss, even if notified of the possibility of such damages, arising from any use of this publication or its contents.
Other than disclosures relating to Barclays, the information contained in this publication has been obtained from sources that Barclays Research believes to be reliable, but Barclays does not represent or warrant that it is accurate or complete. Barclays is not responsible for, and makes no warranties whatsoever as to, the information or opinions contained in any written, electronic, audio or video presentations of third parties that are accessible via a direct hyperlink in this publication or via a hyperlink to a third-party web site ('Third-Party Content'). Any such Third-Party Content has not been adopted or endorsed by Barclays, does not represent the views or opinions of Barclays, and is not incorporated by reference into this publication. Third-Party Content is provided for information purposes only and Barclays has not independently verified its accuracy or completeness.
The views in this publication are solely and exclusively those of the authoring analyst(s) and are subject to change, and Barclays Research has no obligation to update its opinions or the information in this publication. Unless otherwise disclosed herein, the analysts who authored this report have not received any compensation from the subject companies in the past 12 months. If this publication contains recommendations, they are general recommendations that were prepared independently of any other interests, including those of Barclays and/or its affiliates, and/or the subject companies. This publication does not contain personal investment recommendations or investment advice or take into account the individual financial circumstances or investment objectives of the clients who receive it. The securities and other investments discussed herein may not be suitable for all investors. Barclays is not a fiduciary to any recipient of this publication. Investors must independently evaluate the merits and risks of the investments discussed herein, consult any independent advisors they believe necessary, and exercise independent judgment with regard to any investment decision. The value of and income from any investment may fluctuate from day to day as a result of changes in relevant economic markets (including changes in market liquidity). The information herein is not intended to predict actual results, which may differ substantially from those reflected. Past performance is not necessarily indicative of future results. The information provided does not constitute a financial benchmark and should not be used as a submission or contribution of input data for the purposes of determining a financial benchmark.
United Kingdom: This document is being distributed (1) only by or with the approval of an authorised person (Barclays Bank PLC) or (2) to, and is directed at (a) persons in the United Kingdom having professional experience in matters relating to investments and who fall within the definition of "investment professionals" in Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (the "Order"); or (b) high net worth companies, unincorporated associations and partnerships and trustees of high value trusts as described in Article 49(2) of the Order; or (c) other persons to whom it may otherwise lawfully be communicated (all such persons being "Relevant Persons"). Any investment or investment activity to which this communication relates is only available to and will only be engaged in with Relevant Persons. Any other persons who receive this communication should not rely on or act upon it. Barclays Bank PLC is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange.
European Economic Area: This material is being distributed to any "Authorised User" located in a Restricted EEA Country by Barclays Bank Ireland PLC. The Restricted EEA Countries are Finland, Austria, Luxembourg, Portugal, Liechtenstein, Iceland, Slovenia, Malta, Lithuania, Slovakia, Hungary, Romania and Bulgaria. For any other "Authorised User" located in a country of the European Economic Area, this material is being distributed by Barclays Bank PLC. Barclays Bank Ireland PLC is a bank authorised by the Central Bank of Ireland whose registered office is at 1 Molesworth Street, Dublin 2, Ireland. Barclays Bank PLC is not registered in France with the Autorité des marches financiers or the Autorité de contrôle prudentiel.
Americas: The Investment Bank of Barclays Bank PLC undertakes U.S. securities business in the name of its wholly owned subsidiary Barclays Capital Inc., a FINRA and SIPC member. Barclays Capital Inc., a U.S. registered broker/dealer, is distributing this material in the United States and, in connection therewith accepts responsibility for its contents. Any U.S. person wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of Barclays Capital Inc. in the U.S. at 745 Seventh Avenue, New York, New York 10019.
Non-U.S. persons should contact and execute transactions through a Barclays Bank PLC branch or affiliate in their home jurisdiction unless local regulations permit otherwise.
This material is distributed in Canada by Barclays Capital Canada Inc., a registered investment dealer, a Dealer Member of IIROC (www.iiroc.ca), and a

Member of the Canadian Investor Protection Fund (CIPF).
This material is distributed in Mexico by Barclays Bank Mexico, S.A.
Japan: This material is being distributed to institutional investors in Japan by Barclays Securities Japan Limited. Barclays Securities Japan Limited is a joint-stock company incorporated in Japan with registered office of 6-10-1 Roppongi, Minato-ku, Tokyo 106-6131, Japan. It is a subsidiary of Barclays Bank PLC and a registered financial instruments firm regulated by the Financial Services Agency of Japan. Registered Number: Kanto Zaimukyokucho (kinsho) No. 143.
Asia Pacific (excluding Japan): Barclays Bank PLC, Hong Kong Branch is distributing this material in Hong Kong as an authorised institution regulated by the Hong Kong Monetary Authority. Registered Office: 41/F, Cheung Kong Center, 2 Queen's Road Central, Hong Kong.
All Indian securities-related research and other equity research produced by Barclays' Investment Bank are distributed in India by Barclays Securities (India) Private Limited (BSIPL). BSIPL is a company incorporated under the Companies Act, 1956 having CIN U67120MH2006PTC161063. BSIPL is registered and regulated by the Securities and Exchange Board of India (SEBI) as a Research Analyst: INH000001519; Portfolio Manager INP000002585; Stock Broker/Trading and Clearing Member: National Stock Exchange of India Limited (NSE) Capital Market INB231292732, NSE Futures & Options INF231292732, NSE Currency derivatives INE231450334, Bombay Stock Exchange Limited (BSE) Capital Market INB011292738, BSE Futures & Options INF011292738; Depository Participant (DP) with the National Securities & Depositories Limited (NSDL): DP ID: IN-DP-NSDL-299-2008; Investment Adviser: INA000000391. The registered office of BSIPL is at 208, Ceejay House, Shivsagar Estate, Dr. A. Besant Road, Worli, Mumbai – 400 018, India. Telephone No: +91 2267196000. Fax number: +91 22 67196100. Any other reports produced by Barclays' Investment Bank are distributed in India by Barclays Bank PLC, India Branch, an associate of BSIPL in India that is registered with Reserve Bank of India (RBI) as a Banking Company under the provisions of The Banking Regulation Act, 1949 (Regn No BOM43) and registered with SEBI as Merchant Banker (Regn No INM000002129) and also as Banker to the Issue (Regn No INBI00000950). Barclays Investments and Loans (India) Limited, registered with RBI as Non Banking Financial Company (Regn No RBI CoR-07-00258), and Barclays Wealth Trustees (India) Private Limited, registered with Registrar of Companies (CIN U93000MH2008PTC188438), are associates of BSIPL in India that are not authorised to distribute any reports produced by Barclays' Investment Bank.
This material is distributed in Singapore by the Singapore branch of Barclays Bank PLC, a bank licensed in Singapore by the Monetary Authority of Singapore. For matters in connection with this material, recipients in Singapore may contact the Singapore branch of Barclays Bank PLC, whose registered address is 10 Marina Boulevard, #23-01 Marina Bay Financial Centre Tower 2, Singapore 018983.
This material is distributed to persons in Australia by Barclays Bank PLC. None of Barclays Bank PLC, nor any other Barclays group entity, holds an Australian financial services licence and instead relies on an exemption from the requirement to hold such a licence. This material is intended to only be distributed to "wholesale clients" as defined by the Australian Corporations Act 2001.
Middle East: Nothing herein should be considered investment advice as defined in the Israeli Regulation of Investment Advisory, Investment Marketing and Portfolio Management Law, 1995 ("Advisory Law"). This document is being made to eligible clients (as defined under the Advisory Law) only. Barclays Israeli branch previously held an investment marketing license with the Israel Securities Authority but it cancelled such license on 30/11/2014 as it solely provides its services to eligible clients pursuant to available exemptions under the Advisory Law, therefore a license with the Israel Securities Authority is not required. Accordingly, Barclays does not maintain an insurance coverage pursuant to the Advisory Law.
This material is distributed in the United Arab Emirates (including the Dubai International Financial Centre) and Qatar by Barclays Bank PLC. Barclays Bank PLC in the Dubai International Financial Centre (Registered No. 0060) is regulated by the Dubai Financial Services Authority (DFSA). Principal place of business in the Dubai International Financial Centre: The Gate Village, Building 4, Level 4, PO Box 506504, Dubai, United Arab Emirates. Barclays Bank PLC-DIFC Branch, may only undertake the financial services activities that fall within the scope of its existing DFSA licence. Related financial products or services are only available to Professional Clients, as defined by the Dubai Financial Services Authority. Barclays Bank PLC in the UAE is regulated by the Central Bank of the UAE and is licensed to conduct business activities as a branch of a commercial bank incorporated outside the UAE in Dubai (Licence No.: 13/1844/2008, Registered Office: Building No. 6, Burj Dubai Business Hub, Sheikh Zayed Road, Dubai City) and Abu Dhabi (Licence No.: 13/952/2008, Registered Office: Al Jazira Towers, Hamdan Street, PO Box 2734, Abu Dhabi). Barclays Bank PLC in the Qatar Financial Centre (Registered No. 00018) is authorised by the Qatar Financial Centre Regulatory Authority (QFCRA). Barclays Bank PLC-QFC Branch may only undertake the regulated activities that fall within the scope of its existing QFCRA licence. Principal place of business in Qatar: Qatar Financial Centre, Office 1002, 10th Floor, QFC Tower, Diplomatic Area, West Bay, PO Box 15891, Doha, Qatar. Related financial products or services are only available to Business Customers as defined by the Qatar Financial Centre Regulatory Authority.
Russia: This material is not intended for investors who are not Qualified Investors according to the laws of the Russian Federation as it might contain information about or description of the features of financial instruments not admitted for public offering and/or circulation in the Russian Federation and thus not eligible for non-Qualified Investors. If you are not a Qualified Investor according to the laws of the Russian Federation, please dispose of any copy of this material in your possession.
IRS Circular 230 Prepared Materials Disclaimer: Barclays does not provide tax advice and nothing contained herein should be construed to be tax advice. Please be advised that any discussion of U.S. tax matters contained herein (including any attachments) (i) is not intended or written to be used, and cannot be used, by you for the purpose of avoiding U.S. tax-related penalties; and (ii) was written to support the promotion or marketing of the transactions or other matters addressed herein. Accordingly, you should seek advice based on your particular circumstances from an independent tax advisor.
© Copyright Barclays Bank PLC (2019). All rights reserved. No part of this publication may be reproduced or redistributed in any manner without the prior written permission of Barclays. Barclays Bank PLC is registered in England No. 1026167. Registered office 1 Churchill Place, London, E14 5HP. Additional information regarding this publication will be furnished upon request.