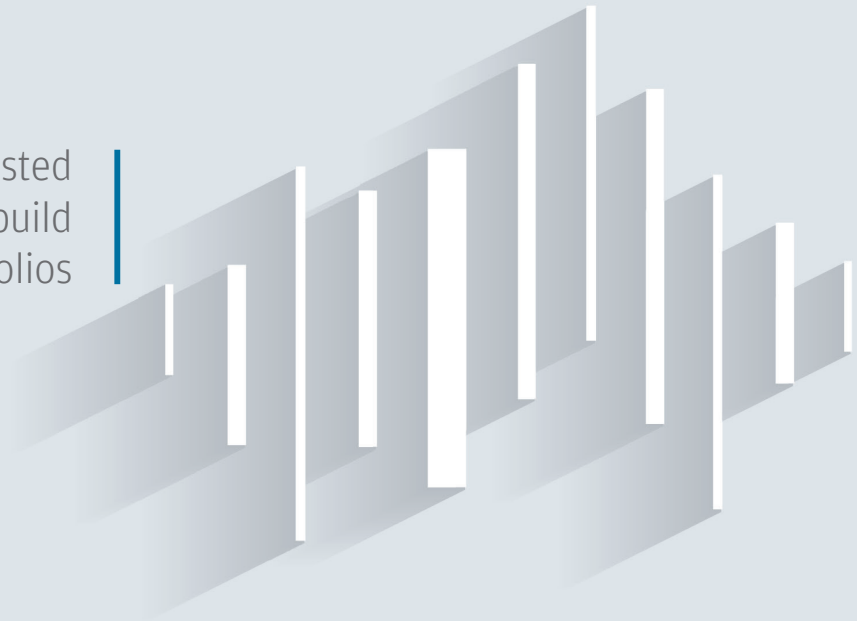
INVESTMENT INSIGHTS

2017 Long-Term Capital Market Assumptions

21st Annual Edition

Time-tested projections to build stronger portfolios



J.P.Morgan
Asset Management

2017 LONG-TERM CAPITAL MARKET ASSUMPTIONS
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FOREWORD

JED LASKOWITZ

MIKE O'BRIEN

"HISTORY DOESN'T REPEAT ITSELF, BUT IT OFTEN RHYMES," Mark Twain is reputed to have said. Investors looking for the rhyme (and the reason) in today's financial markets find themselves at a difficult—and in some ways unprecedented—juncture as the effects of unorthodox monetary policy echo across the global investment landscape.

In this challenging environment, we present the 2017 edition of J.P. Morgan Asset Management's Long-Term Capital Market Assumptions (LTCMAs). In our 21st year of publishing capital market estimates, we incorporate more than 50 asset and strategy classes; our return assumptions are available in 10 base currencies. Investors and advisors depend on our assumptions to inform their strategic asset allocation, build stronger portfolios and establish reasonable expectations for risks and returns over a 10- to 15-year time frame.

We formulate our LTCMAs as part of a deeply researched proprietary process that draws on quantitative and qualitative inputs as well as insights from experts across J.P. Morgan Asset Management—it has been fine-tuned over the past two decades. Our own multi-asset investment approach relies heavily on our LTCMAs—a testament to the strength and depth of the process. The assumptions form a critical foundation in our framework for designing, building and analyzing solutions aligned with our clients' specific investment needs.

In this edition of our assumptions, we consider the far-reaching effects of what we expect to be an extended period of policy normalization. We believe this process will have profound implications for all asset class returns. Looking out over our 10- to 15-year time frame, we see more muted returns almost across the board. All of this underscores the importance of a thoughtful, long-term strategic perspective. It also highlights the value of active asset allocation and diligent manager selection as investors search for new sources of potential returns.

We look forward to working with you to make the best use of our assumptions in setting your own strategic perspective and pursuing your investment goals. On behalf of J.P. Morgan Asset Management, thank you for your continued trust and confidence. As always, we welcome your feedback.

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2017 Long-Term Capital Market Assumptions

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IN BRIEF

This executive summary gives readers a broad overview of our 2017 Long-Term Capital Market Assumptions (LTCMAs); it also provides a context for how some of the structural factors affecting economies today are likely to drive asset returns over a 10- to 15-year investment horizon. The key takeaways from this year's LTCMAs:

- Growth remains under pressure as aging populations and below-average productivity take real economic growth down by 25 basis points (bps) in developed markets and 50bps in emerging markets; the result is lower equilibrium interest rates at all points in the yield curve.
- Policy normalization will take much longer than previously thought. In combination with lower equilibrium interest rates, this leaves returns on long-duration government bonds roughly in line with cash and implies that after several years of quantitative easing (QE), duration premia have finally collapsed to zero.
- Lower rates translate to elevated equity risk premia, even though growth has weighed on expected returns; credit is the bright spot in fixed income markets, but it is real assets that hold up best in a world of challenged growth and lackluster returns.
- Expected returns for a simple balanced 60/40 stock-bond portfolio are down by around 75bps and reinforce our view that static balanced allocation has run out of road; investors seeking to boost returns will have to increasingly consider alternative assets, new avenues of diversification and, above all, an active approach to asset allocation.

A BACKDROP OF PARADOX AND CHALLENGE FOR INVESTORS

The 2017 edition of our Long-Term Capital Market Assumptions is written in an environment that is, in equal measure, strikingly familiar yet completely without precedent. The backdrop of sluggish growth and uninspiring return expectations follows the rhythm of recent years, but the monetary policy decisions of the last 12 months are truly groundbreaking. The starting point for the 2017 assumptions is a paradox in many ways. The U.S. economic expansion is now in its eighth year, yet interest rates have hardly moved from zero. Stock markets are breaking to new highs despite persistent earnings weakness. Capital spending is weak even though the cost of financing is at all-time lows.

Certainly, the environment presents a sizable challenge for investors. The undercurrents behind our long-term assumptions—poor demographics, weak productivity and extended leverage—will be familiar to our regular readers, and once again contribute to a further downgrading of our growth and return assumptions. However, the challenge of normalizing from today's unorthodox policy stance adds a new dimension, and has profound implications for returns across all asset classes.

MACROECONOMIC OUTLOOK

The specter of aging populations continues to haunt most developed market (DM) economies and leads us to downgrade our outlook for global growth again this year (**Exhibit 1**). Over our 10- to 15-year forecast horizon, we see DM real GDP growth of 1.50% and emerging market (EM) growth of 4.50%, down by 25bps and 50bps, respectively, compared with 2016. Persistently weak productivity creates further downside risks to our long-term growth estimates; and while such fallow periods in productivity growth are not without precedent, the low prevailing levels of investment spending compound risks from anemic productivity into the future. The narrowing of the EM over DM growth premium reflects, in part, the demographic challenges facing the developed world while also taking into account the potential deleveraging cycle that still lies ahead for emerging markets.

We maintain the view that most central banks will come close to hitting their inflation targets, but acknowledge that this may be a lengthy process. Given the uncertainty around the path to long-run inflation normalization—notably in Europe and Japan—we trim our DM inflation expectations by 25bps to 1.75% while leaving our EM assumption unchanged at 3.75%. This leads to a uniform downgrade to our global *nominal* GDP expectations of 50bps this year, with DM at 3.25% and EM at 8.25%.

Our 2017 assumptions anticipate lower real GDP growth globally, a narrower DM-EM growth gap and generally stable inflation

EXHIBIT 1: MACROECONOMIC ASSUMPTIONS

	2017 assumptions		2016 assumptions		Change (percentage points)	
	Real GDP (%)	Core inflation (%)	Real GDP (%)	Core inflation (%)	Real GDP	Core inflation
Developed markets	**1.50**	**1.75**	**1.75**	**2.00**	**-0.25**	**-0.25**
U.S.	1.75	2.25	2.25	2.25	-0.50	0.00
Eurozone	1.25	1.50	1.50	1.50	-0.25	0.00
UK	1.25	2.00	1.50	2.25	-0.25	-0.25
Japan	0.50	1.00	0.50	1.50	0.00	-0.50
Australia	2.25	2.25	2.00	2.50	0.25	-0.25
Canada	1.50	1.75	1.75	2.00	-0.25	-0.25
Switzerland	1.50	0.75	1.75	0.75	-0.25	0.00
Emerging markets	**4.50**	**3.75**	**5.00**	**3.75**	**-0.50**	**0.00**
Brazil	2.75	5.25	3.00	5.25	-0.25	0.00
China	5.25	3.00	6.00	3.00	-0.75	0.00
India	7.00	5.00	7.25	5.00	-0.25	0.00
Russia	2.25	5.50	2.75	5.50	-0.50	0.00

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

POLICY CHALLENGES AND THE PATH TO NORMALIZATION

Over the last 12 months central banks have demonstrated again and again that when it comes to rates being lower for longer, "they say what they mean, and they mean what they say." Speculators have lately tired of fighting central banks, and this shift in behavior, coupled with the substantial negative net supply of high quality paper, has pushed rates to, and in many cases through, the zero interest rate bound.

We now consider negative rates and quantitative easing just another part of the central bank tool kit, but we do not expect current zero or negative interest rate policies to remain in place throughout our entire forecast horizon. Nevertheless, the implications of current policies will persist well into our time frame and markedly skew expected returns. We anticipate a protracted period of normalization for all central banks, with the Federal Reserve (Fed) leading the way, but to an equilibrium interest rate in the U.S. that is much lower than in the past. The European Central Bank (ECB) and Bank of Japan (BoJ) will not start to normalize rates until three years into our forecast horizon, we believe, and they will take a further four years to reach equilibrium.

Three notable effects of current policy manifest themselves in our long-run forecasts. The first is that cash rates struggle to reach inflation rates in many economies, resulting in near zero real cash returns at equilibrium and negative real returns, on average, over our 10- to 15-year horizon. The second and more subtle effect is that returns on high quality 10-year bonds are barely above cash returns over our forecast horizon. Effectively, duration premium over the longer run has been eroded to near zero since higher bond yields at some future point must, by definition, force bondholders to bear losses in price terms as normalization takes place. The level of terminal yield justified by our growth assumptions, once rates are eventually at equilibrium, simply does not compensate for today's meager returns and the impact of a protracted normalization phase. The final and most palpable effect of current policy is that returns have essentially been borrowed from the future. In the absence of a substantial upside surprise to nominal growth, we struggle to see a scenario in which the piper is not paid, which means future returns in many asset markets will suffer.

MAJOR ASSET CLASS ASSUMPTIONS

Our message this year is circumspect, but not gloomy. While we recognize that current and prior policies have, in part, mortgaged the future, we acknowledge that the crisis policymakers navigated was grave indeed. We are also struck by the ingenuity of financial policy and expect new policy innovations to emerge as current tools reach their limits of usefulness. Our 2017 return assumptions across all asset classes are affected strongly both by our growth assumptions and by our expectations for policy normalization. The common thread of sluggish growth and an extended period of exceptionally low rates runs through our assumptions for bonds, credit, equities and alternative assets alike (**Exhibits 2A** and **2B**).

A common thread—sluggish growth and an extended period of exceptionally low rates—runs through all our assumptions

EXHIBIT 2A: SELECTED LTCMA RETURNS (%)

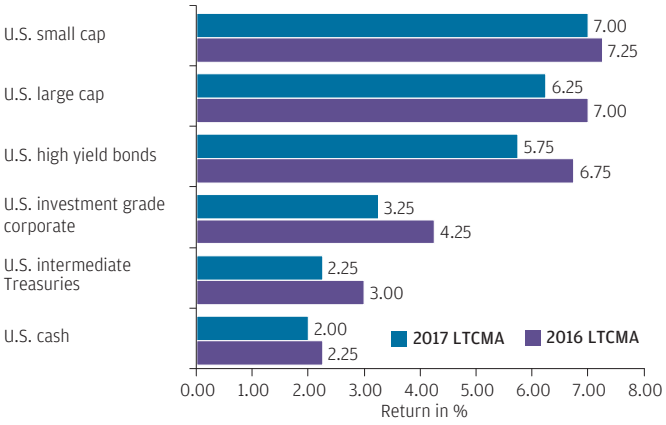
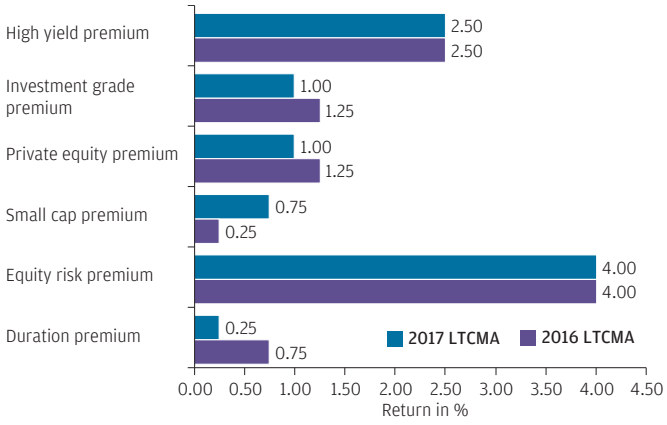


EXHIBIT 2B: SELECTED LTCMA RISK PREMIUMS (%)



Source: J.P. Morgan Asset Management; estimates as of September 30, 2015, and September 30, 2016.

FIXED INCOME – Credit a relatively bright spot

Government bond returns exhibit the most direct sensitivity to our forecast of low economic growth and a protracted normalization phase. Our projected returns for cash and government bonds are low in all major currencies, with the impact of near zero interest rates felt all along the yield curve. Credit markets are a relatively bright spot in the fixed income universe, as they were last year. We start from a point of somewhat tighter spreads, but returns remain attractive over our forecast horizon in high yield and longer-dated investment grade corporate credit in particular. In EM debt, we believe that current spread levels fairly represent the structural challenges and lower growth that confront many emerging economies. Our analysis suggests that despite fears over EM leverage, external debt levels are manageable and systemic risks are limited. As a result, EM debt, like corporate credit, offers some return potential in what are otherwise likely to be lean times for fixed income investors.

EQUITY – A less rewarding but still important source of returns

We reduce our return expectations for global equity markets roughly in line with cuts to our growth estimates, also recognizing the higher valuation starting point in world equities compared with last year. Our total return forecasts range from the mid to high single digits across all major equity regions. However, the source of returns differs markedly: DM returns come principally from increased payouts to shareholders, while EM returns are driven more by EPS growth. The implied equity risk premium (ERP) remains elevated in this year's assumptions, and in some markets sits above the long-term average. The elevated ERP does not signal that equities are cheap, however. To our mind, it suggests instead that bonds are expensive and that our expectations of low growth could lead to greater earnings volatility. A slightly elevated ERP can therefore be considered a natural offset to a lower and more uncertain growth outlook. On balance, though, we believe that equity markets will continue to offer investors an important source of returns.

ALTERNATIVE ASSETS – Real assets resilient even as public market betas decline

In our return forecasts for alternative assets, real assets fare generally better than financial assets. Real estate returns in particular appear likely to be quite resilient against the background of a deteriorating growth outlook, as a pause in supply and improvements in operating cash flow contribute to an appealing valuation picture. The relative attractiveness of real estate compared with other long-duration assets has picked up markedly, and we would expect demand for real assets to remain robust across our forecast horizon. Despite the trimming of our inflation forecasts, commodities are one of the few asset classes where long-run return expectations rise this year compared with last. Sluggish global growth—and especially the slower pace of Chinese growth—make it unlikely that we will see the early onset of a renewed commodity supercycle. However, eradication of supply excesses in key commodity sectors points to a modestly better outlook for the asset class.

We pare our private equity returns in line with our equity market return assumptions this year. Nevertheless, given the scarcity of growth and low return expectations in traditional asset classes, we expect the gravitational pull toward private equity will be hard to resist for some investors. In such an environment, it is especially important for investors to recognize that there is a significant spread of manager performance in private equity returns. Allocation to a median manager adds little to a portfolio in risk-adjusted terms, but we continue to anticipate significant return premiums for upper quartile managers.

FOREIGN EXCHANGE – Still some way from equilibrium, but starting to stabilize

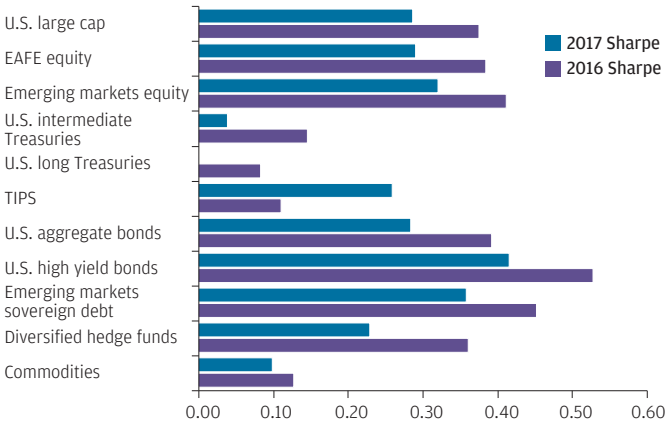
In recent years, policy and growth divergence drove exchange rates some way from their long-run equilibrium fair values. In the last 12 months, some of the more extended currency valuations have begun to reverse, and we see USD/EUR and USD/JPY beginning to move back in the direction of their long-run equilibriums, but the U.S. dollar remains overvalued against both currencies. We expect further dollar depreciation to happen only slowly, as policy differentials between gradual U.S. normalization and unremittingly easy policy in Europe and Japan are likely to persist for several years. Over the past few years, EM currencies have weakened markedly, reflecting the cyclical slowdown brought on by the end of the commodity supercycle. As EM economies address various structural challenges, there is scope for pockets of further temporary weakness. However, the broad-based underperformance of EM currencies is coming to an end and we see scope for USD to weaken against EM FX over the latter stages of our forecast horizon.

IMPLICATIONS FOR INVESTORS

Lower levels of growth and the collapse in duration premium lead to lower risk-adjusted returns across most asset classes in this year's assumptions. There is a stark contrast, however, between government bond markets and riskier assets such as equity and high yield credit. Expected Sharpe ratios in government bonds have dropped precipitously compared with 2016 and now stand close to zero. This is the clearest manifestation of the entire erosion of duration premium, in large part a direct consequence of central bank policy. Sharpe ratios in equity have moderated a little from 2016, reflecting a combination of slightly higher starting valuations and modestly impaired growth prospects. Credit also sees a drop in the expected Sharpe ratio, for similar reasons, amplified by the additional drag exerted by duration on these assets. Real assets, by contrast, have seen their expected risk-adjusted returns hold up reasonably well compared with 2016 (**Exhibit 3**).

Expected Sharpe ratios decline for equity and high yield credit; they drop precipitously for government bonds

EXHIBIT 3: RISK-ADJUSTED RETURN ASSUMPTIONS ACROSS ASSET CLASSES-SHARPE RATIOS



Source: J.P. Morgan Asset Management; estimates as of September 30, 2015, and September 30, 2016.

In recent years, we coined the phrase "6% is the new 8%" to describe our new world, recognizing that many of today's money managers came of age at a time when 8% was considered an appropriate, and achievable, return from a balanced portfolio with moderate risk tolerance. Our 2017 LTCMAs continue along a similar path. The initial slight valuation boost picked up in last year's numbers has disappeared, and we find ourselves in familiar territory, with a static 60/40 global equity-aggregate bond portfolio offering expected returns between 5% and 6%. Further diversification into real estate, credit, emerging market equities and alternatives can boost returns. Simply put, the game is up for static balanced investing. Investors face a stark choice: They can maintain a largely static allocation approach and accept a lower level of return, or they can explore alternative assets more fully, seek new sources of diversification and, above all, extend efforts to follow a truly dynamic asset allocation approach to tap into additional potential returns. The importance of an active approach also extends down to the asset class level—when potential returns for major asset classes are as muted as we expect, the potential alpha from active management represents a significant share of total returns.

A simple efficient frontier (**Exhibit 4**) drives this point home. The uninspiring returns offered in sovereign markets, and the modest drop in economic growth assumptions, which weighs on equity returns, combine to pull the efficient frontier down in a uniform manner. Given the collapse in duration premium this year, risk assets remain more attractive than riskless assets. But simple balanced portfolio returns have dropped 75bps, and few assets offer returns at or above the 8% psychological threshold that many investors still have in the back of their minds. High yield, EM debt and EM equities all sit above the efficient frontier. This suggests meaningful opportunities for diversification, but beating the 8% hurdle is going to be increasingly challenging for investors.

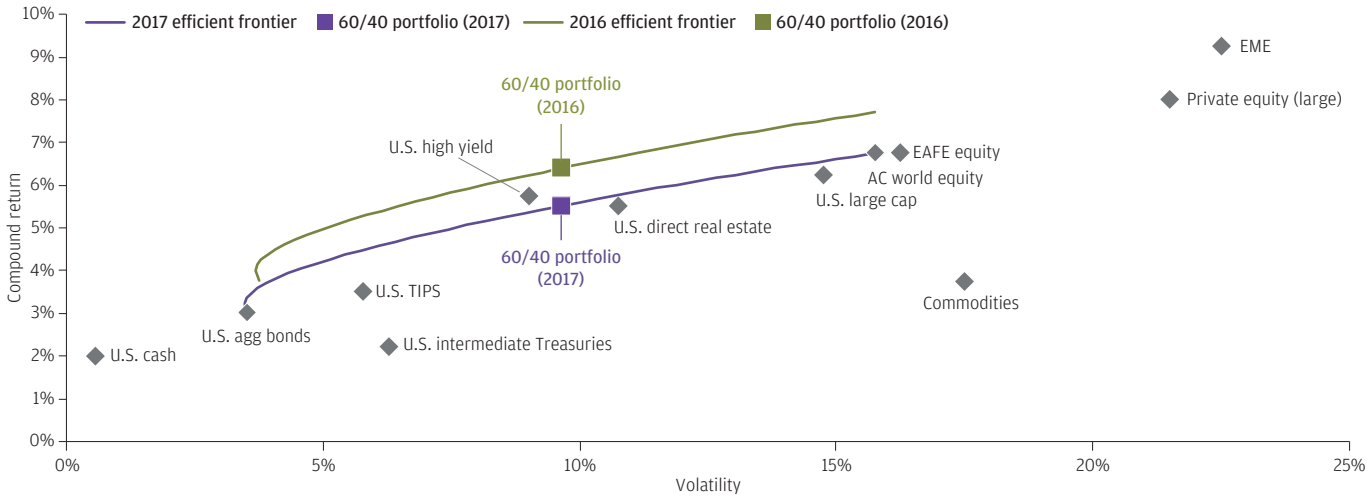
The collapse of returns from duration toward the level of cash returns can be traced almost entirely back to cumulative central bank action since the global financial crisis. While we do anticipate an eventual end to QE policies, the effect of them will linger for an extended period—in turn, requiring investors to approach asset markets with a different mindset. In our view, the compounded effect of QE has been to shift the global capital stack[1] downward.

Central banks are now willing and able to act on the entire government yield curve—and in some cases, even in corporate bond markets. The result is that, in return terms, duration is becoming a proxy for cash and investment grade credit a proxy for sovereign duration, and with so much of developed market equity return now coming from yield, stocks increasingly resemble corporate bonds. This shift downward in the capital stack is, in roughly equal measure, a consequence of caution from policymakers, corporates and investors alike; this, in turn, is putting persistent pressure on public market returns and forcing any form of growth funding to rely increasingly upon private markets. The difficult but unavoidable upshot of this year's message remains that, as a consequence of monetary policies which probably prevented economic Armageddon, we've borrowed returns from the future. Now that future is here.

[1] "Global capital stack": a representation of the global financial markets as an analogy to the capital structure in a financial firm, with cash having the lowest risk but also the lowest returns, followed by bonds, then credit and finally equity, with higher risk but commensurately the highest expected returns.

Investors face a stark choice, our assumptions suggest: Accept a lower level of return and stay static, or explore alternative assets more fully, seek new sources of diversification and embrace an active allocation approach

EXHIBIT 4: EFFICIENT FRONTIERS AND 60/40 PORTFOLIOS BASED ON 2017 VS. 2016 LTCMAS FOR RISK AND RETURN



Source: J.P. Morgan Asset Management; estimates as of September 30, 2015, and September 30, 2016.

A slow-moving, steady slide

Michael Hood, *Global Strategist, Multi-Asset Solutions*
Dr. David Kelly, CFA, *Chief Global Strategist, Head of Global Market Insights Strategy*

IN BRIEF

- Our long-term projections are for lower real GDP growth in developed market (DM) and emerging market (EM) economies. The gap we project between the pace of growth in developed and emerging markets has narrowed slightly.
- Slowing labor force expansion, as the population ages, is a key driver of our macroeconomic projections in the developed markets. Weak productivity gains could potentially generate further downward revisions in coming years.
- Demographics also weigh on the emerging markets, but even more important will be a deleveraging of the sort already experienced by DM nations after the global economic crisis—a challenge that is still ahead for EM countries. We have reduced our assumption for growth in China.
- We expect most central banks, in DM and many EM countries, to come close to hitting their inflation targets, although these expectations are marked by uncertainty given the extraordinary monetary policy stances in place.

AN ONGOING SLIDE IN OUR MACROECONOMIC OUTLOOK

Continuing a trend that has characterized our past few Long-Term Capital Market Assumptions (LTCMAs), we have lowered our projections for nominal growth in both DM and EM economies. In DM economies, demographic change, in which aging populations are slowing the expansion of the labor force, has driven the bulk of these reductions up to now. This slow-moving but steady force remains in play. Very weak productivity gains, discussed elsewhere in this publication, are also now weighing on the outlook and may further lower our assumptions in coming years.

Cuts to our EM forecasts reflect a slightly different set of factors. To be sure, demographic transitions are biting into growth in many EM countries as well. But after years of rapid credit growth, EM economies also seem likely to undergo a version of the deleveraging cycles that the U.S. and other DM economies went through in the wake of the global financial crisis. The resulting private sector retrenchment will likely weigh on growth for an extended period. We have trimmed our China forecast particularly sharply in light of this expectation, and believe slower growth in that economy produces a headwind for its immediate neighbors as well as for commodity exporters elsewhere in the world.

Meanwhile, though we acknowledge that there is considerable uncertainty about the long-term inflation outlook in light of extraordinary monetary policy stances throughout the world, we continue to expect that central banks will generally come close to hitting their targets during our outlook period. During recent decades, despite major swings in commodity prices and large gyrations in growth, inflation-targeting central banks that are independent of governments and which maintain floating currencies have enjoyed considerable success, on average, in achieving their goals. For now, we cannot see any changes in the landscape (such as a loss of control by central banks over their own balance sheets) with sufficient significance to project major deviations from that pattern in the next 10 to 15 years.

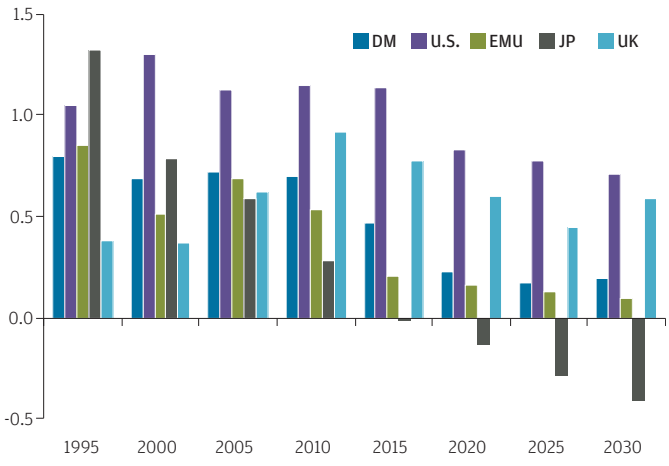
DM REAL ECONOMIC GROWTH: THE PRODUCTIVITY MYSTERY

We view the long-term GDP forecasts in developed markets primarily through the lens of potential, or trend, growth, namely, the expansion rate of each economy's supply side. We break down this potential rate, in turn, into (1) the increase in the labor force and (2) labor productivity growth, which encompasses capital deepening and total factor productivity (a residual that captures, among other things, the pace of technological change).

We base our labor force outlook on population projections, adjusted for long-term trends in labor force participation. We believe that fairly narrow confidence intervals surround our labor force projections, given the nature of medium-term population forecasts. After all, everyone in the world who will be of working age during our 10- to 15-year outlook period has already been born. And we see few major swings in labor force participation—the share of the working-age population engaged in the labor market—that would drive labor force growth significantly away from population trends. During much of the postwar era, for example, the entry of women into the workforce boosted labor supply sharply, but that trend appears to have completed itself some time ago. Instead, we now see broadly offsetting influences on labor force participation. On the one hand, the gradual aging of the population pushes down participation (as older individuals are less likely to work than "prime age" citizens). On the other hand, participation is rising gradually among the cohort aged 65 years and older (while remaining low compared with that of younger people). And almost uniformly, DM workforces will likely grow very slowly by long-term standards (**Exhibit 1**). Even in the United States, with relatively favorable demographics (helped by the immigration wave of the 1990s and 2000s), we expect labor force growth of just 0.4% per annum. In the euro area and especially Japan, the picture looks even worse, with outright workforce shrinkage (by 0.1% and 0.3%, respectively, per annum). The other DM economies broadly resemble the U.S., although Australia stands out on the high side. With its young (and also immigration-boosted) population, Australia's labor force will likely grow 0.9% annually, giving it a leg up relative to the rest of the DM universe.

DM and EM workforces growing slowly, below long-term averages

EXHIBIT 1: POPULATION GROWTH, PEOPLE AGE 20+ (% PER ANNUM, 5-YEAR AVERAGES)

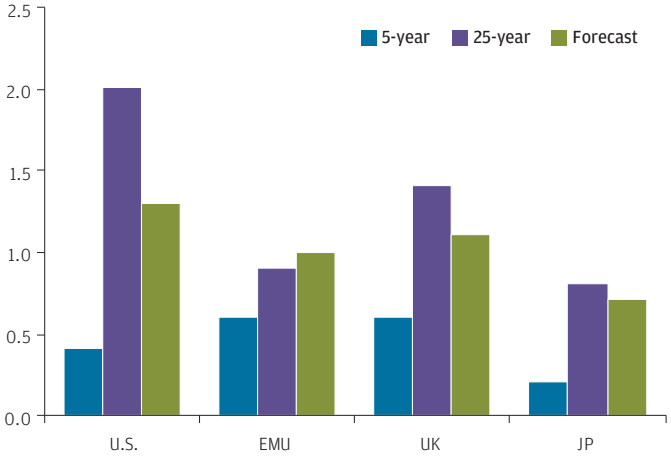


Source: United Nations, J.P. Morgan Asset Management; data and forecasts as of 2015.

Forecasting productivity poses a much greater challenge. Here, we confront two contrasting phenomena. First, DM productivity growth appears broadly stable over time, characterized by slower periods that alternate with accelerations, around a mean of roughly 1.5%. The drivers of the stronger and weaker phases are poorly understood. Second, DM economies have experienced extremely weak productivity growth, about 0.5% since the global financial crisis (and indeed for a period before the recession), and have fallen short of even that mark in the past year or so. We generally attempt to take into account both time periods, putting some weight on the short term while giving more emphasis to the longer term. Each year that passes with no productivity pickup therefore causes us to lower our sights slightly. Still, for now our productivity assumptions lie a bit closer to the (higher) long-term history than to the (weaker) recent path, averaging just over 1% across the DM economies (Exhibit 2).

Our productivity growth assumptions lie closer to long-term averages than to weaker recent rates

EXHIBIT 2: PRODUCTIVITY GROWTH—HISTORY AND FORECASTS UNDERLYING 2017 ASSUMPTIONS (% PER ANNUM)



Source: Haver Analytics, J.P. Morgan Asset Management, J.P. Morgan Securities LLC; data and forecasts as of September 30, 2016.

What might generate a productivity pickup? As discussed in our 2017 LTCMA thematic article, "The global productivity slump: Causes and outlook," we can envision several possibilities. First, the pace of technological change might accelerate. The global economy appears to be going through a fallow period for embodied technological progress, in sharp contrast to the information technology boom of the 1990s. The rate of technological change appears somewhat random and easily could improve in the coming years—unless, that is, every possible useful thing has already been invented!

Second, cyclical influences on productivity might realign. Elevated unemployment may have encouraged firms to boost output by hiring relatively cheap workers. As labor markets tighten, companies may prioritize plant and equipment investment, boosting the capital stock while holding employment steadier.

Third, government statisticians may catch up with difficult-to-measure phenomena, particularly the explosion in digital consumer products. Finally, a tilt toward expansionary fiscal policy, with an emphasis on infrastructure spending, could support productivity—by, for example, facilitating travel. However, all of these potential sources of faster productivity growth remain speculative, and from today's perspective our figures do tilt toward optimism. We may need to cut our DM growth figures by more in the coming years if our conviction grows that the world has entered a new, structurally lower era for productivity gains.

One final adjustment to our DM growth forecasts concerns economies currently operating with considerable spare capacity or, alternatively, believed to be overheating. In such cases, we may raise or lower our long-term growth projection to take account of the likely closure, over time, of these output gaps. In the 2016 LTCMA publication, we boosted our U.S. GDP forecast by 0.25 percentage points because of a perceived output gap. But with the unemployment rate below 5%, such an adjustment no longer seems appropriate. We do, however, nudge our euro area forecast up by 0.25 percentage points, relative to potential, because of a large output gap. The elevated jobless rate in the euro area suggests that the economy has considerable room to run after a series of accidents in recent years. Of course, adverse policymaking may prevent the euro area from absorbing this spare capacity, but current trends, including the revival of bank lending in the region, appear favorable.

Where do these various factors leave us? Relative to last year, we revise down our growth projections for the U.S. by 50bps and for the euro area, UK, Switzerland and Canada by 25bps each. The majority of DM countries cluster between 1.25% and 1.75% growth, with Japan well below the bottom of that range and Australia the standout in the other direction. The DM growth aggregate slips to 1.50% this year, compared with 1.75% in the 2016 edition. We suspect that the balance of risks to our forecasts tilts toward lower growth.

EM REAL ECONOMIC GROWTH: DELEVERAGING SLOWS CONVERGENCE

Our real GDP forecasts for emerging markets have also slipped steadily since 2014, and we have undertaken another round of downward revisions this year. We continue to expect EM economies to grow faster, in real terms, than their DM counterparts, with the EM growth aggregate at 4.50% (against the DM aggregate of 1.50%). That EM-DM growth gap would fall considerably short of the differential of 5 percentage points observed between 2004 and 2012, while representing a mild improvement over the roughly 2.5-percentage-point wedge observed between growth rates in the past couple of years.

This overall EM growth forecast rests on three premises. First, the world will likely remain, for an extended period, less friendly to EM economies than was the case in the mid-2000s. With the globalization process seemingly complete, international trade is no longer growing faster than global GDP, and the conditions that fueled the commodity supercycle seem unlikely to return anytime soon. Second, the credit boom experienced by many EM economies during the past 20 years, most notably China, will likely give way to much more cautious behavior, with EM countries experiencing a version of the deleveraging cycle that the U.S. and other DM economies went through after 2009. Third, in contrast with extended periods of weakness in the past, EM economies today for the most part maintain sustainable financial policies, are open to trade and capital flows, and display at least somewhat flexible labor and product markets. This policy orientation should allow for continued gradual convergence toward the global technology frontier, albeit at a slower pace than during the EM boom years.

This year, we reduce our long-term forecast for Chinese real GDP growth to 5.25%, from 6.00%. While acknowledging uncertainty about the accuracy of official Chinese data, we believe this economy—with per capita income only 15% of the U.S. level—can continue to grow at a fairly fast pace for some time to come, gradually decelerating toward a 4% pace by the end of our forecast period. Still, most economies that have experienced credit expansions remotely similar to what China has gone through in recent years have encountered difficulty at some point, with credit crunches, banking crises and similar phenomena. We can therefore envision several possible paths for China, including a period of very weak growth that could drag the full-period GDP growth number below our forecast.

Elsewhere in emerging markets, our growth expectations display a roughly inverse correlation with current income levels. India, currently the poorest country among our forecast group, leads the way in our growth forecasts. By contrast, we expect growth in relatively well-off Taiwan and Korea to run only a percentage point or so above the DM average. Across the board, we have revised down our projections this year by 0.25 to 0.75 percentage points, reflecting (1) slow-moving demographic forces similar to those operating in DM nations; (2) weaker growth in DM economies more generally; (3) the cut in expectations for China, a significant source of final demand for EM manufacturers and commodity exporters; and (4) specific concerns about the interaction of politics and economy in some EM countries, including Brazil, Russia, South Africa and Turkey.

INFLATION: HEADING FOR TARGETS

In the past two years, headline inflation has fallen to extremely low levels, even turning negative in many countries. That dramatic decline was catalyzed mostly by plunging oil prices, a situation that has begun to reverse. Core inflation rates—which exclude energy as well as food prices—have shown much less action. Indeed, in most DM economies, core inflation has stayed within shouting distance of central bank targets throughout the post-recession period, despite large output gaps. Although long-term inflation expectations have drifted somewhat lower, they have displayed few signs of coming adrift or losing their close relationship with official targets, a connection built up gradually from the 1980s onward. In broad terms, our forecasts expect more of the same, with most projections lying within a range roughly between 1% and 2%. That said, considerable uncertainty surrounds these long-term inflation views. On the one hand, monetary policy stances remain extremely stimulative, and this degree of support could conceivably translate into significantly higher inflation down the road (though the fact that inflation has not accelerated sharply after several years of unconventional policy provides some assurance that this outcome is not very likely). On the other hand, the very low headline inflation observed recently could produce cumulative effects on inflation expectations, making it harder for central banks to achieve their goals.

Our inflation forecasts for DM economies fall into three groups (**Exhibit 3**):

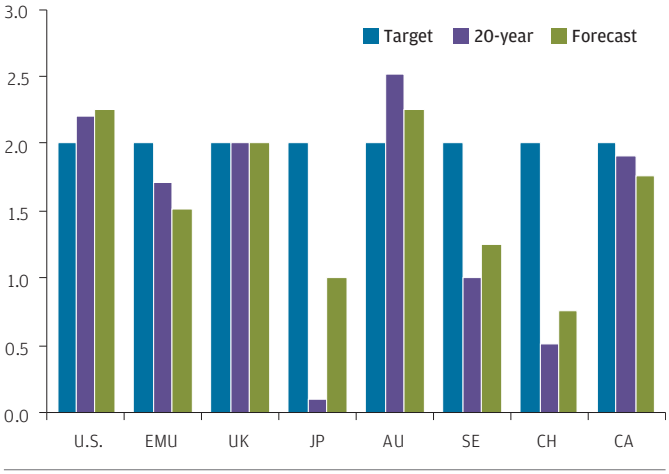
- **Target achievers.** In both the U.S. and UK, headline and core inflation over long periods—for example, 10 and 20 years—have averaged close to central bank targets. We judge policymaker commitment to these goals as still credible. Moreover, both countries' central banks have shown willingness to use all available tools in pursuit of their targets while giving significant attention to strategies

for eventual policy normalization. We expect inflation to run close to the 2% target in each case. In the U.S., our 2.25% projection reflects the fact that consumer price index inflation, the subject of our forecast, tends to run a bit above the inflation rate for personal consumption expenditure, which the Federal Reserve targets at 2%. In the UK, our 2.00% assumption matches the Bank of England's target, but uncertainty around this projection is wide in the wake of the EU referendum, especially given the possibility that persistent weakness in sterling could push up inflation expectations.

- **Target shortfalls**. In a few cases, we think central banks may fall short of their targets. While the Abenomics program has lifted the Japanese economy out of deflation—sustainably, in our view—it has not produced the significant behavioral changes likely needed to push inflation all the way to 2% in the near term. We think the Bank of Japan remains focused on lifting inflation and expect a 1.00% average during our forecast period, a little above current levels. In the euro area, the target itself is somewhat ambiguous, with observers unsure whether "close to but below 2%" implies an asymmetric target and at what exact level. In any case, inflation has run noticeably below 2% over the past 10- and 20-year periods, and with significant spare capacity likely to persist in the next few years, we expect inflation to average 1.50% during our 10- to 15-year horizon. Sweden and Switzerland, for their part, have experienced extremely low inflation in recent years, in part because of persistent currency appreciation. An eventual reversal in exchange rates should help push inflation, but low expectations will likely keep it running at quite a slow pace.
- **Commodity economies**. We expect central banks in Canada and Australia to come close to their targets (2.0% and 2.5%, respectively) but see downside risks in each case. Both economies are experiencing significant resource reallocation in the wake of commodity booms, and the resulting relative price swings will likely push headline inflation lower. Meanwhile, their currencies have weakened sharply in response to plunging terms of trade and seem likely to appreciate in coming years. Both factors will likely cause inflation to run just shy of central bank goals.

Inflation should stay close to policy targets, except where targets far exceed historical rates

EXHIBIT 3: INFLATION—TARGETS, 20-YEAR HISTORICAL AVERAGES AND 2017 LONG-TERM CAPITAL MARKET ASSUMPTIONS (% PER ANNUM)



Source: Haver Analytics, J.P. Morgan Asset Management, J.P. Morgan Securities LLC; data and forecasts as of September 30, 2016.

Our EM inflation forecasts, on average, lie above central bank targets but not dramatically so. Inflation expectations appear less well anchored in EM economies, many of which have suffered considerable instability in recent memory, and some doubt surrounds central bank autonomy in countries like Turkey and Brazil. At the same time, all nine of the EM countries for which we provide forecasts have experienced single-digit inflation, on average, during the past 10 years. The economy with the highest inflation over that period, Russia, has recently taken steps to introduce a formal inflation-targeting regime. These outcomes, which are relatively benign by EM historical standards, occurred despite significant EM currency weakness in recent years. Moreover, during our forecast period we expect only modest increases in commodity prices, a significant influence on EM inflation rates. While EM economies will likely remain more accident-prone than their DM counterparts, and thus susceptible to occasional inflation spikes, we expect a broad atmosphere of stability to prevail. Our single-country forecasts aggregate to an EM inflation rate of 3.75%, 2 percentage points above our aggregate DM inflation projection.

Our 2017 assumptions call for lower real GDP growth globally, a narrower DM-EM growth gap and generally stable inflation

EXHIBIT 4: MACROECONOMIC ASSUMPTIONS

	2017 assumptions		2016 assumptions		Change (percentage points)	
	Real GDP (%)	Core inflation (%)	Real GDP (%)	Core inflation (%)	Real GDP	Core inflation
Developed markets	**1.50**	**1.75**	**1.75**	**2.00**	**-0.25**	**-0.25**
U.S.	1.75	2.25	2.25	2.25	-0.50	0.00
Eurozone	1.25	1.50	1.50	1.50	-0.25	0.00
UK	1.25	2.00	1.50	2.25	-0.25	-0.25
Japan	0.50	1.00	0.50	1.50	0.00	-0.50
Australia	2.25	2.25	2.00	2.50	0.25	-0.25
Canada	1.50	1.75	1.75	2.00	-0.25	-0.25
Switzerland	1.50	0.75	1.75	0.75	-0.25	0.00
Emerging markets	**4.50**	**3.75**	**5.00**	**3.75**	**-0.50**	**0.00**
Brazil	2.75	5.25	3.00	5.25	-0.25	0.00
China	5.25	3.00	6.00	3.00	-0.75	0.00
India	7.00	5.00	7.25	5.00	-0.25	0.00
Russia	2.25	5.50	2.75	5.50	-0.50	0.00

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

I. THEMATIC ARTICLES

The global productivity slump: Causes and outlook

Dr. David Kelly, CFA, *Chief Global Strategist, Head of Global Market Insights Strategy*
Michael Hood, *Global Strategist, Multi-Asset Solutions*
Hannah Anderson, *Research Analyst, Global Market Insights Strategy*

IN BRIEF

- The last few years have seen a slump in both U.S. and global productivity growth.
- Analysis suggests that the biggest problem in the U.S. has been low investment spending, although smaller gains in labor composition and cyclical weakness have also taken a toll.
- Long-term forecasts point to a partial revival in U.S. productivity growth, though not to the same pace as in previous decades.
- Global analysis is more difficult. However, trends in global capital formation and schooling suggest some continued weakness in productivity growth.
- Overall, while productivity growth may also only partially revive outside the U.S., both measurement issues and macro trends continue to cast a shadow of uncertainty over global productivity forecasts.

Global productivity[1] growth has been falling since the mid-2000s, but in recent years growth has turned negative in some emerging markets and slowed to a crawl in developed countries (**Exhibit 1**). Large differences in income per capita are largely a function of differences in labor productivity, and productivity gains in recent decades made huge strides in reducing global poverty. This progress has now slowed. Low productivity growth and stagnant real incomes are fueling political discontent in the developed world, providing a dangerous opening for political extremists.

Productivity growth is also important for investors both in appreciating the overall limits to prospective returns and in distinguishing among those regions that have the best potential to generate those returns.

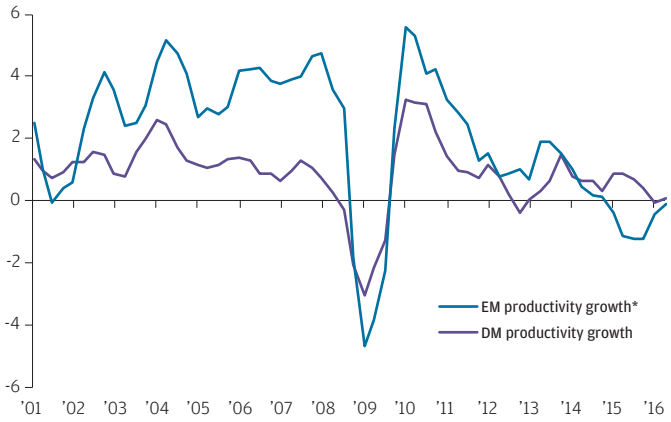
In this paper, we examine the causes of a recent and significant slump in global productivity (chief among them, a falloff in investment spending) and present our outlook for future trends. Global productivity growth, we conclude, is likely to remain sluggish in the years ahead.

Understanding and predicting global productivity growth is complicated. First, there is a cyclical element, with productivity falling as the economy enters recession, reviving thereafter and slowing again as the economy settles into expansion. Superimposed on this are structural changes that impact productivity, including technological change, changes in the mix of industries in an economy, changes in the skill and education levels of the workforce and changes in the equipment with which workers are furnished. Finally, there is the even murkier topic of measurement. Are we capturing all the quality improvements in the goods and services ultimately being purchased by consumers and businesses, and, if not, are we systematically and increasingly underestimating the actual improvements in efficiency and living standards?

The issue of productivity growth is important for the entire global economy. However, largely because of data availability and quality, it makes sense to start by analyzing and projecting U.S. productivity growth and then to consider how the trends seen in the U.S. might apply to other countries.

Global productivity growth has slowed

EXHIBIT 1: YEAR-OVER-YEAR % CHANGE, ESTIMATED AS REAL GDP GROWTH LESS EMPLOYMENT GROWTH



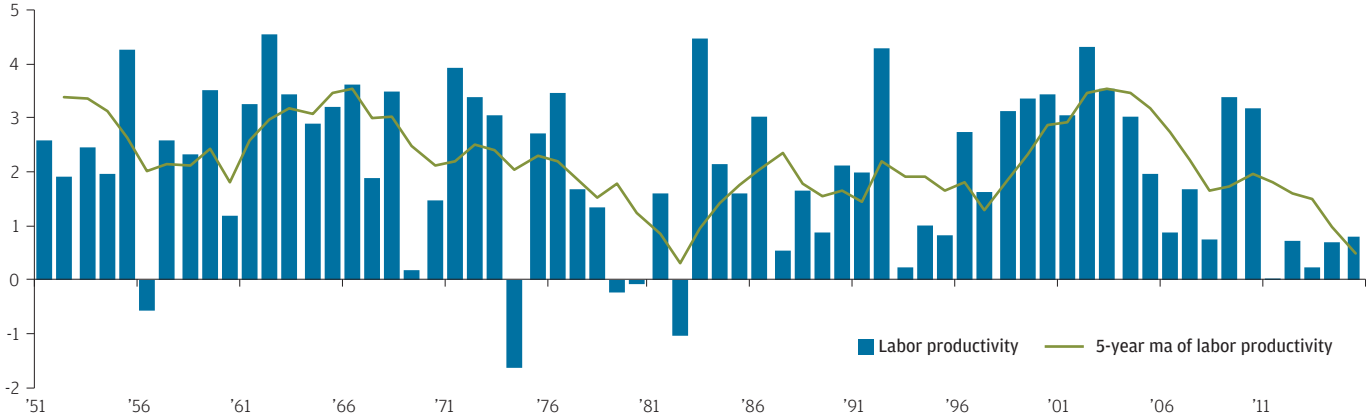
Source: National statistics agencies, J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data as of October 3, 2016.

*Excludes China and India.

[1] Throughout this paper, unless otherwise stated, "productivity" refers to labor productivity—that is, total output per hour of labor input.

Since the 1950s, U.S. productivity growth has slumped, revived and relapsed

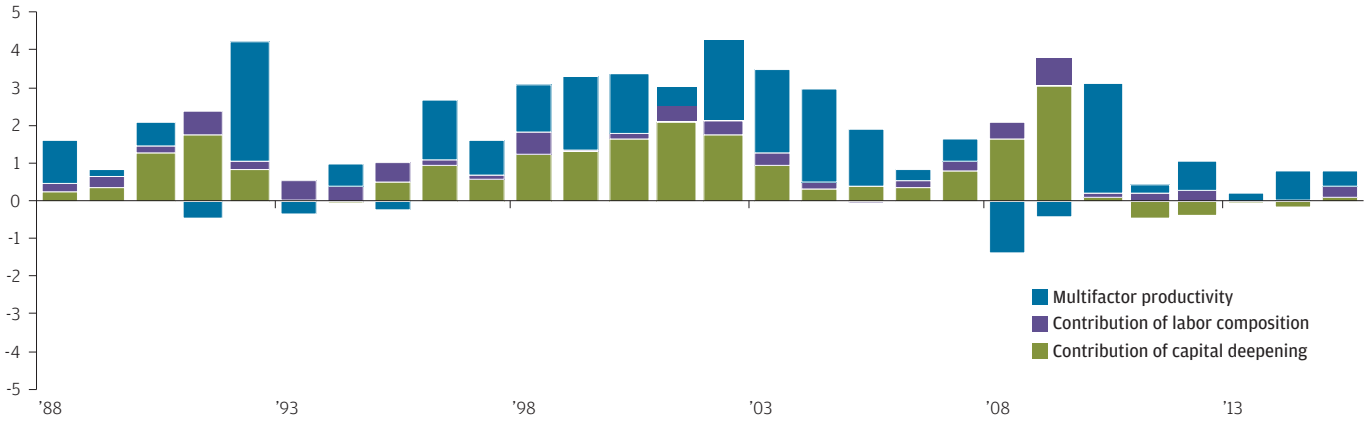
EXHIBIT 2: YEAR-OVER-YEAR % CHANGE, FIVE-YEAR MOVING AVERAGE, REAL OUTPUT PER HOUR, NON-FARM BUSINESS



Source: Bureau of Economic Analysis, Bureau of Labor Statistics, J.P. Morgan Asset Management; data as of September 30, 2016.

U.S. productivity growth has slumped for multiple reasons in recent years

EXHIBIT 3: YEAR-OVER-YEAR % CHANGE, REAL OUTPUT PER HOUR, PRIVATE NON-FARM BUSINESS



Source: Bureau of Economic Analysis, Bureau of Labor Statistics, J.P. Morgan Asset Management; data as of September 30, 2016.

THREE SOURCES OF U.S. PRODUCTIVITY GROWTH

Economists have struggled to understand U.S. productivity growth for many decades. As seen in **Exhibit 2**, productivity growth surged in the 1950s and 1960s, slumped in the 1970s and 1980s, revived in the 1990s and early 2000s and has relapsed again over the past decade. But why did this occur, and how is U.S. productivity likely to grow from here?

One approach to analyzing productivity, followed by the U.S. Bureau of Labor Statistics (BLS),[2] decomposes the growth in labor productivity into three parts.

First, the skill level of workers improves over time through increased levels of education and experience. This can be called the labor composition effect. Second, over time, businesses normally provide each worker with more and better tools—or, in the language of economists, increase the capital/labor ratio. This can be called the capital deepening effect. Finally, there is what is known as multifactor productivity: the increase in the efficiency of workers over and above that which can be explained by better workers or an increase in the capital/labor ratio.

Exhibit 3 shows BLS estimates of these three effects on labor productivity in the private non-farm business sector, from 1988 to 2015. **Exhibit 4** highlights the causes of the slowdown in productivity growth from 2.7% per year from 1996 to 2010 to just 0.5% per year from 2011 to 2015.

Exhibit 4 is pretty clear on the cause of the slowdown, with over 60% coming from a collapse in capital deepening. The key message is that the slump in investment spending following the end of the tech boom is largely responsible for recently slower productivity growth. (It should also be noted that government data show a growing discrepancy between the growth in income in the economy and the growth in output in recent years. If the government has undercounted the growth in output, then true productivity growth from 2011 to 2015 may have been a little stronger, with even more of the recent decline due to a slow-growing capital stock.)

[2] See Preliminary Multifactor Productivity Trends—2015, Bureau of Labor Statistics, May 5, 2016. Data from 2008 on include adjustments to reflect revisions to productivity in the non-farm business sector in August 2016.

Over 60% of the recent fall in productivity has come from a collapse in capital deepening

EXHIBIT 4: SOURCES OF PRODUCTIVITY GROWTH IN PRIVATE NON-FARM BUSINESS

	1996-2010	2011-15	Difference	Share of difference
Labor productivity	**2.7%**	**0.5%**	**-2.2%**	**100%**
Contribution of capital deepening	1.2%	-0.2%	-1.3%	61%
Contribution of labor deepening	0.3%	0.2%	-0.1%	4%
Multifactor productivity	1.2%	0.5%	-0.7%	34%

Source: Bureau of Labor Statistics, J.P. Morgan Asset Management; data as of September 30, 2016.

FORECASTING THE IMPACT OF CAPITAL DEEPENING

So much for recent history—how can we forecast U.S. productivity growth from here? One approach is to forecast the capital deepening, labor composition and multifactor productivity effects separately. To do this, we start by modeling the capital deepening effect.

Capital deepening depends on growing the capital stock faster than the number of workers. As is shown in **Exhibit 5**, the U.S. has seen a sharp slowdown in the growth of the capital stock. From 1951 to 2001, the capital stock grew at an annual pace of 3.4%. From 2002 to 2008, this downshifted to 2.1% per year. From 2009 to 2015, it downshifted again to just 1.3% per year. The growth in the number of workers has slowed also, but less so, and as a result the capital/labor ratio, which grew by 1.9% per year from 1951 to 2008, has grown by just 1% per year since then.

An econometric model relating the BLS estimate of the contribution from capital deepening to changes in the capital/labor ratio from 1988 to 2015 provides a very close fit with an R-squared of 0.98. To construct a forecast, we need to make assumptions about the growth in both labor and the capital stock.

Over the past decade, both investment spending and depreciation have risen. We assume they both continue to do so, but at a diminished pace (since we are starting from closer to the peak than the middle of a business cycle). We also assume that the number of hours worked, which has grown at an average pace of 2.2% per year over the last five years of expansion, slows to 2.0% growth in 2016 and drifts down to 0.5% growth from 2019 on, as the unemployment rate reaches a trough and the retirement of baby boomers slows labor force growth. Under these assumptions, the capital/labor ratio rises by just 0.8% per year from 2016 to 2030. Forecasting with this model suggests that the annual contribution from increasing capital intensity should be roughly 0.41% per year from 2016 to 2030.

FORECASTING THE IMPACT OF CHANGING LABOR COMPOSITION

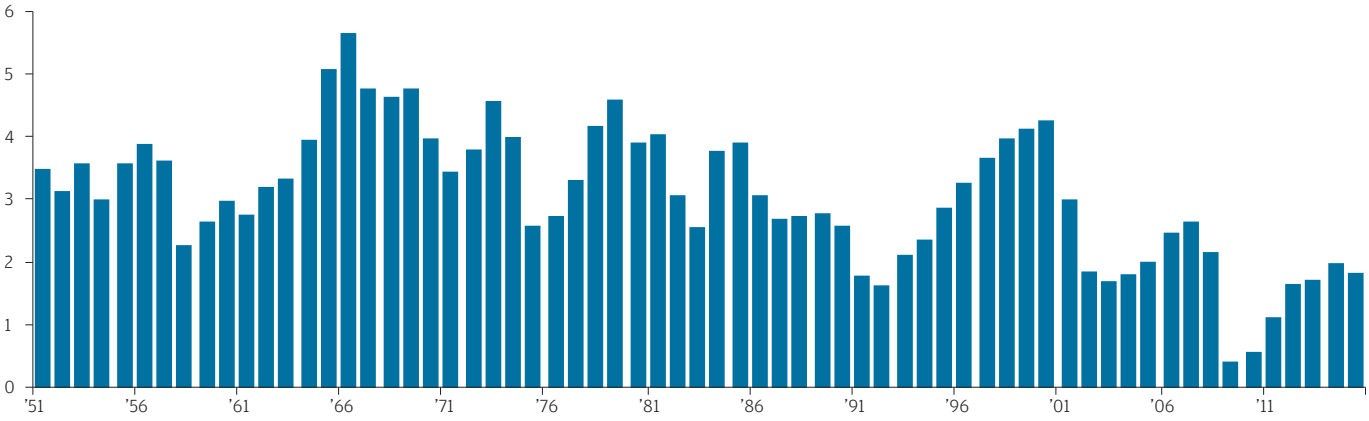
What about the labor composition effect?

There are both secular and cyclical components to changes in the composition of the workforce. Over time, the average American worker has become older and wiser as both the average education levels and the age of workers have increased. In addition, in recessions the least skilled workers tend to get laid off first, allowing for a temporary increase in the skill level of the workforce. A crude econometric model using the change in the years of education of U.S. workers and the change in the unemployment rate explains only about a third of the variation in the labor composition effect from 1988 to 2015. However, this variation itself is relatively small, so errors in forecasting this effect should not significantly impact the accuracy of long-term forecasts for overall productivity.

Looking forward, while the workforce is still getting older and smarter, it is getting older and smarter more slowly. As we have noted, retirement of the baby boomers is removing a large number of older Americans from the labor market, reducing the growth in average years of experience. Similarly, while the workforce is becoming more educated, the growth in average years of schooling has slowed somewhat recently.

The U.S. has seen a sharp slowdown in the growth of its capital stock

EXHIBIT 5: YEAR-OVER-YEAR % CHANGE, CHAIN-WEIGHTED PRIVATE NON-RESIDENTIAL CAPITAL STOCK, 1951-2015



Source: Bureau of Economic Analysis, J.P. Morgan Asset Management; data as of September 30, 2016.

Extrapolating these trends suggests that changes in the composition of the labor force may add 0.27% to annual labor productivity growth over the next 15 years, roughly in line with their contribution over the last decade.

FORECASTING THE IMPACT OF CHANGING MULTIFACTOR PRODUCTIVITY

The third component, multifactor productivity, is the most complicated. We know that there is a cyclical component to multifactor productivity and that it normally shows up in three stages. As the economy heads into recession, businesses at first don't perceive the recession or don't want to fire workers in case the downturn proves to be mild. Consequently, output falls more than labor input and productivity slumps. As the economy turns around, businesses don't initially have to rehire, so output rises faster than labor input and productivity soars. Then as businesses resume hiring, productivity growth returns to trend.

Overlaid upon this is the general impact of slack in the labor market. Regardless of whether unemployment is rising or falling, if unemployment is high, businesses tend to use labor more wastefully. When it is low, they tend to use it more productively.

A model using the unemployment rate, the change in the unemployment rate and the change in the unemployment rate lagged by one year can explain about 46% of the annual variation in multifactor productivity from 1988 to 2015. This is not a particularly tight fit, and the coefficients, while statistically significant, are not being measured with much precision. The problem is that the equation is mostly trying to model business cycle effects and there have been only three recessions since 1988.

To get around this, we estimated a history of private non-farm business labor productivity from 1948 on, based on BLS's closely related numbers on overall non-farm productivity. We then estimated the capital deepening and labor composition effects from 1951 to 1987 from our earlier econometric work. This allowed us to estimate multifactor productivity growth from 1951 to 1987. We then re-ran our multifactor productivity model from 1951 to 2015, now explaining 55% of the variation over the same period, with much more precise coefficient estimates.

The other 45% is very difficult to model. The key problem is that much of the acceleration and deceleration in multifactor productivity comes from the way new technologies are adopted and old technologies become obsolete.

It has been argued that the productivity slump of the 1970s may have been due to obsolescence, as an energy-intensive capital stock simply wasn't suited for a world in which energy was suddenly scarce and more expensive. The 1980s saw huge innovation in the introduction of personal computing to the workplace. However, it is not clear that it was immediately adopted in ways that were actually labor-saving. Indeed, the productivity revival of the 1990s may well have been a delayed payoff from this revolution as businesses finally figured out how to use these machines in a way that made them more efficient. Many technologies of today, particularly in the areas of information technology and robotics, may yet pay a dividend in higher productivity in the years to come. The problem is that, given the murkiness of these trends, time-series statistical analysis cannot model them effectively.

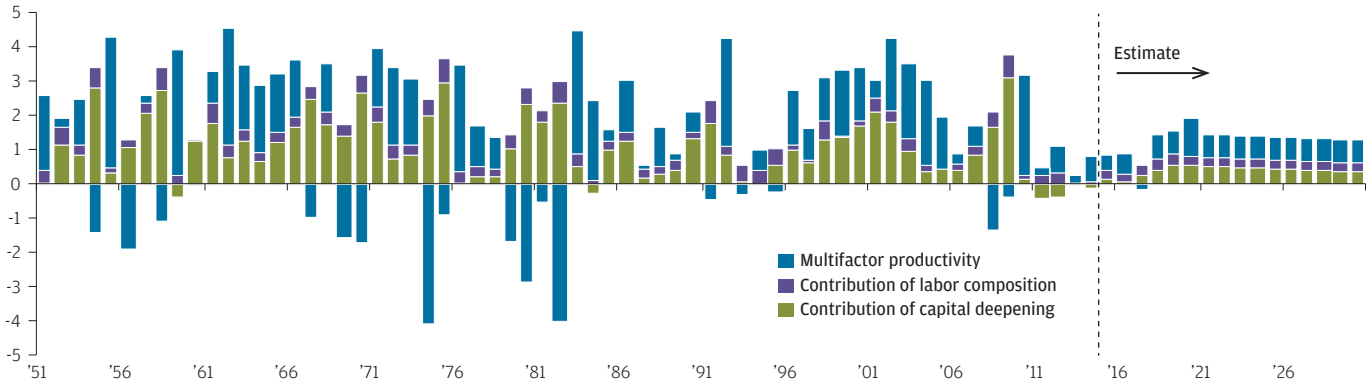
With all these caveats, we can use this model to forecast multifactor productivity going forward. We assume the unemployment rate averages 6.0% over the next 15 years, which equals its average since 1987. Under this assumption, multifactor productivity growth is projected to average 0.66% per year over the next 15 years, better than the 0.44% average over the last decade but worse than the 1.61% per year seen in the prior 10 years.

THE OUTLOOK FOR U.S. PRODUCTIVITY GROWTH

Adding up the projected contributions from the capital deepening, labor composition and multifactor productivity effects suggests that total labor productivity could grow at an average pace of 1.34% per year over the next 15 years (**Exhibit 6**). This, combined with an average of 0.70% growth in total hours worked, implies an annual gain in the real output of the non-farm business sector of 2.01%. It should be noted that the government sector, which is part of GDP but not part of the non-farm business sector, has much lower productivity growth. On average, since 1988 real GDP has grown 0.30% slower than the real output of the non-farm business sector. Consequently, this forecast is equivalent to a forecast of 1.71% annual growth in real GDP, a little lower than the growth rate currently embedded in Federal Reserve long-term forecasts but roughly in line with the estimates used in our Long-Term Capital Market Assumptions.

Our forecast suggests U.S. labor productivity could grow at an average annual pace of 1.34% over the next 15 years

EXHIBIT 6: YEAR-OVER-YEAR % CHANGE, REAL NON-FARM BUSINESS OUTPUT PER HOUR, 1951-2015; ESTIMATE 2016-30



Source: Bureau of Economic Analysis, Bureau of Labor Statistics, J.P. Morgan Asset Management; data as of September 30, 2016.

PRODUCTIVITY GROWTH OUTSIDE THE U.S.

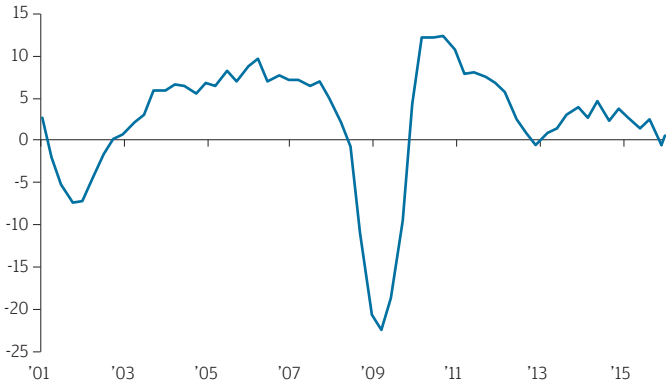
While a lack of data makes a similar statistical analysis impossible for the global economy, productivity growth around the world should be impacted by the same issues of changes in capital investment, labor composition and multifactor productivity.

The U.S. has seen a more dramatic slowdown in productivity growth than elsewhere, largely, as previously discussed, as a result of the slowdown in investment spending. However, as shown in **Exhibit 7**, this is a global phenomenon. Investment spending, especially on equipment, has lagged expectations for a good part of this recovery and never reached the same share of GDP it represented prior to the financial crisis. In the emerging markets, much of the drag is related to the downturn in the commodities cycle—companies are not going to invest in better equipment at a time of rapidly falling prices. In developed economies, stagnant capital spending is likely closely related to weakness in corporate profits and stress in banking systems, particularly in Europe and Japan, that have impeded lending to business. If investment spending remains weak, so will productivity growth.

When it comes to labor composition, the slowing rate of improvement in skills and the aging of the workforce are not limited to the U.S. Most of the world is aging, and although some developing nations have very young populations, the rate of aging will likely slow, as most of the world is already relatively old. More important for productivity, the improvement in skills of this workforce will continue to increase slowly.

Global investment spending is down

EXHIBIT 7: YEAR-OVER-YEAR % CHANGE IN GDP-WEIGHTED BUSINESS INVESTMENT IN FIXED CAPITAL, 1Q01-2Q16



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data as of October 3, 2016.

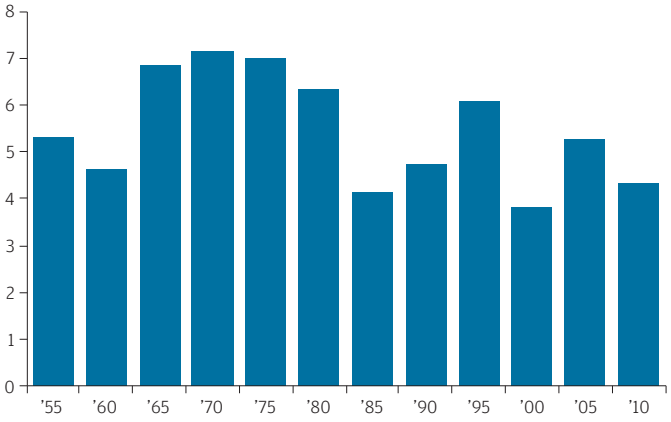
*Excludes China and India

One of the easiest ways to look at the potential for creating more-productive workers is to look at their educational attainment; more-highly educated workers tend to be more productive. Analysis conducted by economists Robert Barro and Jong-Wha Lee[3] suggests that, on a global basis, the rate at which workers are getting higher levels of education is slowing (**Exhibit 8**). On average, workers had 6.1 years of education in 1950, but by 2010 people were staying in school an average of 11.5 years. This was a massive improvement over 60 years, but the rate at which those gains are being achieved is decelerating. This means it is likely that the rate at which workers will get more productive through education is also slowing.

[3] Robert Barro and Jong-Wha Lee, "A new data set of educational attainment in the world, 1950-2010," *Journal of Development Economics*, 104 (2013): 184-198.

Improvement in educational attainment is slowing

EXHIBIT 8: GLOBAL AVERAGE TOTAL YEARS OF SCHOOLING, % CHANGE OVER PREVIOUS PERIOD



Source: Barro and Lee, J.P. Morgan Asset Management; data as of September 30, 2016.

This brings us to multifactor productivity. As in the U.S., there should be a cyclical component to multifactor productivity that will have been hurt by slow global economic growth. Beyond this, however, multifactor productivity is likely being impeded by structural issues such as a slowing diffusion of innovation. A landmark survey of productivity growth at an individual firm level conducted by the Organization for Economic Co-operation and Development (OECD)[4] found that these structural forces, related to both the increasing importance of information technology and the changing nature of business, have reduced productivity growth.

Globally, the average firm has seen slowing productivity gains, despite several firms improving productivity far beyond the rate of their competitors. The slowdown in productivity growth partly reflects the diminishing pace at which the productivity-enhancing tools of leader firms have been spreading to other firms. The first adopters (often the inventors) of these innovations are typically new firms, created because their founders think they have figured out a better way of doing things. These technologies and techniques then find their way into more established firms as employees move around and technologies become more widely available, boosting productivity broadly. Recently, and especially in the post-crisis period, the world has seen a decline in the accumulation of this knowledge-based capital and in the rate of start-up creation.

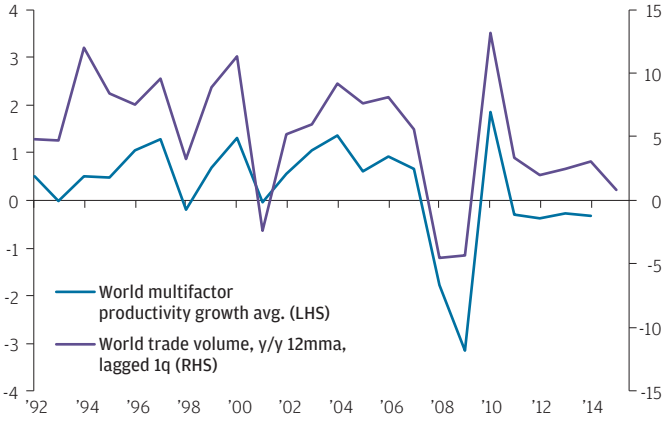
As the rate of technology diffusion has slowed, the gap between leading and laggard firms has widened. Part of the tech-spread slowdown may be due to the inability of lagging firms to adopt new technologies efficiently. But part of it may lie in better technology providing such a high competitive advantage that it enables winner-take-all strategies for certain firms.[5]

In addition, firms with the best track record of productivity growth have been among the greatest beneficiaries of globalization, with sophisticated supply chains spanning several countries. Trade among companies and countries is how new ideas and technologies spread, and increasing specialization along trade routes helps to make the most efficient use of resources. As a result, growth in trade volumes and growth in multifactor productivity follow each other very closely. As shown in **Exhibit 9**, global trade volumes are barely growing, further hurting global multifactor productivity growth.

High global debt levels may also be impeding innovation. Companies require financial backing to expand and adopt new technologies. Highly indebted firms tend to focus on repaying their debts, or in the most extreme situation simply servicing existing debt, rather than taking a risk on innovations.[6] Financial systems already concerned with recouping their investments are unlikely to extend credit to new firms,[7] presenting a challenge to boosting productivity.

Slowing trade has contributed to a decline in global productivity growth

EXHIBIT 9: YEAR-OVER-YEAR % CHANGE, WORLD TRADE VOLUME, TWELVE-MONTH MOVING AVERAGE LAGGED THREE MONTHS, AVERAGE WORLD MULTIFACTOR PRODUCTIVITY



Source: Conference Board, Netherlands Bureau for Economic Policy Analysis World Trade Monitor, J.P. Morgan Asset Management; data as of September 28, 2016.

[4] See "The Future of Productivity," OECD 2015, using calculations from the ORBIS database.

[5] See "Race against the machine," Brynjolfsson and McAfee, 2014.

[6] See "Comment on 'cyclical budgetary policy and economic growth: What do we learn from OECD panel data?'" Caballero and Hammour, NBER, 2005.

[7] See "Did bank distress stifle innovation during the Great Depression?" Nanda and Nicholas, NBER, 2014.

MEASUREMENT ISSUES

Finally, it is important to recognize the issue of measurement error in estimates of productivity, a theoretical problem that impacts productivity analysis for all countries.

All estimates of productivity growth come from calculating the nominal value of output, deflating by an appropriate measure of inflation and then dividing by total hours worked. There are few theoretical problems with hours worked (provided we are willing to fudge the issue of people busily sending work e-mails from home or doing online shopping from their desks). However, the measurement of real output is hugely problematic.

The main problem is that it is unlikely that government output measures fully account for improvements in the quality of goods and services. In the goods sector, these improvements can manifest themselves as safer, more reliable cars, high-definition big-screen televisions or more effective pharmaceuticals. In the services sector, defining productivity improvement is even more difficult. A doctor may see the same number of patients as 30 years ago, so his measured productivity may be unchanged. However, the quality of his diagnoses and prescriptions should be much better. It should be noted, in fairness, that government statisticians work hard to try to account for quality improvements. The problem is that these improvements are hard to measure in a defensible way.

Even harder to gauge is the value of being able to do things that would have been unimaginable to prior generations. Most people own a smartphone or tablet that allows them to download almost any song, movie or book ever created, to Google the answer to almost any question, to map their way around any town or to video-chat around the world. Some have said that this is a slow period for technological improvement. This may be the case for business labor-saving devices. It is hardly the story for the average consumer.

CONCLUSION

The last few years have seen a significant slump in global productivity growth. Statistical analysis of U.S. trends suggests that this phenomenon is primarily due to a decline in investment spending, although other issues, such as a slowdown in the rate of skills improvement in the labor force, may have taken a toll. Beyond this, an ongoing shift from goods to services production, a diminished pace of innovation and slower widespread adoption of labor-saving technologies may be having an effect. Many of the same forces that have restrained U.S. productivity growth appear to be also operating on a global scale.

Going forward, many of these trends are likely to persist and could slow measured global productivity growth. However, it is still the case that developing countries, with lower capital/labor ratios, younger workforces and lower levels of educational attainment, have more potential for productivity improvement in the future. For consumers, it is important to recognize that measured productivity growth is not the only yardstick of improving living standards—many innovations in information technology are profoundly impacting society while leaving only a small imprint on measured productivity. Investors, however, must focus on measured productivity, as it is a critical source of both economic and profit growth. Our analysis suggests a continuation of relatively slow productivity growth in both the U.S. and around the world in the years ahead. The best investment returns should accrue to those who can identify those companies and countries that are able to find the strongest productivity gains in a world where those gains will continue to be harder to achieve than in decades gone by.

Tackling leverage: Leaders, laggards and history lessons

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IN BRIEF

- While overall debt levels in developed markets remain elevated, they are not much above the thresholds considered dangerous in historical studies. In many cases, low interest rates are extending developed market (DM) borrowers' debt-carrying capacity.
- In contrast to DM progress, emerging market (EM) debt levels are rising and excess leverage is becoming a cause for concern. The amount of EM debt denominated in hard currency is limited, however, which reduces systemic vulnerabilities.
- Vulnerabilities to a credit crisis are likely to be largely isolated from the wider financial system—or sufficiently limited in scale to render them domestic rather than global issues.
- Financial sector leverage in systemically important developed markets has generally contracted since the global financial crisis (GFC). DM and EM household debt have not expanded meaningfully, so systemic risks are generally lower. Leverage is, however, becoming an issue for some EM corporates.
- We do not believe apocalyptic risks are associated with high debt levels, although aggregate economic growth could well suffer and we anticipate pockets of stress. The risk appears elevated in some of the commodity countries.

DELEVERAGING (OR THE LACK OF IT) SINCE THE GLOBAL FINANCIAL CRISIS

In the immediate aftermath of the global financial crisis, a great deal of policy discussion centered on how to address leverage across the global financial system. Eight years on, the results can best be described as mixed. There is little evidence of actual deleveraging in developed economies' aggregate debt ratios, yet memories of painful austerity are still raw. Nevertheless, there have been notable successes—bank leverage fell sharply, from a pre-crisis leverage multiple of 15.5x assets to equity to 9x today in the U.S., and from 24x to 18x in Europe. Household debt levels have also fallen across many developed markets. Taken together, the deleveraging has neutralized some of the more dangerous elements in the system. In contrast to this progress in the developed markets, leverage in emerging economies is rising and excess leverage is becoming a cause for concern (**Exhibit 1**).

An optimistic read today would be that for the developed world a balance sheet transfer has taken place. The shrinkage in U.S. financial sector and mortgage market debt—offset by a sharp rise in the level of government debt to GDP—has significantly reduced systemic leverage risks, even if it has not alleviated the aggregate debt burden. Arguably, given the dollar's reserve status, this may be a uniquely sustainable intermediate-term solution for the U.S.

The more pessimistic view is that attempts to reduce leverage via growth or inflation have palpably failed. Instead, the developed markets have fallen back on containing the debt overhang through a combination of austerity and financial repression—or they are merely ignoring it.

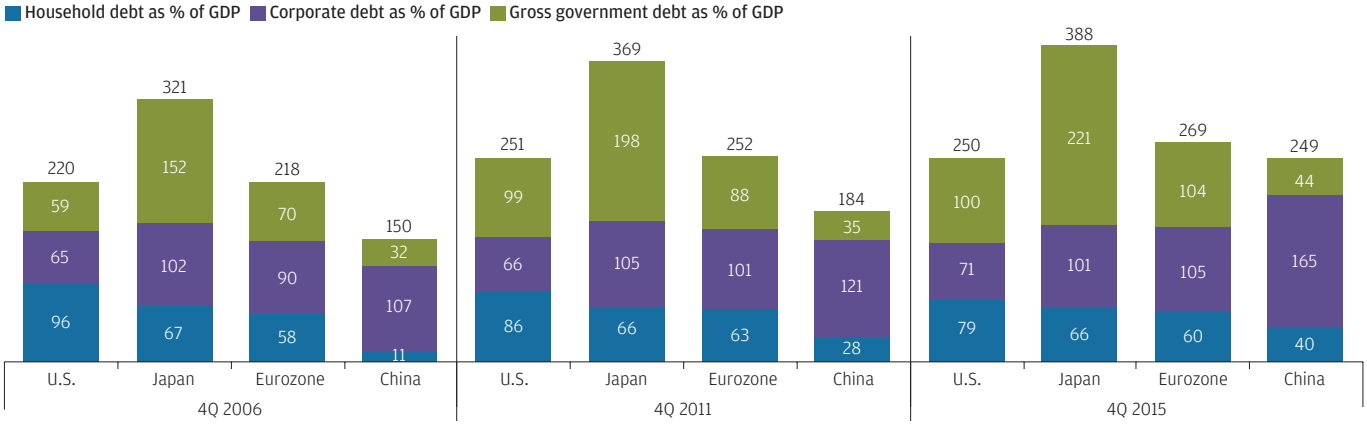
The emerging world's debt has ballooned since the GFC. While it is likely that the debt surge gave global growth a welcome boost, we now face the start of an EM deleveraging cycle. The good news is that EM debt is unlikely to become the major systemic risk that U.S. housing debt proved to be. The bad news is that EM deleveraging will put a further brake on growth just as developed markets appear to be abandoning their deleveraging efforts and accepting the inevitability of a low-growth world.

LEVERAGE TODAY IN DEVELOPED AND EMERGING ECONOMIES

High global leverage ranks as a significant concern for investors. While we don't share the more apocalyptic views of the risks associated with high debt levels, we acknowledge that aggregate economic growth could well suffer, and we anticipate some pockets of stress. The fear of elevated leverage tends to be associated with two factors: its longer-run effect on growth and the shorter-run possibility of a credit crisis (arising either from systemic risks connected to the debt itself or from the unintended consequences of policy measures deployed to bring debt levels down). In our view, the impact on growth from both the level and expansion of leverage will have a visible effect on asset returns over our 10- to 15-year horizon. Measures to address debt will likely vary significantly across regions, with emerging economies more likely to resort to familiar methods of deleveraging—inflation, currency adjustment, restructuring—while developed economies may need to explore new tools. However, in most cases, we do not see an elevated risk of a systemic credit crisis forming, as it did in 2008.

In the U.S. and eurozone, household and corporate leverage have leveled off; in contrast, debt levels in these two sectors in China have risen markedly

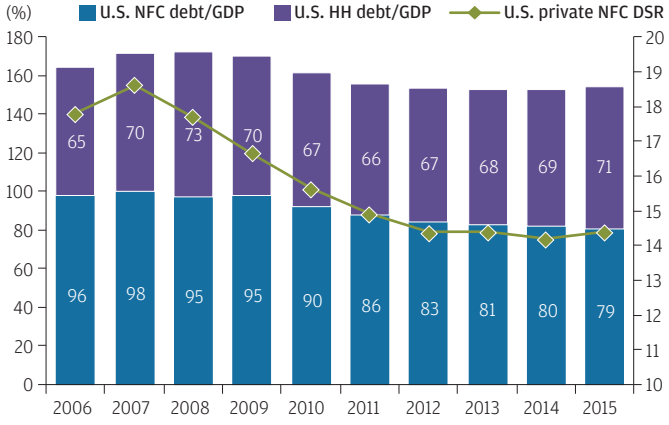
EXHIBIT 1: COMPOSITION OF NATIONAL/REGIONAL INDEBTEDNESS (AS % OF GDP)



Source: Bank for International Settlements; J.P. Morgan Asset Management Multi-Asset Solutions; data as of October 7, 2016.
Data is market value apart from Chinese government debt as a % of GDP, which is nominal value.

The U.S. private debt service burden fell along with the absolute level of debt itself

EXHIBIT 2: U.S. HOUSEHOLD AND NON-FINANCIAL CORPORATE (NFC) DEBT-TO-GDP AND DEBT SERVICE RATIO (AS % OF GROSS DISPOSABLE INCOME)



Source: Bank for International Settlements, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016.

Debt service ratio (DSR) is defined as the ratio of interest payments plus amortizations to income.

To better frame where leverage creates vulnerabilities in the system today, we focus on three elements of debt: its level, rate of growth and location. Recent academic studies have demonstrated that the first two of these factors—the absolute level of debt and its rate of growth—can affect future economic growth through several mechanisms, including the reallocation of capital, the propensity to increase savings and pay down debt, the pulling forward of future demand, etc. The final consideration—the location of debt on the national balance sheet—is crucial for understanding the risk of a systemic crisis and determining which policy tools to deploy. Simply put, the further the debt sits from the financial sector and from household balance sheets, the lower the risk of an acute crisis.

Developed economies

Early and extensive deployment of the sovereign balance sheet from 2008, notably by the U.S. and the UK, facilitated the transfer of private sector debt to the public sector, effectively defusing its explosive power. Private debt service ratios fell sharply as debt levels shrank (**Exhibit 2**). Yet even as sovereign debt levels soared, ultra-low interest rates kept DM governments' debt servicing costs well under control (**Exhibit 3**). Since this transfer has largely neutralized the systemic risk of large DM countries' aggregate debts, it is questionable how much incentive they have now to address them.

So long as investors remain willing to hold DM sovereign debt, we struggle to see an imminent day of reckoning for advanced economies that have shifted debt onto the government balance sheet. The persistence of a global savings glut goes a long way to reinforcing this status quo, as aging savers seek out lower risk assets. So, too, does financial industry regulation that requires ever-greater holdings of "riskless assets"—in what bears more than a passing resemblance to previous episodes of financial repression.

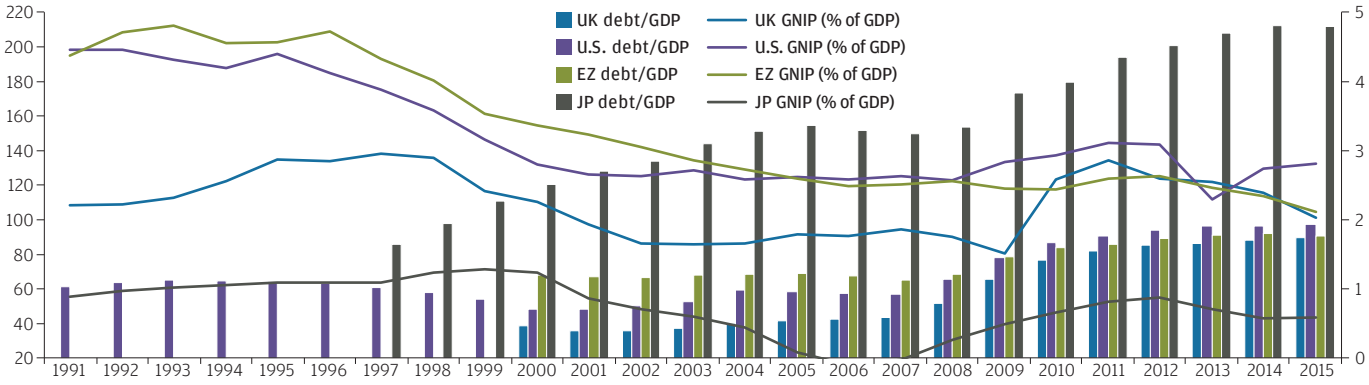
Emerging economies

Patterns of leverage differ in emerging economies, as do potential paths of deleveraging. For the most part, the absolute level of debt in emerging economies remains subdued by DM standards. In most cases, debt service burdens are light (**Exhibit 4**). This may afford some comfort to investors scarred by the Asian financial crisis of the late 1990s and the Latin American debt crisis of the 1980s. Nevertheless, levels of EM private sector debt have risen sharply since the GFC, particularly in the corporate sector, and without an offset through a corresponding fall in interest rates, debt servicing costs for EM companies and households have increased steadily (**Exhibit 5**).

Despite a steep increase in government debt post-GFC, accommodative interest rates have kept debt service ratios well contained

EXHIBIT 3: U.S., EUROZONE, UK AND JAPAN SOVEREIGN DEBT-TO-GDP RATIOS AND GOVERNMENT NET INTEREST PAYMENTS (GNIP) (% OF GDP)

Debt to GDP %



Source: Bank for International Settlements, OECD, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016.

Three qualities of EM leverage suggest that systemic risks are contained: (1) EM governments' relatively unstressed balance sheets; (2) relatively low levels of hard currency-denominated debt; and (3) the concentration of leverage in the broader corporate sector—not in the financial sector. As such, EM countries will probably experience a more "traditional" deleveraging cycle than DM economies (discussed below). Where the buildup in EM leverage is not uniform across all channels, policymakers may have the choice to deal with leverage by shoring up one component of the national balance sheet at the expense of another.

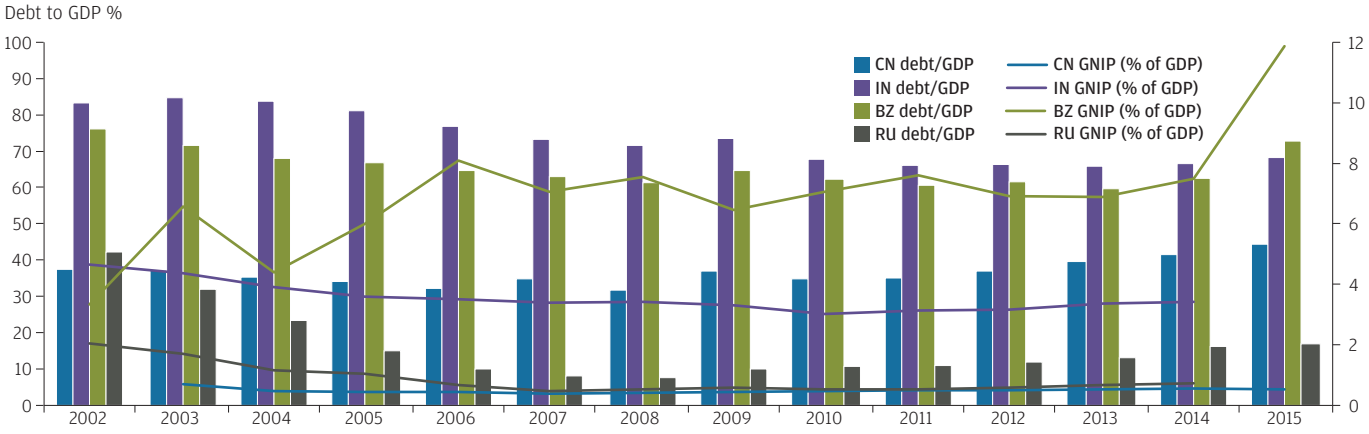
EM economies: Greater flexibility to address leverage

History suggests that the composition of an economy's balance sheet sets up some of the conditions under which credit crises tend to erupt. A crisis may originate when an economy's balance sheet has deep external linkages and the policy response is simply not fast enough to prevent contagion (e.g., the U.S. mortgage crisis) or when stress in one part of an economy's balance sheet is shifted to another, which cannot withstand the shock (e.g., the transfers between the balance sheets of eurozone sovereigns and banks). Ultimately, if policymakers have access to a relatively immune balance sheet with few externalities, they have more flexibility to deal with excess leverage. Countries with deep household savings might be in this camp—certainly, the way Japan has piled up leverage may offer high-savings-rate emerging economies (e.g., China) clues on how to cope.

In our view, emerging economies have more latitude than their DM counterparts to address excess leverage in the next few years through a combination of familiar patterns: balance sheet transfer, inflation and currency adjustment. Meanwhile, developed world efforts to inflate away debt appear to have largely failed, and attempts at currency adjustment in Japan and Europe seem to have backfired, contributing instead to a

EM indebtedness is low by DM standards, and debt service burdens are in most cases light

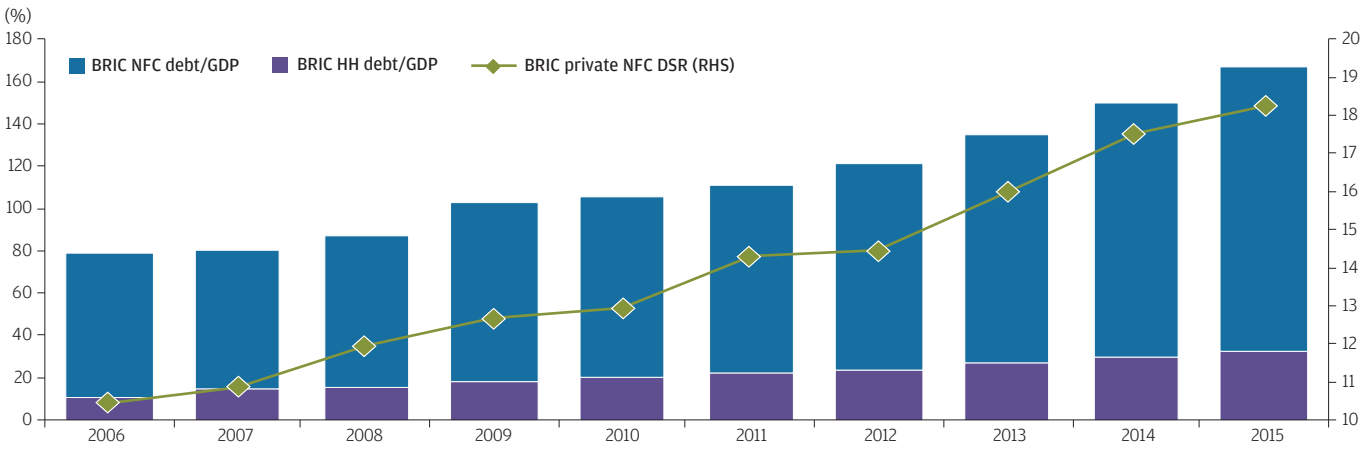
EXHIBIT 4: GOVERNMENT DEBT-TO-GDP AND NET INTEREST PAYMENTS (GNIP) (% OF GDP) FOR CHINA, INDIA, BRAZIL AND RUSSIA



Source: Bank for International Settlements, OECD, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016.

Contrary to the situation in the developed markets, rising debt service ratios have accompanied the increase in private sector EM debt

EXHIBIT 5: HOUSEHOLD AND NON-FINANCIAL CORPORATE DEBT-TO-GDP AND DEBT SERVICE RATIOS FOR CHINA, INDIA, BRAZIL AND RUSSIA (GDP-WEIGHTED AVERAGE)



Source: Bank for International Settlements, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016.

sharp dollar rally that, in turn, threatened the fragile trajectory of global growth. DM policymakers must choose to be much more inventive—or else more willing to overlook the problems of excess leverage and accept it as a permanent component of their economic framework.

MAPPING THE VULNERABILITIES ARISING FROM EXCESS LEVERAGE

In assessing the world economy's vulnerabilities to leverage today, we can identify three simplified paths to addressing the problem. Debt can be reduced rapidly and with inevitable pain; it can be reduced gradually, at a pace that doesn't excessively disrupt economic growth; or it can be serviced into perpetuity. Since the first outcome causes both debtors and creditors to suffer, we can assume that leverage will be addressed—wherever possible—by the latter two means. Our first observation was that the risk of a systemic credit crisis is reasonably low. While there are some concentrations of leverage, its location—where that debt sits on the national balance sheet—reduces the risk of rapid contagion. Nevertheless, our second observation was that both the level and growth of debt have in some instances breached the thresholds where, according to academic literature, they begin creating significant headwinds to future economic growth.

Judging from the absolute debt-to-GDP levels in key EM and DM regions (**Exhibit 6A**), developed economies remain significantly more leveraged than emerging economies, despite the perception that over the last five years the developed world has been deleveraging while emerging world debt levels have risen. Yet even though absolute EM debt levels remain subdued, in almost all sectors, debt is now markedly above long-run averages (**Exhibit 6B**). A Bank for International Settlements (BIS) working paper from 2011 examined debt's drag on growth. It found that in OECD countries, when government or household sector debt-to-GDP ratios drifted north of 85% of GDP and when corporate sector debt-to-GDP rose above 90%, those debt levels impeded growth.[1] In most of the emerging world, absolute levels of debt have remained well below these thresholds—with Chinese non-financial corporates the clear exception. However, it is plausible that debt could start to become a drag on growth at a lower threshold in emerging markets. Hence, government debt in India and Brazil, along with EM corporate debt in general, deserves further scrutiny.

Across developed markets, aggregate debt levels remain elevated. Yet there is still reason for optimism. First, in the U.S., Europe and Japan, household sector debt has fallen meaningfully post-GFC and is now quite low vs. long-run averages. Second, while DM general government debt has risen, in many cases it remains below 90% of GDP, even after the massive balance sheet transfers of recent years. Further, with interest rates very low, the danger threshold may arguably be somewhat higher today than the levels inferred from historical studies. Finally, there is evidence that debt levels have begun to recede from their peak in the most important DM regions.

Nevertheless, there are pockets of potential stress in the developed world, in particular in the economies most exposed to the commodity supercycle: Canada, Australia and Sweden. Of concern are the levels of household debt in Australia and Canada, and corporate debt in Canada and Sweden. Generally, household debt, alongside financial sector debt, is the most economically significant pocket of leverage on any nation's balance sheet. But while such vulnerabilities in Australia and Sweden are considerations for the local economies, they are unlikely to present a significant contagion risk due to the global banking system's relatively small exposure to these countries.

If we change our lens from the level of debt to the growth in debt, and view it in two ways—current growth rates in debt in **Exhibit 7A** and growth rates in debt vs. long-term averages in **Exhibit 7B**—we see a more mixed pattern of vulnerabilities. For the most part, systemic risks are reasonably contained. While there is a significant increase in general government debt in the emerging world, a relatively small component of the issuance is denominated in hard currency. Indeed, with the exception of India, the growth rate in household debt over a standardized three-year rolling window is below historical averages.[2]

Away from the EM household sector, the rise in non-financial corporate leverage stands out. We suspect that this rise in EM corporate leverage may present more of a risk to growth than an equivalent increase in DM corporate debt.[3]

[1] Steven G. Cecchetti, M.S. Mohanty and Fabrizio Zampolli, "The real effects of debt," BIS Working Papers No. 352 (2011) (http://www.bis.org/publ/work352.htm).

[2] "Household debt and business cycles worldwide," NBER Working Paper No. 21581 http://www.nber.org/papers/w21581 (2015). This is significant because Mian, Sufi and Verner find that an expansion of household sector debt by more than 1 standard deviation above trend is associated with a drag on GDP growth in the following three years.

[3] Note, however, that Mian, Sufi and Verner find a limited linkage between corporate leverage and economic growth in their sample set. Of the 30 countries in the set, only a handful are EM nations.

While compared with the developed markets, EM debt ratios seem favorable …

EXHIBIT 6A: ABSOLUTE LEVEL OF DEBT-TO-GDP, BY BALANCE SHEET SECTOR, IN KEY DEVELOPED AND EMERGING ECONOMIES

LEVELS (% GDP)	U.S.	UK	JP	EZ	AU	CA	SE	CH	CN	IN	BR	RU	MX	ZA	TR
Private non-fin (all sectors)	150.5	160.3	167.2	162.1	206.6	209.8	237	209.4	210.4	60.6	75.7	75.6	40.9	73.7	77.9
Private non-fin (banks)	51.5	90.1	115.3	93.6	140.8	109.6	130.5	166.4	155.4	56.8	67.9	57.1	17.9	67.5	70.9
Non-fin corp	71.2	73.0	101.3	102.8	82.3	112.2	152.5	85.7	170.8	50.6	50.1	59	25.3	36.7	56.9
Households	79.2	87.3	65.9	59.3	124.3	97.6	84.5	123.7	39.5	10.1	25.5	16.6	15.6	37.0	21.0
Non-fin sector	250.6	265.5	388.2	266.3	243.8	287.6	283.4	242.9	254.8	129.1	148.5	92.4	76.7	126.2	113.1
General government (market value)	100.1	105.2	221	104.3	37.2	77.8	46.4	33.5							35.1
General government (nominal value)	97.3	89.4	211.6	90.8	33.5	70.9	43.4	34.5	44.4	68.4	72.8	16.9	35.8	52.5	32.9

U.S.: United States; UK: United Kingdom; JP: Japan; EZ: eurozone; AU: Australia; CA: Canada; SE: Sweden; CH: Switzerland; CN: China; IN: India; BR: Brazil; RU: Russia; MX: Mexico; ZA: South Africa; TR: Turkey.

… current levels of indebtedness in many EM balance sheet sectors have risen well above long-term averages

EXHIBIT 6B: CURRENT DEBT LEVEL VS. 10-YEAR AVERAGE, BY Z-SCORE

LEVELS (10-year Z-score)	U.S.	UK	JP	EZ	AU	CA	SE	CH	CN	IN	BR	RU	MX	ZA	TR
Private non-fin (all sectors)	-0.8	-1.6	-0.7	0.2	2.5	1.9	0.8	1.2	2.0	0.9	1.6	2.3	2.3	0.5	1.7
Private non-fin (banks)	-0.1	-1.5	1.4	-1.6	1.9	1.5	0.8	1.6	2.1	1.1	1.3	2.1	1.8	-0.3	1.7
Non-fin corp	1.1	-1.7	-0.7	0.6	1.4	2.3	0.6	0.7			1.7	2.6	2.5		1.9
Households	-1.4	-1.2	-0.3	-0.8	2.4	1.3	1.2	1.7			1.5	1.3	1.8		1.0
Non-fin sector	0.8	0.5	1.3	1.0	2.3	1.7	1.0	1.3	2.0	0.9	2.4	2.4	2.1	2.5	1.6
General government (market value)	0.9	1.2	1.4	1.3	1.6	1.1	1.3	-0.7							-1.4
General government (nominal value)	1.1	1.1	1.3	1.0	1.7	1.1	1.3	-0.5	2.3	-0.4	3.2	2.3	1.8	1.9	-1.4

Source: Bank for International Settlements, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016. Non-financial sector is the sum of non-financial corporates, household and general government (market value).

Growth in global debt today seems relatively well contained …

EXHIBIT 7A: THREE-YEAR GROWTH RATE OF DEBT-TO-GDP, BY BALANCE SHEET SECTOR, IN KEY DEVELOPED AND EMERGING ECONOMIES

3-year rolling (% GDP)	U.S.	UK	JP	EZ	AU	CA	SE	CH	CN	IN	BR	RU	MX	ZA	TR
Private non-fin (all sectors)	1.0	-6.2	-1.3	-0.9	10.6	9.2	2.9	1.2	19.9	-0.4	11.2	30.2	18.8	5.3	18.6
Private non-fin (banks)	5.7	-5.4	1.0	-5.3	10.2	5.8	-0.1	3.3	16.1	1.1	6.4	25.2	10.1	2.6	21.7
Non-fin corp	5.6	-11.0	-2.0	0.8	11.4	13.4	2.6	-2.5	19.4	-2.3	10.8	39.1	26.9	18.3	29.4
Households	-2.9	-1.7	-0.3	-3.5	10.1	4.7	3.4	3.9	22.0	11.8	11.9	6.2	7.6	-5.0	-3.4
Non-fin sector	0.9	-0.5	2.2	1.5	12.6	7.9	4.5	1.0	18.9	1.7	15.6	30.4	18.7	9.5	9.4
General government (market value)	0.6	9.8	5.1	5.5	25.7	4.5	13.0	-0.4							-6.2
General government (nominal value)	1.7	4.1	3.0	0.4	25.3	2.5	11.8	0.1	14.4	3.4	20.5	31.5	18.5	16.0	-8.9

… and compares favorably with the historical pattern

EXHIBIT 7B: CURRENT THREE-YEAR AVERAGE GROWTH RATE IN DEBT VS. 10-YEAR AVERAGE, Z-SCORE

3-year rolling (all history Z-score)	U.S.	UK	JP	EZ	AU	CA	SE	CH	CN	IN	BR	RU	MX	ZA	TR
Private non-fin (all sectors)	-0.6	-1.2	-0.5	-1.3	0.7	1.0	-0.1	-0.4	1.1	-0.8	0.1	0.3	0.3	0.4	0.1
Private non-fin (banks)	0.4	-1.2	-0.2	-1.4	0.1	-0.3	-0.4	0.0	1.1	-0.6	-0.3	0.2	0.1	0.1	0.2
Non-fin corp	0.4	-1.4	-0.3	-0.5	0.5	1.4	-0.5	-0.8	0.5	-1.4	0.2	1.6	1.6	1.4	0.8
Households	-1.1	-0.8	-0.8	-1.6	0.3	-0.1	-0.1	0.2	-0.5	1.8	-0.2	-1.0	0.2	-0.2	-0.4
Non-fin sector	-0.4	-1.1	-0.2	-1.1	2.0	0.9	-0.2	0.0	0.8	-0.4	1.2	1.5	1.0	1.3	0.6
General government (market value)	-0.1	-0.4	-0.8	-0.1	0.4	0.2	1.4	0.4							0.6
General government (nominal value)	0.0	-0.7	-1.1	-0.8	0.4	0.1	1.4	0.5	0.2	0.2	1.5	1.2	0.7	1.1	0.4

Source: Bank for International Settlements, J.P. Morgan Asset Management Multi-Asset Solutions; data as of August 5, 2016. Non-financial sector is the sum of non-financial corporates, household and general government (market value).

HISTORICALLY HIGH LEVERAGE — HISTORICALLY LOW LEVERAGE

China, where the level of corporate leverage is commonly cited as a vulnerability, presents a unique case. Much of its corporate leverage has built up in state-owned enterprises (SOEs) and so may, in some circumstances, be thought of as quasi-sovereign debt. Even if it is not viewed as quasi-sovereign, there are arguably fewer obstacles to impede the transfer of SOE debt onto the government balance sheet than would likely be the case for private non-financial corporate debt.

In general, the developed markets score well on their growth in leverage over the last few years, but once again, those most exposed to EM economies and the commodity supercycle—Australia, Canada and Sweden—have the most elevated vulnerabilities. Even there, the growth in leverage is not greatly above the long-run trend. However, if GDP growth is now structurally slower, this measure of leverage will deteriorate in the next few years, potentially constituting a barrier to growth in the years to come.

CONCLUSION: IMPLICATIONS OF EXCESS DEBT AND THE PLAYBOOK FOR DELEVERAGING IN DEVELOPED AND EMERGING ECONOMIES

What do we see as the next phase of the global credit cycle? In our view, developed and emerging economies will follow markedly different trajectories. Developed economies have the capacity to maintain the status quo of elevated debt levels—provided interest rates remain depressed. More important, they have few appealing alternatives. Their efforts to inflate away the debt have largely failed; allowing CPI to drift a few tenths of a percentage point above targets will not be sufficient to meaningfully shrink government debt in real terms in the near future. With popular tolerance for austerity at its limits, we also do not see enough room for reducing government debt levels through further fiscal tightening. We therefore see the most likely course for developed economies in the next few years as acceptance—effectively learning to live with the consequences of persistently higher debt levels.

Eventually, making changes to tax systems, extending debt maturities or swapping debt for more equity-like structures may be plausible endgames, yet we see little appetite today from borrowers or savers for such steps. Instead, we believe debt's drag on growth will persist and along with it, downward pressure on interest rates. It will likely take a future economic contraction for governments to find it politically feasible to take the necessary steps to bring down the stock of debt.

Emerging economies have rather more latitude to follow a more traditional deleveraging path. Where acute issues exist—notably, in China's non-financial corporate sector—policymakers, by and large, have the luxury of an unstressed government balance sheet that could be tapped to provide relief. We think it is possible that in the coming years a sizable share of China's corporate debt could be nationalized, particularly debt associated with China's SOEs. However, for this transition to proceed smoothly, greater transparency and development of the domestic banking system will be essential. In other emerging economies, the ability to stoke inflation is arguably greater than in developed economies, giving policymakers a tool to reduce their debt stock in real terms. In particular, the lack of hard currency debt presents EM policymakers with the possibility of using the foreign exchange channel to tackle excess debt. In general, we see excess EM debt as a likely drag on growth rather than an accident waiting to happen.

In our view, we are not on the precipice of another global credit crisis. Despite dire warnings to the contrary, we believe that—for the most part—DM policymakers have sufficiently inoculated their banking systems and households by allowing government balance sheets to take the strain. Meanwhile, emerging markets, notwithstanding the growth in their leverage, still have a broadly manageable aggregate level of debt. Where there are pockets of vulnerability in developed and emerging economies, they are largely isolated from the wider global financial system or are of sufficiently limited scale to render them a domestic rather than a global issue.

The buildup in debt levels across the system is the mirror image of the creation of a global savings glut—which, with aging populations and increasing regulation, is unlikely to disappear quickly. In plotting the trajectory of the credit cycle, it is crucial that we simultaneously consider that of the savings glut. While post-GFC policy intervention may have removed the most toxic elements of the credit overhang, we still face a drag on growth from excess capital—debt or savings, depending on which side of the ledger you sit—that is only servicing prior investment and consumption and not being put to work to fund new growth. In asset terms, this points to lower interest rates, flatter yield curves and reduced returns for riskier assets. Leverage probably won't cause the next economic contraction, but it may take the next economic contraction to push policymakers into more direct efforts to reduce the stock of debt.

Legacy effects of monetary easing: Stimulus or "seeping poison"?

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IN BRIEF

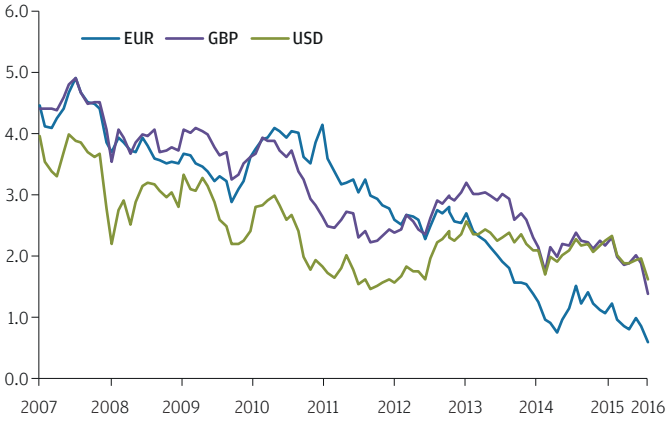
- The adoption of quantitative easing (QE) by the world's central banks, in some cases reinforced by zero and negative interest rate policies, has brought relief to distressed borrowers and short-term gains to investors. The persistence of these policy rates in the eurozone, Japan and perhaps the UK appears rather more problematic.
- A chronic reliance on unorthodox policies may threaten the viability of investment guarantees and distort the incentives of market practitioners.
- Prudential solvency measures, such as Solvency II, give a special status in liability valuation to the risk-free bonds that the central banks are purchasing. This puts monetary policy and long-term savings vehicles on a collision course.
- The conservative response to this conundrum has been closure to new business and matching legacy liabilities. More adventurous responses have fostered unfamiliar risk-taking and have distorted the composition of capital markets. Both responses inflict sustained damage on the savings culture and the investment opportunity set.

AN UNPRECEDENTED STARTING POINT

We start by acknowledging the remorseless decline in bond yields over the past 30 years, with particular focus on the period since the global financial crisis (GFC). This yield decline has caused the average euro-denominated bond to trade at more than a 20% premium to its face value. While capital gains of this magnitude gladden the hearts of all investors, the flip side of the coin is that future returns and expected reinvestment rates have correspondingly declined—so institutions with long-term liabilities now find themselves chasing ever-less attainable targets. Moreover, as yields have moved lower (**Exhibit 1**) and central banks have reduced the free float of bonds, yield-hungry investors have been obliged to move further along the duration and credit spectrum into higher risk instruments.

Bond yields have moved consistently lower

EXHIBIT 1: GOVERNMENT BOND YIELDS (%)



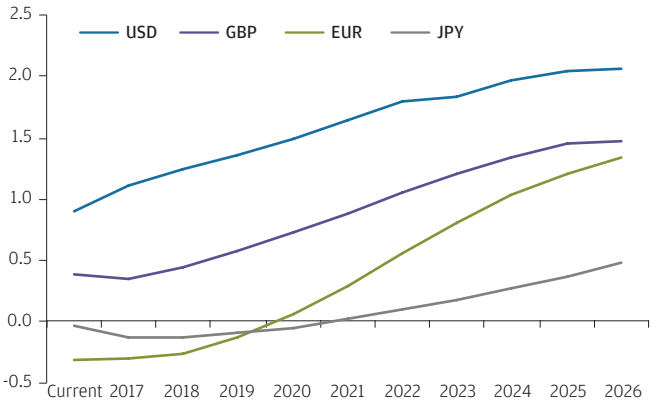
Source: Barclays Capital Government Bond Index; data as of June 30, 2016.

In mid-2014, the European Central Bank (ECB) adopted a negative deposit rate policy to reinforce a low yield regime for fixed income assets. ECB president Mario Draghi explained that negative rates were required to combat expectations of sub-target inflation and growth in a region exposed to deficient demand, global overcapacity and aging workforces. This risk is accentuated within the eurozone since participants are governed by a fiscal compact treaty that limits structural fiscal deficits to just 0.5% of GDP and hence prohibits aggressive countercyclical spending in areas such as infrastructure.

A key question for European authorities is how to catalyze a prompt boost to nominal GDP expectations so that businesses, consumers and investors regain their "animal spirits" in a sustainable manner. As **Exhibit 2** indicates, the markets are expecting that negative short-term rates will persist in the eurozone for a few more years before reversing back into modestly positive territory.

Markets are pricing in several more NIRP years for the eurozone

EXHIBIT 2: THREE-MONTH LIBOR RATE PATHS, AS IMPLIED BY FORWARD SWAP RATES (%)



Source: Bloomberg; data as of September 30, 2016.

If we interpret these market-implied rates as forecasts of future short-term rates, then investors appear to have lost confidence in a return to the yield levels that prevailed prior to the global financial crisis. A more positive interpretation is that current market levels are simply artificial, distorted downward by temporary central bank action across the whole curve.

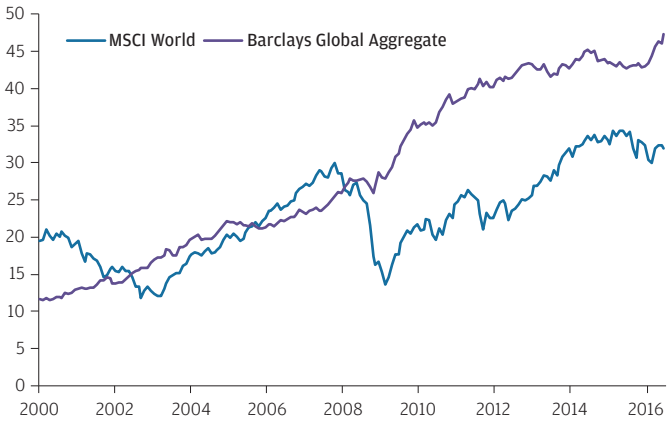
INVESTORS ARE MORE RELIANT ON BONDS THAN EVER BEFORE

Global investors are now more exposed to fixed income assets than ever before. Since January 2000, the composition of global capital markets has moved from 63% equity/37% fixed income to 40% equity/60% fixed income, on a market capitalization basis (**Exhibit 3**).

This reallocation has arisen because of the heavy new issuance of bonds (equivalent to 8.2% annualized growth in the notional amount outstanding each year). This de-risking of the global opportunity set has occurred despite the re-rating of equities after the financial crisis. It reflects the reduced risk appetite of pension funds and insurers—and the appointment of more cautious CEOs—in the aftermath of the early 2000s tech bust.

Goodbye to 60/40: The investment opportunity set has become bond-heavy

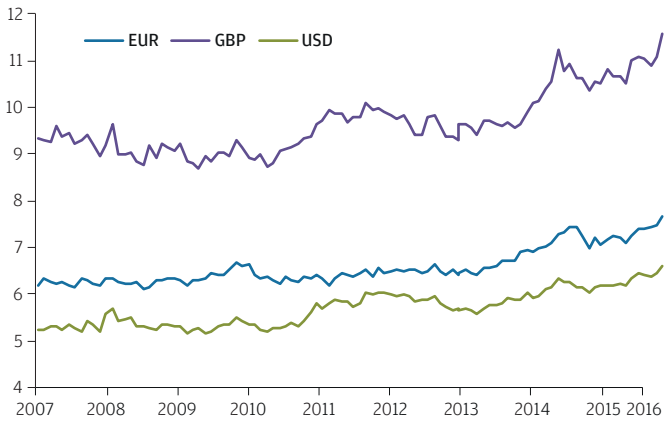
EXHIBIT 3: MARKET CAPITALIZATION (USD TRILLION)



Source: Barclays Global Aggregate, MSCI; data as of June 30, 2016.

Governments have locked into lower rates and extended bond duration

EXHIBIT 4: GOVERNMENT BOND INDEX DURATION (YEARS)



Source: Barclays Capital; data as of June 30, 2016.

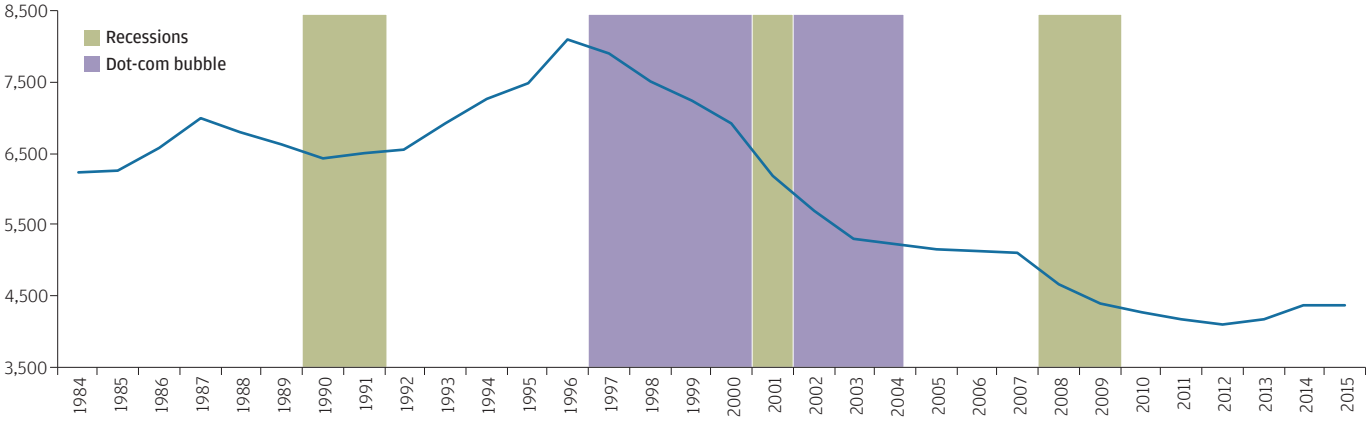
THE IMPACT OF NIRP WILL PERSIST

Negative interest and zero interest rate policies (respectively, NIRP and ZIRP) have had a profound impact on the structure of capital markets and the available opportunity sets for investment. Low rates have forced investors in search of yield to seek longer-duration bonds and lower-rated credits. Issuers have responded to this demand by locking in term finance at ultra-low levels (**Exhibit 4**) (e.g., Ireland and Mexico have issued 100-year bonds with yields of 2.35% and 4.3%, respectively). The structural lengthening of duration, and the associated volatility increase, may outlive the negative rate policy by several decades. This change may prove more disruptive to fixed income markets than previous tightening cycles, due to the increased proportion of "bond tourists" that have ventured into unfamiliar long-term investments.

The low yield environment has also encouraged corporate financial officers to bolster earnings per share by taking on increasing amounts of debt to finance share buybacks rather than productive investment, a practice that is partly reflected in the steady decline in the number of publicly quoted companies but does nothing for productivity growth. Low yields have also supported mergers and acquisitions, contributing to a 45% decrease in the number of U.S.-listed companies since the 1990s (**Exhibit 5**). Indeed, M&A, particularly since 2008, has moved away from investing in new capacity and toward increasing market share and reducing competition, as evidenced by the weighted average revenue share of the top four firms across sectors in the U.S., which grew from 26% in 1997 to 32% in 2012.

The number of publicly traded stocks has been declining for two decades in the U.S.

EXHIBIT 5: NUMBER OF U.S.-LISTED COMPANIES



Source: *The Economist*, U.S. Census Bureau; data as of June 30, 2016.

We believe that the more entrenched these market distortions become, the more widespread holdings of expensive securities will be. Our central case for interest rates assumes that a gradual normalization for the U.S. is underway, while that for the eurozone will commence in 2019. If we are correct and financial gravity reasserts itself, what has risen in price terms will return to earth with a sharp bump.

MANAGED STIMULUS CAN BE POISONOUS IN LARGE DOSES—ESPECIALLY IN EUROPE AND JAPAN

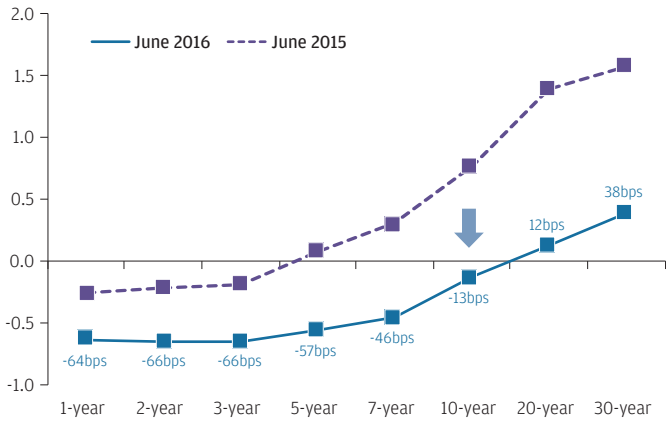
The U.S. LTCMA forecast for the past several years has been consistent with a slow and steady recovery in short rates toward a terminal level that is lower than historical norms. After a full economic recovery from the GFC of 2008-09, our outlook consigns ZIRP to American history after having served to support economic demand and borrower creditworthiness during a deleveraging period, via a temporary redistribution from savers to borrowers. Consequently, pension liability matching should become more affordable and insurance and banking business models will find some room to breathe. The outcome represents a positive example of intervention and timely exit, which should protect the financial system.

The benign U.S. outlook appears to contrast starkly with the intensifying financial repression imposed on European and Japanese investors through negative rate policies. In those two economies, quantitative easing may have initially appeared to be pain-free, since new borrowers enjoyed lower rates and investors enjoyed capital gains on their existing holdings. Over time, however, the cost of the policy has become more apparent to investors as their required future investment returns have become unattainable. ECB deposit rates have gradually sunk to negative levels to underline the central bank's commitment to restoring inflation. QE has then communicated these rates into the longer-duration bond market, as can be seen from **Exhibit 6**.

The orthodox approach to managing interest rate risk is to lengthen the duration of a portfolio's fixed income assets to mirror that of its liabilities. This eliminates exposure to reinvestment risk but locks into the currently available yield structure. At today's yields, this is not an attractive solution for underfunded institutions, but rather represents strategic surrender. According to Frank Grund, head of insurance and pension fund supervision at the German regulator BaFin, low interest rates have become a "seeping poison." Wolfgang Schäuble, the German finance minister, has even suggested that ECB policies are bolstering right-wing protest parties by appearing to favor Southern European borrowers to the detriment of German savers and their security.

Negative rates (and QE) drag down the whole curve

EXHIBIT 6: GERMAN BUND YIELD CURVE (%, ANNUALIZED)



Source: Bloomberg; data as of June 30, 2016.

THE REGULATORY BOA CONSTRICTOR: TENSIONS BETWEEN MONETARY POLICY AND REGULATION

Long-term savings institutions are under severe pressure. The conflict of objectives between central banks and insurance and pension regulators is undermining the feasibility of long-term guaranteed savings products. Central banks are encouraging investors to take greater risk by raising the prices of risk-free bonds, while regulators are focusing on market-based solvency testing using these same bonds.

a) Impact on defined benefit pension funds

Pension funds are vehicles designed to generate future retirement income at an acceptable current cost. Defined benefit plans are required to conduct liability valuation exercises to estimate the degree of confidence that they will meet their benefit promises with available resources under prevailing return expectations. As yields decline, the present value of fixed benefits climbs, funding levels fall, and regulators call for higher recovery contributions (**Exhibit 7**).

Pension funding under pressure

EXHIBIT 7: FUNDED STATUS (%), AS MEASURED BY NATIONAL ACCOUNTING STANDARDS

Country	Measure	June 30, 2016	1 year earlier	5 years earlier
UK	PPF*	78	85	98
Netherlands	nFTK**	98	109	111
U.S.	U.S. GAAP†	78	84	78

* Source: Pension Protection Fund. Measures solvency based on benefits insurable with central discontinuance fund.

** Source: DnB, J.P. Morgan Asset Management. Aggregate funding ratio is based on market information, before averaging over time.

† Represents GAAP funding levels at fiscal year 2011 (generally ended December 31). As a point of reference, refer to Milliman's corporate funding tracker: http://us.milliman.com/PFI/.

Defined benefit plans face increasing pressure to de-risk by purchasing expensive bonds in order to match their liabilities and secure existing promises. Once a plan has de-risked, however, it may lock in low investment returns and crystallize deficits. It becomes increasingly difficult to erase these deficits and rebuild surpluses that would be required to support a later re-risking program. The plan gradually loses its freedom to maneuver and must move into a "run-off" mode.

Dutch pension plans are acutely aware of this challenge since they need to balance the security of their current solvency position against the prospective returns that younger members may anticipate. Jean Frijns, former chief investment officer of the Netherlands' public pension system ABP, has warned that this tension may be irreconcilable and that the Dutch collective system must move toward an unguaranteed defined contribution (DC) system.

U.S. regulation, by contrast, is not pure mark-to-market—it kicks the can down the road by heavily smoothing discount rates. This offers more room for maneuver in the short term, and smoothing means that pension plans can see the pain coming from a long way off.

Considering their predicament globally, we believe defined benefit plans should be able to navigate a few more years of ultra-low rates. Their strategy is likely to entail keeping asset duration fairly short (in order to benefit from higher rates in the future and avoid heavy capital losses on long-duration bonds), while taking on additional credit and active risks to replace their return shortfall. Inevitably, however, there will be casualties whenever this strategy is overtaken by events, such as the high profile failures of British Steel and BHS in the UK, where guarantees are most onerous.

b) Impact on defined contribution pensions

Defined contribution plans do not articulate a target benefit level—and hence cannot become underfunded. Plan participants have the same needs for long-term replacement income, but they can be more flexible in how they seek to achieve this. Participants in the drawdown phase of their investment cycle can move into a broader selection of income-rich strategies across the fixed income, equity and alternatives spectrum.

From a system-wide perspective, this relieves current pressure on the bond market because there is reduced demand for liability matching. Thus the move to DC may be seen partly as an escape from mark-to-market regulation within a QE world. Yet for DC plan participants, a timely and orderly withdrawal from extreme monetary measures will be no less vital in order to nurture and protect a savings culture and to prevent an overlarge reaction when the return boost from quantitative easing dissipates as QE measures are unwound.

c) Insurers and the Solvency II challenge

The transition to full Solvency II capital standards for long-term insurers is bringing the tensions between regulation and monetary policy into sharp relief. The impact of the low yield environment is most significant for continental European life insurers with large books of legacy savings policies that typically offer guaranteed investment rates of return of 3% to 4% per annum. As yields have fallen, many life insurers have experienced deteriorating solvency margins, with significant asset-liability duration gaps resulting from assets held at much shorter durations than liabilities.

To mitigate the impact of low yields, these insurers are augmenting their investment universe to include a larger opportunity set. However, with their balance sheets under pressure, many do not have sufficient surplus capital to support the risk and capital budgets necessary to pursue investment opportunities that could meet legacy policyholder guarantee rates. Transitional measures under Solvency II have softened the immediate blow, but the clock is running, and it is looking increasingly likely that NIRP and ZIRP could outlast the transition.

By contrast, there is no mark-to-market solvency regime in the U.S., so most life insurers there are feeling the impact of falling rates more gradually as new money book yields fall to between 3% and 3.5%. However, if the yield decline is sustained, meeting minimum guarantees and long-term care obligations could become problematic just at the point where new business terms appear less attractive to customers.

CONCLUSIONS

The U.S. appears to be gradually moving toward rate normalization, which will offer pension plans greater freedom to meet their obligations. A progressive exit from extraordinary policies should leave the nation's investing institutions broadly intact. The eurozone may ultimately follow this path, but only after an extended period of zero and negative policy rates. NIRP may not be sufficiently dramatic to reverse a low-growth mindset, but it will act to re-price the universe of low risk bonds.

European life insurance companies and pension plans will be subject to extreme stress without recourse to simple solutions. Some will restructure their benefit offerings toward lower guarantees, while others will have sufficient surpluses to hibernate during an extended winter. A greater use of credit and alternative investment strategies should enhance their strength until the rate cycle turns.

While we expect normalization in economic conditions over the next 10 to 15 years, capital markets are likely to bear the imprint of NIRP and ZIRP policies. As ever, financial markets will respond to client needs, and the broadening and deepening of the European corporate bond market will offer a glimmer of hope to besieged investors, which is particularly important as the Capital Markets Union project gets underway. The project should encourage the long-term savings culture necessary to supplement guaranteed and insurance-based products.

In sum, the global financial crisis is now a piece of history that we hope will not be repeated, but we may be feeling its aftershocks for some time to come.

We would like to thank Rupert Brindley for his contributions to this article.

Estimating long-term returns: The impact of time horizon and business cycles

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Patrik Schöwitz, CFA, *Global Strategist, Multi-Asset Solutions*

IN BRIEF

- Our Long-Term Capital Market Assumptions (LTCMAs) use a 10- to 15-year horizon in estimating returns and risks across major asset classes. We view this time frame as effective in providing the stable, consistent input required—by our clients and our own Solutions teams—in making portfolio construction and asset allocation decisions. Our research supports this view and shows that our process is robust.
- Time frame (horizon): A long-term horizon (10 to 15 years) can provide the smoothed, stable compound annual returns required for strategic asset allocation decisions. The shorter the investment horizon, the more volatile are the average historical returns and the wider the range of likely outcomes around return forecasts.
- Business cycles: The shorter the time frame, the greater the impact of business cycles on returns. Historically, compound annual returns over a 10- to 15-year time frame show much reduced sensitivity to the stage of the cycle at the beginning or at the end of the period.
- Sharp market moves: Our research finds little evidence of a significant, **predictable** response in market returns following a sizable market increase or decrease. The implication: A **systematic** adjustment to our assumptions following sharp market moves, even if these occur close to the start of our projections, is unlikely to be warranted.

Our Long-Term Capital Market Assumptions are designed to be a foundational input to portfolio construction and strategic allocation decisions. Institutional and individual clients and our own Global Investment Management Solutions teams rely on these assumptions in structuring policy portfolios and client investment solutions—processes that call for long-term risk and return assumptions that are relatively stable over time and internally consistent across asset classes. In projecting asset class returns, we use long-term, cycle-neutral economic assumptions and take current starting levels for asset market valuations (such as price/earnings ratios or spread and yield levels) relative to neutral positions (forward-looking long-run equilibrium levels) into account. These projections can themselves be adjusted as necessary for any expected structural changes. The time frame for our assumptions is 10 to 15 years. Over this extended period, we expect more stable return outcomes as some of the inevitably unique features of business cycles are partially smoothed out. Using a time frame of this length should make the results more suitable for determining strategic portfolio allocations. It also allows us to form more meaningful views on illiquid asset classes in the alternatives space by capturing longer-term dynamics, such as manager alpha cycles, commodity cycles, etc.

Many investors have inquired about the sensitivity of our LTCMAs to (1) the length of the assumption time frame; (2) the phase of the business cycle in which the assumption period begins and ends; and (3) the occurrence of sharp market movements. In this article, we re-examine these aspects of the LTCMA process, validating our approach.

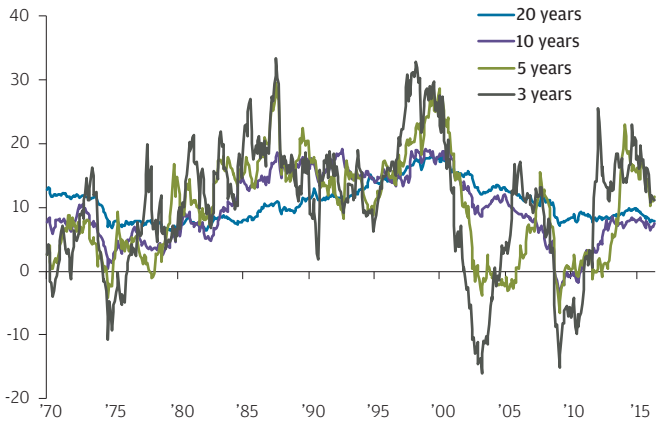
TIME HORIZON MATTERS—A LOT

We first look at how much the choice of time frame matters for the variability or stability of returns. To state the conclusion up front: time horizon matters a lot—and it matters more for volatile asset classes (such as equities) than for relatively stable assets (such as bonds). Historical compound annual returns calculated over shorter time intervals (for example, five vs. 10 or 20 years) are more volatile. Similarly, shorter horizon forecasts have a wider confidence interval—that is, a much wider range of likely outcomes, making them poorly suited as anchors for long-term strategic portfolio planning.

Exhibit 1 shows compound annual total returns for U.S. large cap equities over rolling three-, five-, 10- and 20-year periods since 1970. Over a relatively short three-year horizon, compound annual equity returns range from +33% to -16%, a nearly 50 percentage point (ppt) span. Even over the often-used five-year horizon, the range is still quite wide (between +29% and -6%) and, like the three-year horizon results, includes several (though fewer and less pronounced) negative outcomes. This means that any strategic asset allocation process using assumptions with a five-year horizon would need to be able to deal with the possibility of negative return estimates for major asset classes. This would probably require embedding a very specific view about business cycles—a topic we examine below. It is worth noting that these time horizon-related issues are likely to matter even more for international markets than for the relatively low-volatility U.S. equity market.

Longer-term return horizons are more appropriate for estimating the stable returns needed to guide strategic asset allocation decisions

EXHIBIT 1: U.S. LARGE CAP EQUITY TOTAL RETURNS (% CAGR)



Source: Bloomberg, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data from January 31, 1950, through May 31, 2016.

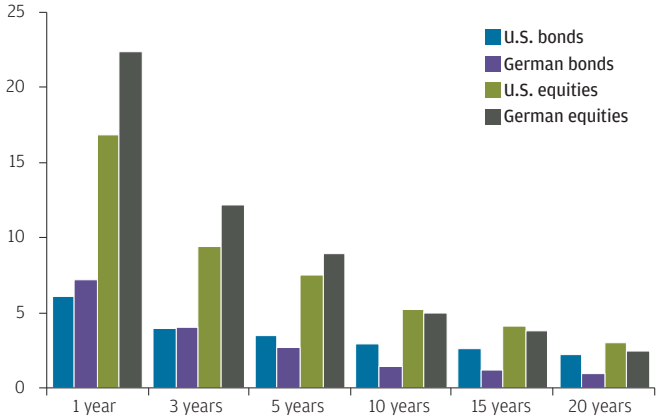
Another way to look at this volatility issue is to compare standard deviations of rolling one-year through 20-year annual total returns. The comparison is illustrated in **Exhibit 2** for U.S. and German equities and bonds. As would be expected, standard deviations of returns are higher for equities than for bonds, but for both asset classes they fall monotonically as time horizons lengthen, with declines in return variability gradually leveling off. As noted above, this effect is much more dramatic for the more volatile equity asset class than for bonds.

To put these volatility numbers into context, compound annual total returns for comparable time periods were 11.2% for U.S. large cap equities, 6.1% for German large cap equities, 6.0% for U.S. bonds and 6.7% for German bonds.[1]

[1] The following time frames and sources apply here and to the data appearing in Exhibit 1 through Exhibit 6 of this report. For January 31, 1950, to May 31, 2016, U.S. equities are represented by U.S. large cap returns from Ibbotson SBBI (Stocks, Bonds, Bills and Inflation) Valuation Yearbook and Standard & Poor's; U.S. bonds are represented by long-term bond returns from Ibbotson and Barclays, and German bonds are represented by returns for Credit Suisse Long-Term Bond Index for Germany. For January 31, 1965, to May 31, 2016, German equities are represented by returns for the Deutsche Börse AG German Stock Index (DAX).

Volatility is greater for equities vs. bonds and shorter vs. longer time horizons, and for German vs. U.S. equities (over shorter horizons)

EXHIBIT 2: STANDARD DEVIATION OF ROLLING ANNUAL TOTAL RETURNS FOR U.S. AND GERMAN BONDS AND EQUITIES



Source: Barclays, Bloomberg, Credit Suisse, Datastream, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data from January 31, 1950, to May 31, 2016, for U.S. equities, U.S. bonds and German bonds, and from January 31, 1965, to May 31, 2016, for German equities.

THE BUSINESS CYCLE MATTERS—MOSTLY FOR SHORTER-TERM HORIZON RETURNS

Another question that flows from our discussion is how horizon length and the stage of the business cycle at the beginning or end of the return period are likely to affect return estimates. We would expect the cyclical stage at the beginning or ending points to have a greater impact on return estimates the shorter the time frame. We would also anticipate, especially in the case of shorter horizons, that the impact on returns would vary with the cyclical stage (early, middle, late, recession) prevailing at either end of the horizon. Our analysis supports both of these points.

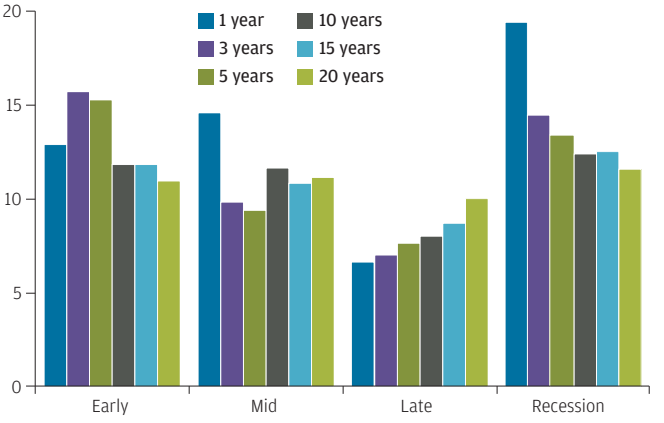
Finally, we address the question of whether it matters more to get the starting or the ending point right if one did attempt to time the business cycle. For example, it is frequently suggested that the most important timing error to avoid is selling risk assets in a recession. Our analysis bears this point out as well, at least over short time horizons.

Business cycle impact at the start of return periods

We examine these effects by first breaking down the period from 1950-2016 into stages of the business cycle, then filtering historical asset class returns by the length of the horizon and the phase of the business cycle at the start of the horizon period—and, finally, computing an average annual return for each grouping.[2] For example, the average compound annual return for U.S. equities over one-year time frames that began in a recession is roughly 19% vs. 13% over 15-year horizons that began in a recession (**Exhibit 3**).[3]

Returns are generally best for periods starting in a recession and worst for periods starting in the late stage of a business cycle, with the spread most pronounced over shorter horizons

EXHIBIT 3: U.S. LARGE CAP EQUITY AVERAGE RETURNS BY BUSINESS CYCLE STARTING POINT (% CAGR)



Source: Bloomberg, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data as of May 31, 2016.

The results for U.S. large cap equities largely confirm our expectations. When filtering for starting points, in general the strongest forward returns for equities occur for periods beginning in a recession. These periods would, on average, be close to equity market bottoms. At the other extreme, the worst returns are for periods starting in a late-cycle stage—periods generally close to equity market tops. Returns for early- and mid-cycle starting points fall in between, with returns for early-cycle starting points appearing to be the stronger of the two.

[2] We focus on the U.S. business cycle and U.S. asset classes, but results look similar for the other regions that we have examined (UK, Germany). We use data from the Multi-Asset Solutions strategy team's business cycle indicator framework to classify historical business cycle phases.

[3] As we are using different time horizons in the analysis, we are not comparing entirely consistent time periods in our exhibits. In essence, there are many more one-year or three-year time periods in our data set than there are 20-year periods. There is a choice to be made between using "equalized time periods" (which would throw away 20 years of returns data) or using the maximum amount of historical data. We have run the analysis both ways and, finding no significant difference in conclusions, have chosen to focus here on the results that include the maximum amount of historical data.

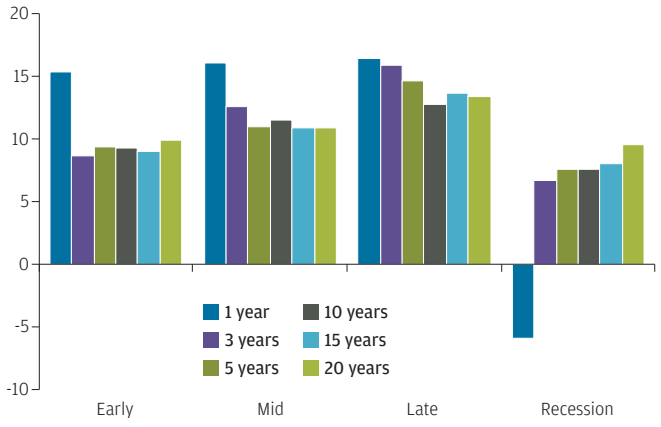
What is most relevant for our discussion is the spread between return outcomes from investing at the "best" vs. "worst" possible entry points, and how this spread varies with the length of the time horizon. U.S. large cap equity returns over a one-year horizon have averaged 7% when starting in late cycle and 19% when starting in a recession—a 12ppt spread. This spread diminishes as the time horizon lengthens: Over a 15-year horizon, comparable to the time frame of our LTCMA process, it declines to just 4ppts (the difference between a 9% average return for periods starting in late cycle and a 13% average return for periods starting in recessions)—supporting our choice of a relatively long time horizon to minimize cyclical impact. Admittedly, this spread falls to just 2ppts over an even longer, 20-year horizon, but much of the benefit in terms of stability of returns is captured using 10- to 15-year horizons.

Business cycle impact at the end of return periods

Repeating the above analysis, but filtering end points by the stage of the business cycle, confirms more of our initial intuition. Filtering this way, periods ending in late cycle (when markets are likely to be close to highs) show the strongest returns, while those ending in recessions (when markets are likely to be close to lows) show the weakest returns. Over short time horizons, the stage of the cycle in which the return period ends appears somewhat more important (for equities, at least) than the stage in which it starts. In particular, the average return for one-year time horizons ending in a recessionary period is the only one to show a negative average return (Exhibit 4).

Returns are generally best for periods ending in a late cycle and worst for periods ending in a recession, with the spread most pronounced over a one-year horizon

EXHIBIT 4: U.S. LARGE CAP EQUITY AVERAGE RETURNS BY BUSINESS CYCLE END POINT (% CAGR)



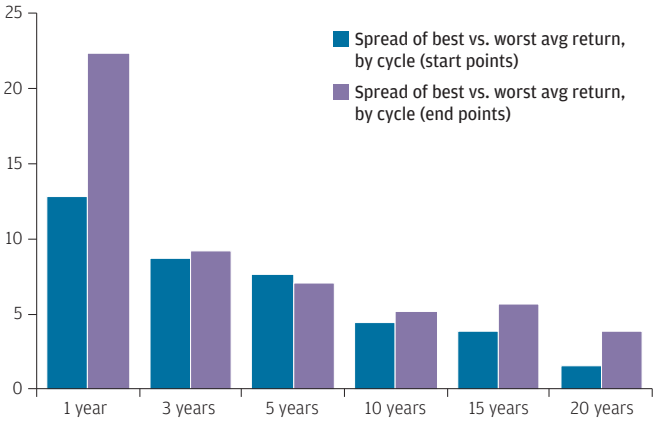
Source: Bloomberg, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data as of May 31, 2016.

Business cycle impact and length of return period

Exhibit 5 brings the relationship between the length of the time horizon and the impact of the stage of the business cycle at starting and ending points into sharper focus. The stage of the cycle (whether at the start or end of the interval) has a substantially lower impact on returns for longer time horizons; the spread narrows sharply after the one-year horizon and generally keeps narrowing as the horizon lengthens. Hence, we would anticipate little further gain in the stability of our capital market assumptions from using an even longer time frame.

For U.S. equity returns, the impact of the stage of the business cycle at the start or end point of a return horizon generally decreases with horizon length

EXHIBIT 5: U.S. LARGE CAP EQUITIES—SPREADS BETWEEN BEST AND WORST RETURN OUTCOMES ACROSS DIFFERENT STAGES OF THE BUSINESS CYCLE, BY LENGTH OF HORIZON (% PPT SPREAD)



Source: Bloomberg, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data as of May 31, 2016.

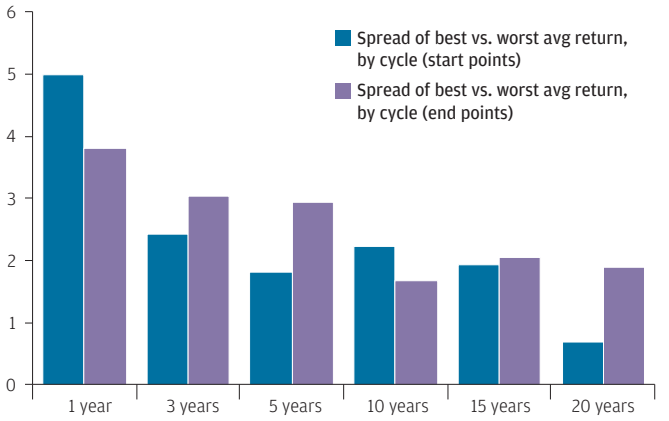
Business cycle impact on bond returns

Repeating the analysis for U.S. bonds reveals similar results but, of course, at a much reduced overall level of return variability (Exhibit 6). Again we can see that the beneficial impact from lengthening time horizons is somewhat less pronounced for bonds vs. equities. Additionally, the variability of outcomes generally does not narrow much further beyond a 10-year horizon.

Overall, these results support the choice of a fairly long time horizon for our LTCMA return estimates.

For U.S. bond returns, business cycle impact generally decreases with horizon length, but less dramatically than for U.S. equities

EXHIBIT 6: U.S. BONDS—SPREADS BETWEEN BEST AND WORST RETURN OUTCOMES ACROSS DIFFERENT STAGES OF THE BUSINESS CYCLE BY LENGTH OF HORIZON (% SPREAD)



Source: Bloomberg, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data as of May 31, 2016.

SHARP MARKET MOVES MATTER—SOMEWHAT AND UNPREDICTABLY

Although our process focuses on the long run, questions inevitably arise regarding its susceptibility to near-term market moves. For example, if the market experienced a sizable move near the beginning of our assumptions period, should this be viewed as a transient development or a consequential move calling for a standardized adjustment to our long-term estimates? We address this question by examining the tendency of markets to mean revert after a significant move and assess whether there is empirical support for systematic adjustments.

Our research focuses on the behavior of equity and bond returns in the U.S. and Germany[4] in the months following sizable short-term market movements and looks for evidence of mean reversion. In the presence of mean reversion, one might expect to see, for example, large market declines followed by significant market increases. If a well-defined, predictable pattern in returns is evident following sharp market moves, a systematic adjustment may be warranted. Our analysis finds little consistent and statistically significant evidence of mean reversion in returns across regions and asset classes, suggesting that no systematic adjustment to our long-term assumptions is likely to be needed, even following pronounced market moves.

[4] U.S. equities are represented by S&P 500 and Russell 2000, and U.S. bonds are represented by Citibank U.S. Government Bond Index. The time series are backfilled to 1926 by incorporating data from Ibbotson SBBI (Stocks, Bonds, Bills and Inflation) Valuation Yearbook. European equities and bond returns are proxied by DAX Index and Deutsche Börse REX Bond Indices, respectively.

The strongest case for a potential adjustment—the U.S. equity market

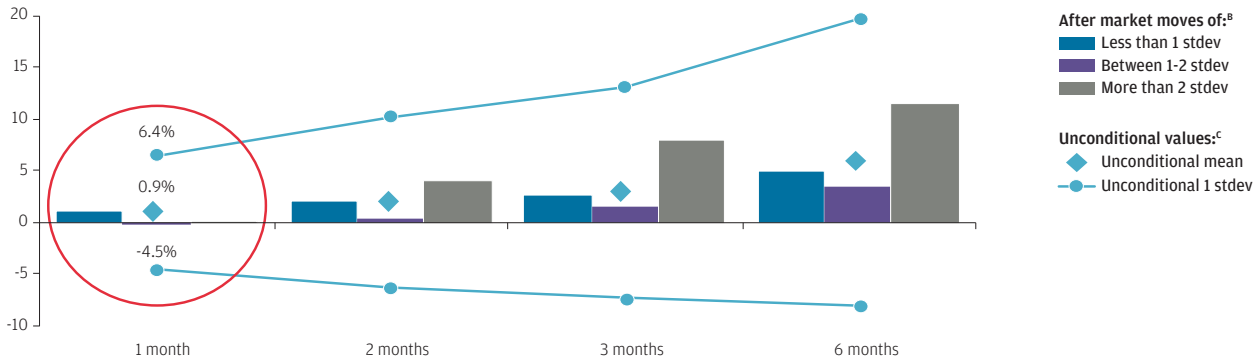
Our research takes the U.S. equity market as a starting point and analyzes the average one-month to six-month forward returns following negative (**Exhibit 7A**) and positive (**Exhibit 7B**) market moves of varying magnitudes.[5] To aid in assessing the significance of the difference in average returns following these market moves, the unconditional mean and standard deviation of returns are also shown.

For periods following a pronounced market sell-off, one might expect to see a "catch-up" effect—forward returns above their long-term average, with more pronounced increases after larger sell-offs. However, this pattern is not consistently visible. Exhibit 7A shows that historically after strong declines (1 to 2 standard deviations) forward returns are in fact below historical averages. An extreme negative move (more than 2 standard deviations) is needed for a small but notable increase in forward returns; even then, forward returns are not above their means by a statistically significant amount.

U.S. equities show little evidence of reversion after pronounced market moves

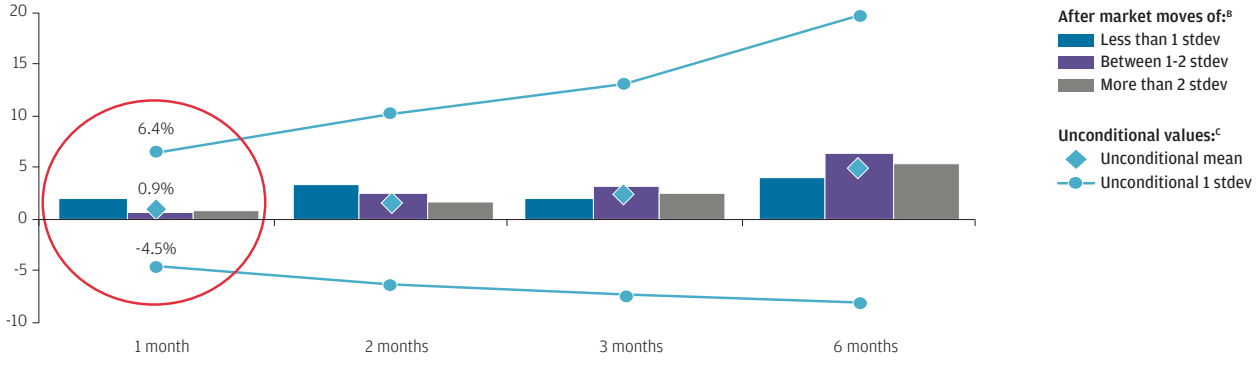
EXHIBITS 7A AND 7B: U.S. EQUITY RETURNS FOLLOWING MARKET MOVES OF VARYING MAGNITUDES

7A: RETURNS FOLLOWING NEGATIVE MARKET MOVES (%)[A]



*Example: Over the sample period, the average one-month U.S. equity return is **0.9%** and the standard deviation is 5.4%. Therefore, if returns for U.S. equities one month after market dislocations average at or above **6.4%** or below **-4.5%** (i.e., +/- 1 standard deviation from the unconditional mean), this could be considered a statistically significant response.*

7B: RETURNS FOLLOWING POSITIVE MARKET MOVES (%)[A]



Source: FTSE Russell, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data from January 1926 to June 2016.

[A] 1-, 2-, 3- and 6-month returns are not annualized.

[B] The magnitudes of market moves (stdevs) are based on historical 2-month returns.

[C] Unconditional means and standard deviations are calculated across the entire data set, from January 1, 1926, to June 30, 2016.

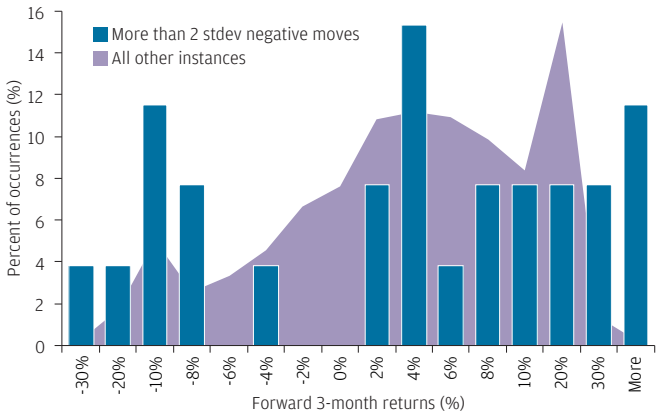
[5] Magnitudes are determined based on two-month returns and historical standard deviations. Results are similar when one-month and three-month returns are used in the analysis. We focus on two-month returns in the discussion, as market corrections may start and end intra-month such that one-month returns may not capture the full extent of the move.

While Exhibit 7A shows slightly higher forward returns after extreme negative market moves, **Exhibit 8** reveals the devil in the details. This histogram compares the distribution of returns following extreme negative market moves with the distribution of returns for all other market environments. The distribution after extreme negative moves has much heavier tails (both left and right). The probability of negative returns is around 30% for both distributions, but the chance of experiencing a large loss (or a large gain) is much higher for the months following extreme market declines.

The occurrence of these large magnitude gains/losses means that these extreme negative market sell-offs matter—but appropriate responses should be specific to the scenario. Rather than a systematic adjustment based on statistical analysis, the drivers of such market events should be individually explored and understood, as there are likely to be fundamental factors at play that might require a reassessment of many of the core assumptions underlying our long-term estimates.[6]

Extreme negative market moves are more likely to be followed by sizable gains or sizable losses

EXHIBIT 8: HISTOGRAM OF U.S. EQUITY FORWARD 3-MONTH RETURNS FOLLOWING EXTREME MARKET DECLINES*



Source: Bloomberg, FTSE Russell, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data as of June 30, 2016.

*An extreme market decline is defined as a move of more than 2 standard deviations in 2-month returns.

Turning to upward moves in the U.S. equity market to complete the analysis, there is little evidence of mean reversion. Forward returns are, on average, positive, frequently at or above their historical average, with no apparent structural difference by magnitude of the prior up move (Exhibit 7B). In summary, none of the forward returns of U.S. equities is significantly different from the corresponding unconditional historical averages, regardless of the direction or magnitude of the market move (Exhibits 7A and 7B).

Less convincing cases for a systematic adjustment—international equities and bonds

It is striking that the return pattern after extreme negative dislocations for U.S. equities is not observed in international equity markets. For example, the same analysis using European equity returns shows no such reversion after pronounced market moves (**Exhibits 9A** and **9B**).

A look at the bond market indicates that mean reversion is also not well observed across asset classes. Similar analyses of both U.S. and European bonds show even less discernable patterns than for equities. Overall, our research finds no evidence that forward returns for global equity or bond markets, including those in the U.S., are significantly different from their corresponding historical averages, regardless of the direction or magnitude of recent market moves.

LONG HORIZONS MAKE OUR FORECASTS MORE ROBUST

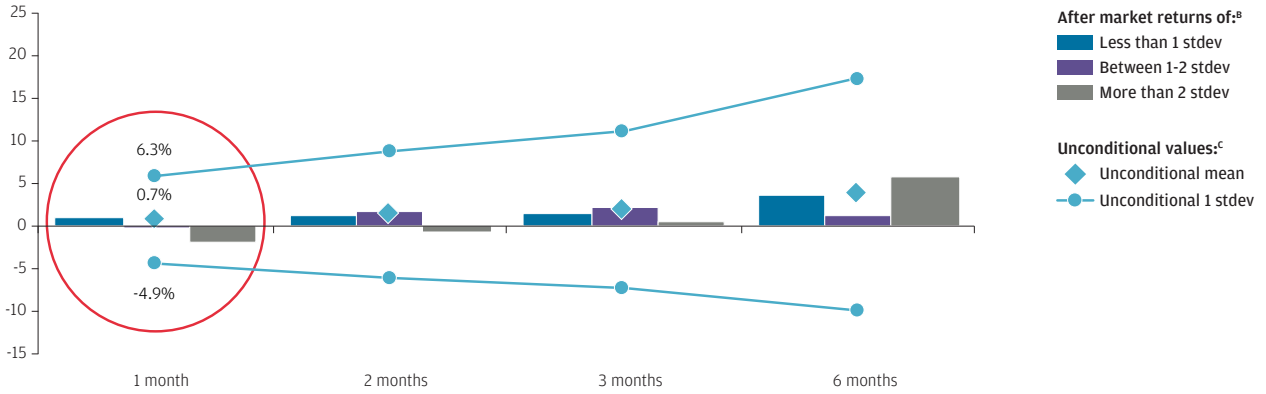
In conclusion, our research suggests that our process for generating long-term return assumptions over a 10- to 15-year horizon is robust. Relative to shorter periods, this time frame appears to be long enough to considerably reduce the volatility of historical returns and to dampen the impact on returns of the stage of the business cycle in which the time frame begins or ends. Similarly, forecasts over longer horizons have a tighter confidence interval—that is, a narrower range of likely outcomes—making them better suited for long-term strategic portfolio planning. Even if the markets experience a sharp positive or negative move around the starting point for our assumptions, we cannot reliably predict the direction of the impact on our long-term return outlook. Historical inconsistency in the market response to such moves, within and across asset classes and geographies, makes the need for systematic adjustment to long-term return assumptions unlikely.

[6] Although we did not find evidence to suggest systematic mean reversion, for reference, a return adjustment of approximately 5% over the forecast horizon would translate to 25 basis points in compound annual return.

European equities show even less evidence than U.S. equities of systematic reversion—even following extreme negative market moves

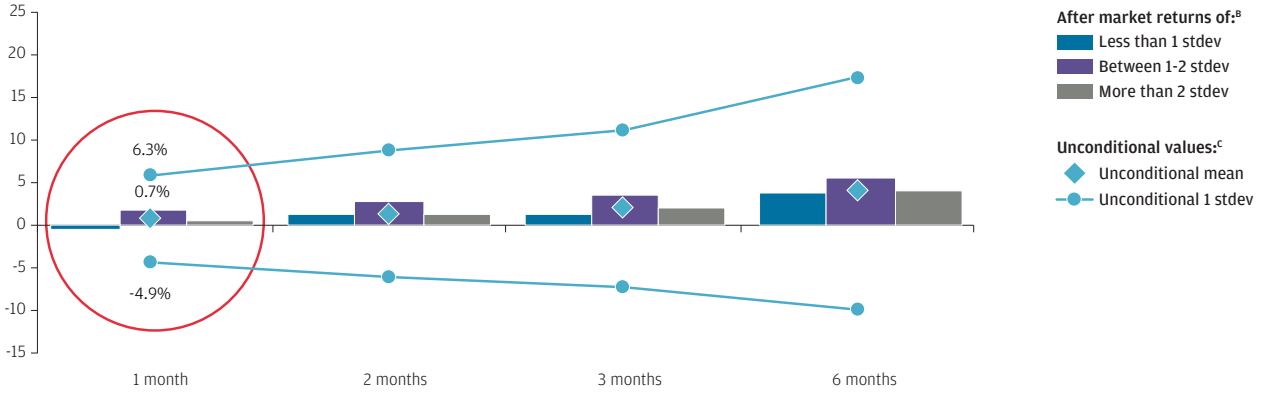
EXHIBITS 9A AND 9B: EUROPEAN EQUITY RETURNS FOLLOWING MARKET MOVES OF VARYING MAGNITUDES

9A: RETURNS FOLLOWING NEGATIVE MARKET MOVES (%)[A]



Example: Over the sample period from 1960 to June 2016, the average one-month European equity return is 0.7% and the standard deviation is 5.6%. Therefore, if returns for European equities one month after market dislocations average at or above 6.3% or below -4.9%, this could be considered a statistically significant (1 standard deviation) response.

9B: RETURNS FOLLOWING POSITIVE MARKET MOVES (%)[A]



Source: FTSE Russell, Ibbotson, Standard & Poor's, J.P. Morgan Asset Management; data from January 1960 to June 30, 2016.

[A] 1-, 2-, 3- and 6-month returns are not annualized.

[B] The magnitudes of market moves (stdevs) are based on historical 2-month returns.

[C] Unconditional means and standard deviations are calculated across the entire data set, from January 1, 1926, to June 30, 2016.

II. ASSUMPTIONS

G4 government bonds: A slower and shallower path to normalization

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Grace Koo, PhD, *Quantitative Analyst and Portfolio Manager, Multi-Asset Solutions*

IN BRIEF

- We expect a significantly slower and shallower path of global interest rate normalization, with lower terminal rates for both the cash rate and 10-year yields. In turn, this all but wipes out duration premium and drives returns on longer-dated bonds down to the level of cash returns.
- U.S. government yields should settle modestly below nominal GDP, with the aggregate "true economic borrowing rate"[1] a little above nominal GDP.
- Credit still shines as the bright spot in fixed income. We take into account market concern about a persistent liquidity premium in high yield but anticipate that any additional gain from spread will accrue to investors, as we expect average default rates and recovery rates to be stable over the long term.
- Emerging market (EM) debt faces some structural challenges, but we see current spreads on corporate and sovereign debt as broadly fair compared with their long-term equilibrium.

[1] We define the true economic borrowing rate as the rate that, on average, the economy as a whole (government, consumers and corporations) is financed at; this is approximated from 0.2 x treasury yield + 0.4 x mortgage rate + 0.4 x corporate yield.

The last 12 months witnessed the start of the U.S. rate normalization process while, simultaneously, negative interest rate policies expanded elsewhere around the globe. Overall, weighted average G10 cash rates remained static as rate cuts in several key economies effectively offset the U.S. rate hike. More significant, the expected pace for future rate hikes slowed sharply over the same period, with the weighted average G10 two-year yield falling by more than half to just 14 basis points (bps). At the time of writing, 70% of 10-year developed market sovereign bonds yield less than 1%. But while this era of ultra-easy monetary policy and ultra-low bond yields may persist for some time longer, it won't last forever. Ultimately, we still expect policy rate normalization to occur in all economies, but the path of policy normalization will be both slow and shallow. We also believe that the potential for interest rates to fall is limited, especially in regions such as the euro area and UK. As a result, the outlook for interest rates is asymmetric. This has important consequences for liability-relative investors, who should be aware of the risks of locking in liabilities at current low rates.

Our changes to the path of normalization are a direct consequence of our reduced expectations for global growth and inflation and result also in a lower level of equilibrium cash and 10-year yields. We expect U.S. monetary policy to normalize very gradually over the next four years. In the eurozone, we expect the current negative rate environment to persist for another three years, followed by a glacial four-year normalization period (Exhibit 1). In both regions, we see equilibrium cash rates converging toward the respective region's rate of inflation—implying negative real returns on cash over our assumptions horizon.

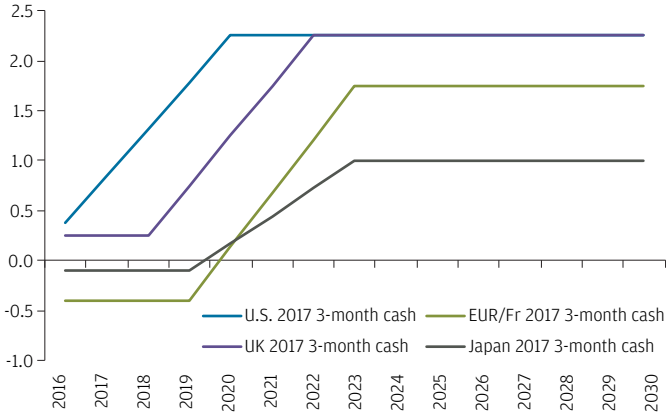
Our fixed income assumptions methodology constructs equilibrium yields from simple building blocks

BUILDING BLOCKS–ANATOMY OF FIXED INCOME YIELDS AND SPREADS

1. **Equilibrium cash rate**
   - The level of cash rates consistent with our long-run growth and inflation forecasts by country
2. **+ Curve (equilibrium long-dated yield)**
   - Additional yield to compensate investor for holding long-term bonds (term premium)
3. **+ Credit spread**
   - Additional credit spread, incorporating rating migration assumptions for *investment grade* and credit/liquidity risk premia and expected default loss for *high yield*
4. **Return calculation**
   - Reflects normalization path to equilibrium interest rate, annual roll-down and rebalancing to a constant maturity index, plus coupon accrual and any defaults/losses

A shallower path to normalization by the Fed will result in a still-lower level of equilibrium cash yields

EXHIBIT 1: EXPECTED PATH OF DEVELOPED MARKET CASH RATES OVER OUR ASSUMPTIONS HORIZON (%)



Source: J.P. Morgan Asset Management estimates; data as of September 30, 2016. The terminal rate represents the average equilibrium rate.

Along with the eurozone, Japan, Denmark, Sweden and Switzerland are currently pursuing negative interest rate policies. We believe these policies are approaching their limits as the adverse impact on credit availability from falling banking profitability effectively offsets a diminishing increase in credit demand from even lower rates. Monetary policy authorities globally are therefore increasingly eager for fiscal authorities to pick up the baton of providing stimulus to the economy, which should in time facilitate the normalization of rates.

A side effect of the simultaneous pursuit of dovish monetary policies globally is the globalization of yield curve slopes (the difference between the yield on long-term bonds and cash) now that curve slopes owe more to global factors than to more domestically driven ones. As a result, we expect the path of normalization of long-term bond yields to be much more globally synchronized than that for cash rates. In other words, we expect the U.S. yield curve slope only to fully normalize once monetary policy tightening is close to starting in the eurozone and Japan, rather than solely following the path of U.S. monetary policy.

A final consideration in our framework for the equilibrium level of long-term government bond yields is their level relative to our long-run nominal growth expectations. Prior to 2000, 10-year U.S. Treasury yields consistently exceeded the rate of nominal GDP growth, but since then they have consistently tracked below. The combination of the global savings glut, the income needs of an aging population, increased regulation and ongoing financial repression, as well as sluggish global growth and inflation, will in our view prevent a return to the relationship we observed before 2000.

Even with Treasury yields modestly below the rate of nominal GDP growth, however, the aggregate "economy-wide" borrowing yields will remain consistently above it (**Exhibit 2**).

As current government bond yields are reflecting an even more pessimistic near-term outlook than our longer-term assumption of sluggish global growth and muted inflation, the outlook for government bond returns is not compelling. Early in our forecast horizon, returns are impaired by low or even negative yields. Subsequent returns struggle to offset the negative mark-to-market impact incurred while rates normalize, due to the low level of our equilibrium yields. Over the full horizon, our return assumptions across the yield curve and regions are paltry indeed.

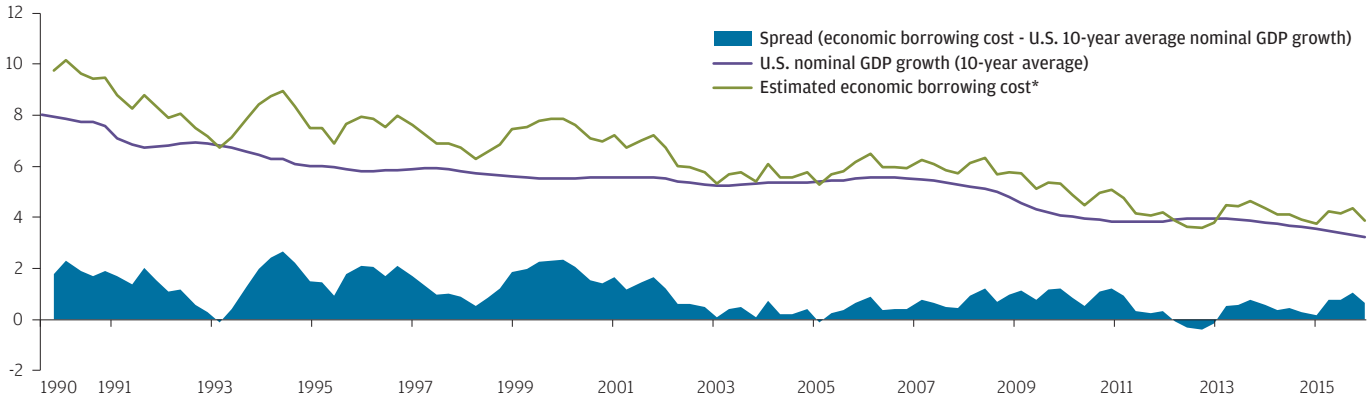
Credit still shines as a relative bright spot even after taking account of the change in liquidity risk, and we expect attractive spread returns to accrue to investors, as our fundamental expectations for defaults and recoveries remain unchanged.

U.S. RATES

U.S. rates have started to normalize at a much slower pace than we had initially expected. We therefore extend our time horizon to arrive at the equilibrium rate of 2.25% from three years to four. This rate is 25bps lower than last year's assumption and suggests a close to zero real rate in equilibrium for cash. To reflect the anchoring effect of global policy, this year we extended the normalization period for 10-year yields to five years (**Exhibit 3**), implying that the normalization phase lasts for roughly one third of our forecast

Even with Treasury yields modestly below the rate of nominal GDP growth, the aggregate "economy-wide" borrowing yields will remain consistently above it

EXHIBIT 2: PATH OF U.S. NOMINAL GDP AND ECONOMY-WIDE BORROWING COSTS (%)

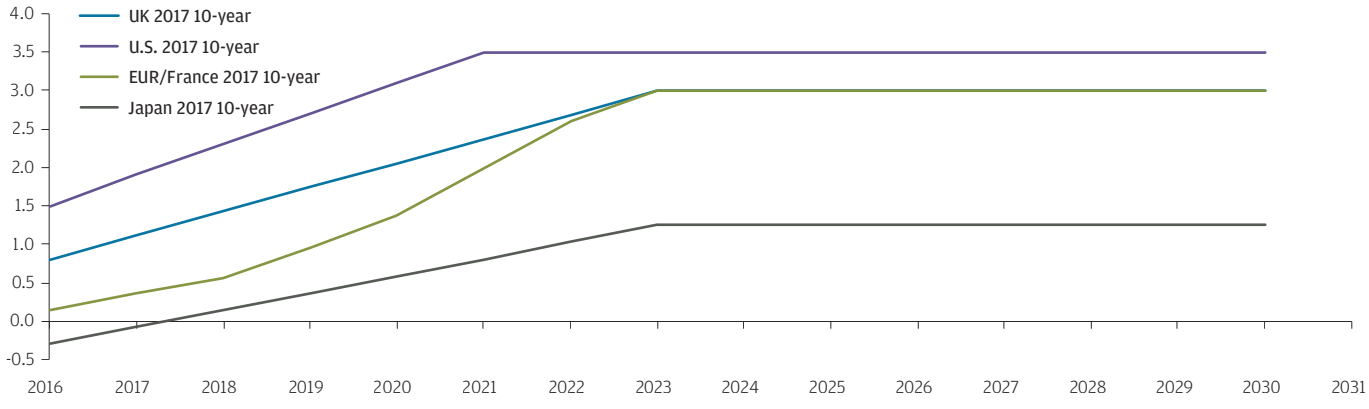


Source: Bloomberg, Haver Analytics.

*Estimated borrowing cost is approximated from 0.2 × Treasury yield + 0.4 × mortgage rate + 0.4 × corporate yield.

A weaker nominal growth outlook relative to last year leads us to reduce our 10-year equilibrium yield assumptions

EXHIBIT 3: EXPECTED PATH OF DEVELOPED MARKET 10-YEAR GOVERNMENT BOND YIELDS OVER OUR ASSUMPTIONS HORIZON (%)



Source: J.P. Morgan Asset Management estimates; data as of September 30, 2016.

The terminal rate represents the average equilibrium rate.

horizon. In keeping with our reduced expectations for long-run U.S. nominal growth rates, we have further reduced the equilibrium yield by 50bps to 3.50%. Compared with last year, this implies a modestly flatter curve slope between cash and 10-year yields in equilibrium. We maintain the 25bps yield curve premium assumption for the slope between 10-year and 30-year yields. Our macro forecasts for inflation are modestly higher than the current market expectations implied by TIPS breakevens; hence we see room for better inflation-linked returns in our 2017 assumptions.

EUROZONE RATES

In the eurozone, we anticipate that significant output gaps and negative rates will persist for some time. Cash rates will therefore only begin to normalize in 2019 and reach their equilibrium rate of 1.75% four years later, implying a significantly negative real return on cash over our assumption horizon. We use as our reference point 10-year French government bonds, which we expect to trade close to the weighted average 10-year government bond yield of the eurozone as a whole. A weaker growth and inflation outlook relative to last year leads us to reduce our 10-year yield assumption by 50bps to 3.00%. We expect eurozone 10-year yields to normalize in seven years—two years later than the U.S.—with a curve slope between cash and 10-year rates of 125bps in equilibrium. This is a palpably steeper slope than today but rather flat in a historical context. In line with the U.S., we see upside risks to European inflation breakevens, as our macro forecasts for inflation are modestly higher than current market expectations.

UK RATES

Historically, the UK economy tended to be relatively synchronized with the U.S. growth cycle; as such, the monetary policy of the Bank of England (BoE) typically followed that of the Federal Open Market Committee (FOMC), with a modest time lag. An irony of Brexit, however, is the significant realignment of UK monetary policy—and our assumption of UK rate normalization—toward the eurozone. We now expect BoE monetary policy to remain ultra-easy until 2018, before cash rates rise over a period of four years to reach their equilibrium level of 2.25%. Real returns over our assumptions horizon are close to zero, reflecting the high sensitivity of the UK economy to the level of short-term rates. Our equilibrium yields for 10-year UK Gilts are sharply lower from last year, reflecting a lower trajectory for nominal growth as well as persistent demand for longer-duration bonds. In line with other global bond markets, UK Gilt yields are expected to normalize over seven years, with a modestly steeper yield curve slope than current levels in equilibrium.

JAPANESE RATES

Japanese cash rates will follow a similar trajectory to the eurozone's but level out at an even lower equilibrium yield of just 1.00%. To ensure ongoing debt sustainability, Japan's equilibrium 10-year government bond yields will have to remain well below the nominal GDP growth rate. We expect 10-year yields to reach their equilibrium level of 1.25% after a seven-year normalization period, resulting in the flattest yield curve slope of all the major economies. This forecast reflects the profound demographic challenges the country faces and their impact on the long-run growth and inflation outlook. Also implied in our forecast is a more moderate level of success of Abenomics over the assumptions horizon.

Lower equilibrium yield and return assumptions are a direct consequence of our reduced expectations for global growth and inflation

EXHIBIT 4: EQUILIBRIUM YIELD AND RETURN ASSUMPTIONS FOR U.S., UK AND EUROZONE FIXED INCOME MARKETS (%)

	U.S.		UK		Euro	
	Equilibrium yield	Return	Equilibrium yield	Return	Equilibrium yield	Return
Inflation	2.25	-	2.00	-	1.50	-
Cash	2.25	2.00	2.25	1.75	1.75	1.00
10-year bond	3.50	2.25	3.00	1.50	3.00	1.25
Gov't bond market*	3.50	2.25	3.00	1.00	3.00	1.25
Investment grade credit**	4.75	3.25	4.50	2.50	3.75	2.00
High yield	8.25	5.75			6.75	4.25
Emerging market debt†	7.00	5.50				

Source: J.P. Morgan Asset Management estimates; data as of September 30, 2016.

* U.S intermediate Treasuries, UK Gilts, euro government bond index. ** Investment grade corporate bonds, †EM sovereign debt; UK Gov't: UK: Gilts; IG corporate bonds; Euro: Government Bond Index; IG corporate bonds.

GLOBAL CREDIT MARKETS: THE PICK OF THE FIXED INCOME UNIVERSE

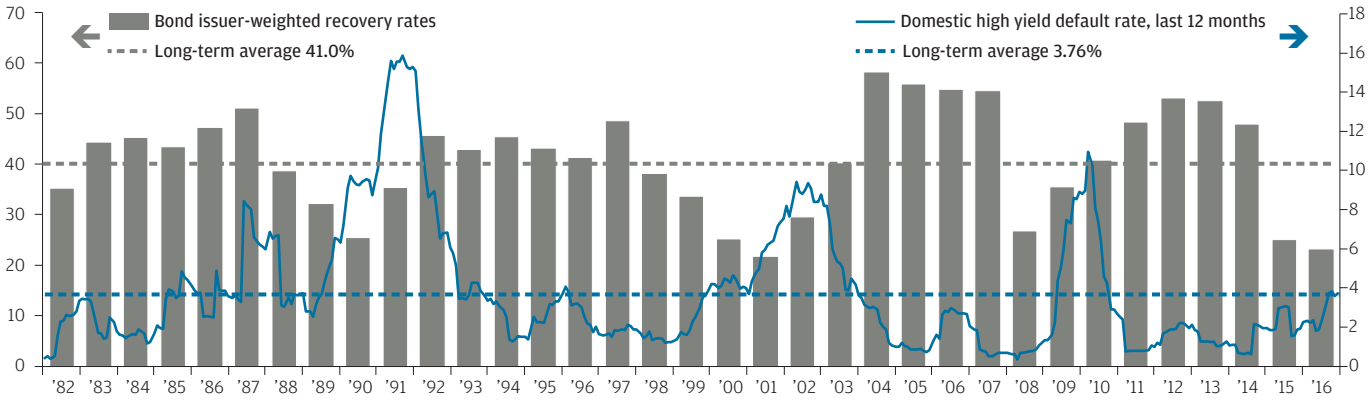
Over the long term, credit spreads tend to strongly mean revert, as both default rates and recovery rates have remained remarkably stationary over the long term. While both the frequency of default and the recovery rate vary somewhat across cycles, there is no evidence of a trend in these factors over multiple cycles. Although readers using our work to consider shorter horizons may want to factor in the recent dip in recovery rates, we assume that over the assumptions horizon credit spreads will remain in line with the long-run mean (**Exhibit 5**).

Credit investors may also be concerned that the "extraordinary" monetary policies that followed the global financial crisis (GFC) suppressed defaults compared with what the economic contraction would have justified. With monetary policy still far from normal, this level of policy accommodation might not be available were another crisis to occur in the near term, and future credit losses should therefore be expected to be higher. While we believe this is a valid near-term concern, we do not consider it sufficient to raise the expected credit loss amount over our assumptions horizon.

There are, however, two recent developments in credit markets that we expect to have a longer-term structural impact: extended duration and leverage in the investment grade sector and a liquidity premium in high yield.

While both the frequency of default and the recovery rate vary across cycles, there is no evidence of a trend in these factors over multiple cycles

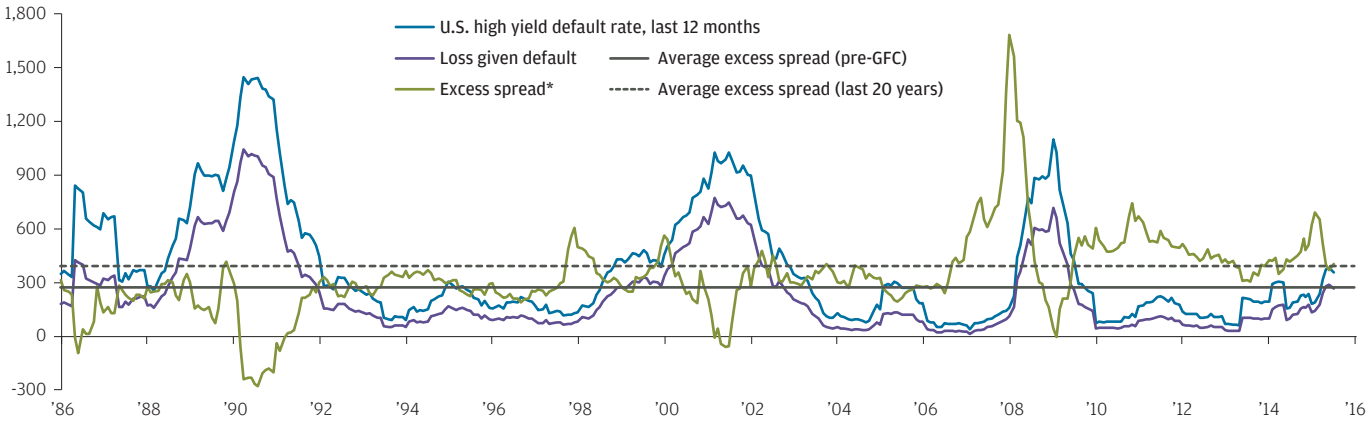
EXHIBIT 5: LONG-RUN DEFAULT AND RECOVERY RATES FOR U.S. HIGH YIELD (%)



Source: Moody's Investors Service, JPMorgan Chase & Co.; data as of June 30, 2016.

The average post-default spread of U.S. high yield is currently markedly higher than the pre-financial crisis average—some, but by no means all, of this can be attributed to reduced liquidity

EXHIBIT 6: U.S. HIGH YIELD EXCESS SPREAD OVER LAST 20 YEARS AND THE 20 YEARS LEADING UP TO THE GFC (BPS)



Source: Moody's Investors Service, JPMorgan Chase & Co.; data as of June 30, 2016.

* Excess spread = level of spread available after accounting for credit loss.

As investment grade issuers—especially large cash-generative firms with higher quality balance sheets—extend duration and leverage, it is likely to exert some upward pressure on the equilibrium credit spread. We estimate that an additional 25bps of spread for long-duration corporate credit will be required to generate sufficient investor compensation for the increased spread duration and credit risk. We raise our equilibrium spread assumption to 175bps over duration-equivalent treasury yields.

In high yield credit, we acknowledge the lower level of secondary market liquidity that has accompanied tighter regulation of broker-dealers. However, we believe this is only one element in the market narrative of a liquidity premium. A more critical consideration is that high yield investors tend to have not just a relative return requirement but also a fairly anchored minimum total return requirement, which needs to be met to generate demand. Consequently, when risk-free rates are relatively low, credit spreads will remain wider to overcome this minimum expected return hurdle. Even after years of ultra-low rates, investors have only slightly lowered this hurdle compared with the past. As we anticipate equilibrium yields for risk-free assets to remain well below their historical norm, we also expect to see a moderate widening in equilibrium high yield credit spreads.

The long-run average excess (post-default) spread of U.S. high yield credit has risen significantly post-GFC. In the 20 years before the GFC, it averaged 275bps, whereas over the last 20 years—a period that captures the credit crisis and the post-GFC environment fully—the average excess spread is almost 400bps (**Exhibit 6**). We do not believe that this entire differential reflects a permanent shift in liquidity; indeed, we would expect that much of the additional spread will erode as risk-free rates normalize and as default rates and recovery rates revert toward long-term averages. Nevertheless, we would expect some residual liquidity-linked spread to remain in place over our assumptions horizon and estimate this to be around 25bps. To reflect this, we raise our equilibrium spread assumption (before accounting for default losses) by 25bps to 500bps for U.S. high yield.

GLOBAL EMERGING MARKET DEBT: SIGNS OF STABILIZATION, BUT DELEVERAGING RISKS REMAIN

Emerging market debt faces a number of headwinds in the coming years from deleveraging and a slowing pace of credit quality improvements. Nevertheless, the absolute level of debt is likely to be manageable, and we believe the risk of an acute crisis, as seen in the late 1990s, is small. The post-global financial crisis average spread level on the J.P. Morgan U.S. dollar-denominated diversified emerging market bond index (EMBI) of around 325bps reflects a fair balance of the risks, as well as the persistent demand for EM debt that is likely to result from low yields in developed markets. The structural challenges, aggregate debt levels and challenges to credit quality improvement probably prevent spreads on EM hard currency debt from tightening significantly toward the extremes seen immediately before the financial crisis.

Corporate EM debt has a number of pockets of vulnerability and may face some near-term challenges should an EM deleveraging cycle get underway. We believe that the J.P. Morgan diversified corporate emerging markets bond index (CEMBI) has an equilibrium fair value spread of 375bps over our forecast horizon. This compares with a post-GFC average of around 360bps. While EM corporate debt is often compared with developed market high yield debt, the index itself is roughly two-thirds investment grade and one-third high yield. Thus our forecast of a 375bps spread, we believe, amply reflects the structural challenges generally facing EM debt, with the credit quality embedded in corporate EM debt indices.

Modest downgrades, disappointing returns

Patrik Schöwitz, CFA, *Global Strategist, Multi-Asset Solutions*
Stephen Macklow-Smith, *Portfolio Manager, European Equity Group*
Michael Albrecht, CFA, *Global Strategist, Multi-Asset Solutions*

IN BRIEF

- For several years, our equity return assumptions have been lower than history might lead us to expect. This year, we take both developed market (DM) and emerging market (EM) total return expectations down another peg.
- Our DM return assumption reflects our expectation that a low-growth environment will persist, leading to lower real growth and inflation and hence diminished earnings growth. A relatively large share of developed market equity total returns will likely come from a high level of payouts to shareholders rather than from earnings growth.
- Our EM return assumption falls by a slightly larger amount than our DM return assumption in local currency terms, reflecting more severe economic growth downgrades than in developed markets, but also higher valuations that are now a modest drag on our return projections. The return assumption declines by slightly less in U.S. dollar terms, following our expectation of emerging market currency appreciation. Overall, the resulting return gap in favor of emerging markets is the same in U.S. dollar and local currency terms in this year's assumptions, and continues to be roughly in line with historical experience.
- Our equity return assumptions are based on a methodology that accounts explicitly for specific drivers, including the global composition of corporate revenues—companies have increased their global investment, so we need to take this into account rather than linking revenues only to domestic GDP growth—as well as normalization of profit margins and valuations, and the impact of share buybacks and dilution.

COMPARED WITH LAST YEAR, EQUITY RETURNS MOVE LOWER AGAIN

Once again, our equity assumptions deliver a message of low returns relative to history, in particular for developed markets.

We moderately downgrade our assumptions for DM equities compared with last year, to 6.00% from 6.75%. This reflects our expectation of both a lower level of revenue growth and a slight de-rating. Valuation levels remain elevated on a historical basis, and as these revert to mean they are likely to prove a headwind for future returns. In the U.S. and Japan, we anticipate that margins, which are higher than their historical averages, will come under some pressure, while in the eurozone and UK we expect margins to recover.

Our outlook for EM returns remains somewhat brighter than our expectation for DM returns, but it is also reduced by a similar amount. Our aggregate EM equity return assumption falls to 8.75% in local currency terms from 9.75% last year. This takes the gap by which we see emerging markets surpassing DM equity returns down to 2.75 percentage points (ppts) in local currency terms. Our expectations follow from our assumptions of lower economic growth (and thus revenue growth), offset to some degree by a little less dilution than we assumed last year.

At the regional level, our local currency return assumption for EM Asia falls by 100 basis points (bps) to 9.00%, while the return in Europe, the Middle East and Africa (EMEA) declines by 125bps to 8.75%. It falls by 150bps to 7.00% in Latin America. In U.S. dollar (USD) terms, our EM return assumption declines by 75bps to 9.25%, as we see a slightly stronger but still mild appreciation of EM currencies over our horizon. Similarly, the impact of currency assumptions on aggregate DM equity returns boosts the USD return assumption by 50bps to 6.5%. Overall this leaves the return advantage of emerging markets over developed markets in USD terms identical to the return advantage in local currency terms. Foreign exchange (FX) trends thus boost the attractiveness of international equity markets (both EM and DM) to U.S. dollar-based investors, as we expect the USD to weaken gradually over our assumptions horizon.

Despite the undeniable cyclical and structural challenges that lie ahead for emerging markets, we see recovery potential over our long-term horizon. EM return assumptions and drivers vary among specific markets, but we believe that economic growth rates will, in most cases, remain substantially above those in developed markets, while emerging markets do not generally face the same valuation headwinds as developed markets.

BUILDING OUR FORECASTS

We continue to rely on the equity return assumptions methodology we introduced in our 2015 assumptions, summarized in **Exhibit 1**.

Our equity assumptions methodology breaks equity returns into easy-to-forecast return drivers

EXHIBIT 1: BUILDING BLOCKS–ANATOMY OF EQUITY TOTAL RETURNS

1. **Aggregate revenue growth**
   - Includes domestic and international growth, as well as any additional expansion of revenues
2. **× Aggregate earnings growth / revenue growth (margins) = Aggregate earnings growth**
   - Reflects normalization in most markets
3. **× Earnings per share (EPS) growth / aggregate earnings growth (net dilution) = EPS growth**
   - Breaks down into: (a) **gross dilution;** (b) **buybacks**
4. **× Price return / EPS growth (valuations) = Price return**
   - Consistent with long-term risk-free yields and equity risk premium (ERP)
5. **+ Dividends (carry) = Total return**
   - Payout ratio consistent with sustainable growth rate

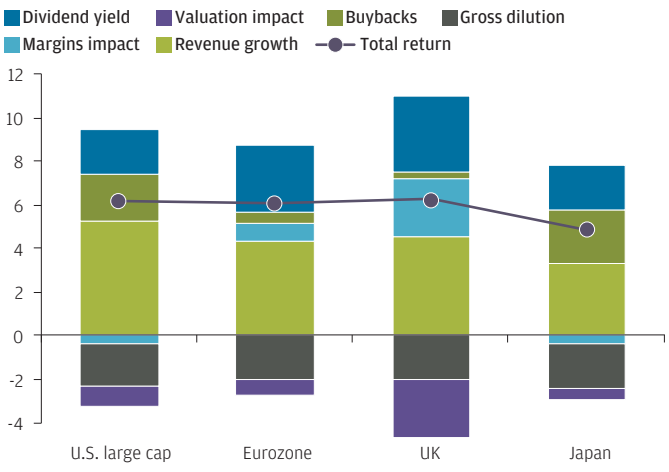
Similar to DuPont analysis, this methodology allows us to decompose total returns structurally into easy-to-forecast ratios as drivers of return. It enables us to account explicitly for the global composition of corporate revenues—and how fast different regions are growing—as well as the normalization of profit margins and valuations, and the impact of share buybacks and dilution. Finally, we tie together complex interrelationships among these factors by ensuring that they are consistent with expected return on equity (RoE), based on an index-level adaptation of Robert Higgins's sustainable growth rate (SGR) concept—which we further refined this year. This framework makes certain that total payouts to shareholders (dividends plus buybacks) and resulting net dilution are sustainable and consistent with earnings growth and expected RoE (for the latter we use a DuPont-style decomposition to shape our expectations).

DEVELOPED MARKET EQUITY RETURN ASSUMPTIONS

As we have noted, at the aggregate DM level our total return assumption falls again slightly this year, to around 6.00% in local currency terms. All major DM markets continue to see small downgrades in their top-line aggregate sales estimates, reflecting reductions in our economic growth expectations. We see RoEs remaining high relative to earnings growth, consistent with payouts (dividends plus buybacks) contributing proportionally more to total returns compared with history. Valuations will remain a headwind, dragging on expected total returns across all major developed markets. The composition of equity return assumptions across the major developed markets is illustrated in **Exhibit 2**.

The makeup of equity return projections differs across developed markets

EXHIBIT 2: CONTRIBUTION TO TOTAL RETURNS, % ANNUAL, FOR G4 LARGE CAP EQUITIES



Source: J.P. Morgan Asset Management; data as of September 30, 2016.

For the U.S., our return assumption declines modestly to 6.25%, mostly reflecting a lower level of revenue growth. Margins appear to have less far to fall than we were projecting last year. Valuations should provide a similar drag, although we have slightly raised target P/E assumptions for European and U.S. equity markets to reflect an expected environment of lower for even longer bond yields.

In contrast, our return expectation for U.S. small caps ticks down only marginally to 7.00% from 7.25% last year. Earnings growth should be somewhat faster than for large caps, even though we assume a larger decline in margins from current record levels than for large caps, and in spite of lower exposure to fast-growing emerging markets. Lower RoE continues to imply higher dilution than for large caps. The key change from last year, however, comes from valuations—while valuations for large caps have risen further since last year, they have actually declined mildly for the small cap index, leading to a fairly substantial positive return contribution. Overall the small cap return premium expands to 0.75% from 0.25% last year.

Our eurozone assumption decreases 100bps to 6.00%. Revenue growth continues to decelerate in line with our expectations for global growth, but we expect valuations to present less of a headwind, given the market's decline since last year. We still project that margins will recover, but we have lowered our assumed rate of recovery. This largely reflects the ongoing pressures on European bank profits, as very low interest rates will continue to squeeze net interest margins. We have also embedded an expectation of a continued need for more capital in the European financial sector, reflected in the relatively high ongoing dilution numbers compared with pre-crisis levels.

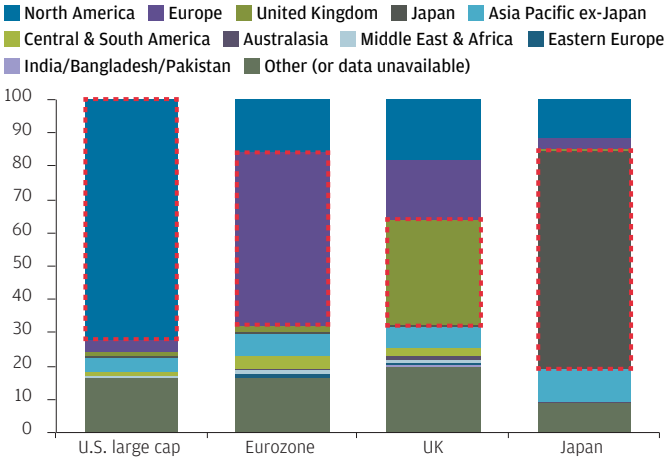
We continue to believe that future returns in Japan depend significantly on the success of corporate governance reform, a critical and as yet unfinished piece of Abenomics. As Japanese equity fundamentals (notably profit margins and RoE) remain at record levels by local standards, we are reluctant to assume either a wholesale reversion to historically lower mean values or a surge to the much better levels that are normal in the rest of the developed world. We take the middle road, projecting that fundamentals will remain relatively close to current levels, and introducing the assumption of a mild downward trend in margins. We make that move seeing little evidence of underlying margin improvement absent further foreign exchange help, which we do not believe is forthcoming. (Our FX assumptions continue to envision yen appreciation from here.)

The prevailing high level of profitability translates in our framework into pressure for higher shareholder payouts in order to sustain it. However, absent stronger earnings growth, sustaining the current level of profitability would imply unrealistically high payout rates to shareholders. We have therefore chosen to cut our RoE assumption and thereby cap implied buybacks in our framework at a still-high 2.5% per annum. Abenomics encourages companies to put their reserves to work, but recent evidence suggests that issuance still outweighs buybacks. We cut our Japanese equities return assumption, in local currency terms, to 4.75%, due to the aggregate impact of a decline in growth, falling margins and capped buybacks, compensated for by a higher dividend yield. Given that Japan's economic and political environments are in a state of flux, we will continue to reassess our assumptions.

In the UK, our equity return assumption falls 1ppt to 6.25%. Two important factors point in opposing directions: Normalization of margins should boost returns going forward, while high valuations should act as a drag. UK earnings have suffered from the commodity cycle, given the heavy weighting of commodity-related sectors in the UK index. This is before any impact from Brexit—in fact, UK equities have performed relatively well post-Brexit, only adding to the rise in valuations. On balance, we expect that the negative drag from valuations will outweigh the lift from improving margins. This comes, in part, from cutting our target level for margins again this year to take account of the likely headwind from Brexit-related uncertainty. Across markets, the share of revenue from international sources varies widely (**Exhibit 3**) and is particularly high for the UK. In the near term, a weaker sterling should help boost the revenues (in GBP terms) and margins of UK exporters, but this impact has not yet been seen in financial data and so does not affect our starting point; in the longer run, recovery in sterling means any boost to earnings should be only temporary, and there is little impact to our long-term equilibrium projections.

While U.S. companies generate 72% of their revenue in North America, UK companies rely on domestic markets for just 31% of their revenue

EXHIBIT 3: INTERNATIONAL REVENUE BREAKDOWN FOR G4 MARKETS



Source: Thomson Reuters Datastream, J.P. Morgan Asset Management; data as of September 30, 2016.

EMERGING MARKET EQUITY RETURN ASSUMPTIONS

We derive our aggregate EM equity assumption—8.75% in local currency terms and 9.25% in U.S. dollars—by applying the same methodology to nine large emerging markets and aggregating by market capitalization weight. The countries we include account for more than 85% of the market capitalization in the MSCI Emerging Markets Index. Data history in emerging economies is generally shorter, and data quality less robust, so our confidence in the resulting assumptions is by nature somewhat lower than for developed markets. Despite this reservation, and the variety of cyclical and structural crosscurrents moving through the emerging market universe, we identify a few common themes.

Top-line growth in most EM countries remains much higher than in developed markets, despite a downgrade in our assumptions again this year. While Taiwan and South Korea are the obvious slower-growing outliers in the EM universe, the aggregate EM growth rate is still stronger than the DM rate by more than 3ppts. This feeds through to faster aggregate EM earnings growth, although at the moment we expect the pace will be slowed a little by pressure on profit margins. An offset to faster aggregate earnings growth is the generally higher level of net shareholder dilution, although at current levels it is modest relative to history.

On the valuation front, the picture is mixed across emerging markets. Valuations look low in China, as they do in South Korea and Taiwan to a lesser degree. In contrast, Mexico, India, Brazil and South Africa appear to be at the expensive end of the spectrum. Overall, in the wake of a recovery that began at the start of 2016, EM equity valuations no longer look low, resulting in a modest drag on returns of around 40bps.

In **Exhibits 4** and **5** below, we present the building blocks that form the foundation of our DM and EM equity assumptions.

Once again, our equity assumptions deliver a message of low returns relative to history, in particular for developed markets

EXHIBIT 4: SELECTED DEVELOPED MARKET EQUITY RETURN ASSUMPTIONS AND BUILDING BLOCKS

Equity assumptions	U.S. large cap	Euro area	UK	Japan
Revenue growth	**5.3**	**4.3**	**4.5**	**3.3**
+ Margins impact	-0.3	0.9	2.6	-0.4
Earnings growth	**5.0**	**5.2**	**7.3**	**2.9**
+ Gross dilution	-2.0	-2.0	-2.0	-2.0
+ Buybacks	2.1	0.5	0.3	2.5
EPS growth	**5.1**	**3.7**	**5.5**	**3.4**
+ Valuation impact	-0.9	-0.7	-2.7	-0.6
Price return	**4.1**	**2.9**	**2.6**	**2.8**
+ Dividend yield (DY)	2.0	3.0	3.5	2.0
Total return, local currency	**6.25%**	**6.00%**	**6.25%**	**4.75%**

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

EXHIBIT 5: SELECTED EMERGING MARKET EQUITY RETURN ASSUMPTIONS AND BUILDING BLOCKS

Equity assumptions	China	Korea	Taiwan	India	South Africa	Brazil
Revenue growth	**8.2**	**6.8**	**5.3**	**12.3**	**8.9**	**9.6**
+ Margins impact	-0.2	-1.8	0.5	0.1	-0.1	1.0
Earnings growth	**8.1**	**5.0**	**5.9**	**12.4**	**8.8**	**10.7**
+ Gross dilution	-2.2	-0.2	-1.3	-2.7	-2.2	-4.7
+ Buybacks	0.3	0.8	0.5	0.5	1.0	0.5
EPS growth	**6.0**	**5.5**	**5.1**	**9.9**	**7.4**	**6.0**
+ Valuation impact	0.7	0.8	0.1	-2.5	-2.3	-2.2
Price return	**6.7**	**6.4**	**5.2**	**7.1**	**4.9**	**3.7**
+ Dividend yield (DY)	2.8	1.5	3.5	1.5	3.0	3.5
Total return, local currency	**9.75%**	**8.00%**	**9.00%**	**8.75%**	**8.00%**	**7.50%**

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

Beta dominates the outlook, but alpha may be bottoming

Anthony Werley, *Chief Portfolio Strategist, Endowment and Foundations Group*

IN BRIEF

- The 2017 long-term estimates for composite returns across alternatives managers are mostly lower relative to 2016 assumptions, following the path of the public markets outlook. Beta dominates the return projection; the alpha outlook appears to be low but stable and potentially in a bottoming process.
- Manager selection remains a critical determinant of success in achieving risk and return objectives for all alternative strategy classes, given the variation in manager skill and resources.
- Private equity return assumptions are marked down, reflecting lower public equity return assumptions, full valuations and increased competition for harder-to-find opportunities. We anticipate a premium of roughly 1% vs. public equities.
- Direct lending returns are expected to decline from current levels, given downward pressure on credit yields generally and an increase in credit default rates as global growth slows and lending standards loosen.
- Hedge fund returns are also marked down, based on declines in the core drivers of those returns (public market betas) and challenges to alpha generation, such as growth in industry assets, increased competition and regulatory constraints.
- Real estate returns are a relative bright spot, particularly in the U.S., given attractive valuations vs. the upward pricing on many capital market sectors; a late-cycle slowdown in new construction and an improvement in net operating income should support prices as the economic expansion winds down.
- Infrastructure equity returns are reduced, reflecting lower growth and inflation in the countries of the Organization for Economic Co-operation and Development (OECD), only partially offset by investors' lower risk premium demands. Our infrastructure debt assumption reflects our estimate for A rated debt plus a spread for the relative illiquidity of these loans.
- Commodity assumptions have improved, based on a modest increase in projected demand and a sharp contraction in supply, varying by individual commodity and most pronounced for energy. We expect returns to be in excess of U.S. and global inflation.

SIGNS OF THE (ALPHA) BOTTOM

Our assumptions for alternative strategy classes are estimates of average manager returns, which are driven largely by beta components. However, a wide dispersion in manager returns is a characteristic of all alternative strategies, making effective manager selection critical. Savvy diligence in selecting investment partners will likely provide a measure of fair compensation for the risk taken above and beyond traditional asset investing.

The alternative strategies return outlook is marked mostly lower following the path of the public markets asset outlook (**Exhibit 1**). Beta dominates the return projection even as the alpha outlook appears to be low but stable and potentially in a bottoming process. The flood of cash looking to outperform traditional assets has saturated non-traditional strategy markets and swamped available alpha, casting adrift the alternative value proposition. But enhancement of the return opportunity set within private equity and hedge funds—amid signs that new asset flows may be starting to slow, if not reverse—could, on balance, help restore some of alpha's buoyancy. Geographic expansion, financial technology and movements out on the risk curve may be partial antidotes to the current diluted alpha conditions.

Real estate, specifically core U.S. strategies, provides the sole alternative exception to the lower beta return outlook. The unusual supply restraint in the face of ongoing demand has created an anomalous condition this far into the economic cycle. Real estate net operating income strength compares favorably with the equity earnings and fixed income cash flow outlook without using the excessive leverage of the past cycle.

Alternative assets have been marked down, save for U.S. core real estate and commodities

EXHIBIT 1: SELECTED ALTERNATIVE STRATEGIES—RETURN ASSUMPTIONS (IRR%)

	2017 assumptions	2016 assumptions
Private equity* (USD)	8.00	8.50
U.S. private equity-small cap	7.50	n/a
U.S. private equity-mid cap	7.75	n/a
U.S. private equity-large cap	8.00	8.50
Private debt (USD)		
Direct lending	6.75	n/a
Hedge funds (USD)		
Equity long bias	4.50	5.50
Event driven	4.75	6.00
Diversified	3.50	4.25
Macro	4.00	5.00
Relative value	4.25	5.25
Conservative	3.00	n/a
Real estate-direct (unlevered, local currency)		
U.S. core	5.50	5.50
U.S. value-added	7.00	7.25
European ex-UK prime	5.00	5.50
European ex-UK non-prime	7.00	n/a
UK core	5.25	n/a
Asia Pacific core	5.50	n/a
REITs (unlevered, local currency except global indices in USD)		
U.S. REITs	6.00	6.00
European REITs	6.25	8.25
Global REITs	6.00	7.25
Global ex-U.S. REITs	5.75	7.50
Global infrastructure (USD)		
Equity-direct	6.25	6.50
Debt	4.25	n/a
Commodities (USD)	**3.75**	**3.00**
Gold	4.00	3.50

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016, and September 30, 2015.

*The private equity composite is AUM-weighted: 60% large cap and very large cap, 30% mid cap and 10% small cap.

PRIVATE EQUITY

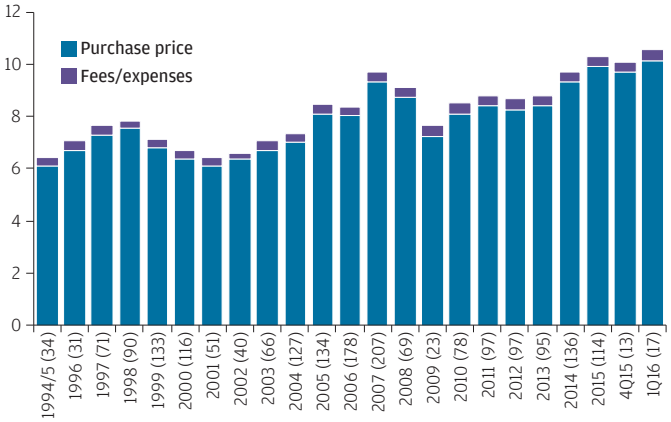
We have expanded our 2017 Long-Term Capital Market Assumptions (LTCMAs) for private equity to include projections by fund size.[1] Lower return assumptions for public markets and increasing pressures on private equity returns lead us to reduce return assumptions for private equity—from 8.50% (for large cap) last year to 8.00% (large cap), 7.75% (mid cap) and 7.50% (small cap) this year.

Forward-looking assessment of private equity conditions and return implications

The private equity strategy class shares many of the same challenges faced by other asset and strategy classes: rising valuations (**Exhibit 2**), harder-to-find investment opportunities and increasing competition from other investors with the means to mine the opportunity set. Additionally, financial sponsors are increasingly embedding flat to lower exit multiples and longer holding periods in their return assumptions, reflecting expectations that "less than perfection" corporate stories will take longer to exit, at least via the public markets. What's more, stretched valuations are likely to decline within investment exit time frames. Access to debt capital remains firm, though the source of that capital, on the margin, has moved from the banks to mezzanine-type lenders and insurance company investment pools—which could prove less reliable. Most important, our public market return projections for the main beta exposures in the private equity composites are down year-over-year by approximately 50 to 100 basis points (bps), directly impacting our private equity return assumptions.

Rising valuations are likely to weigh on private equity returns

EXHIBIT 2: PRIVATE EQUITY PURCHASE PRICE MULTIPLES (X)



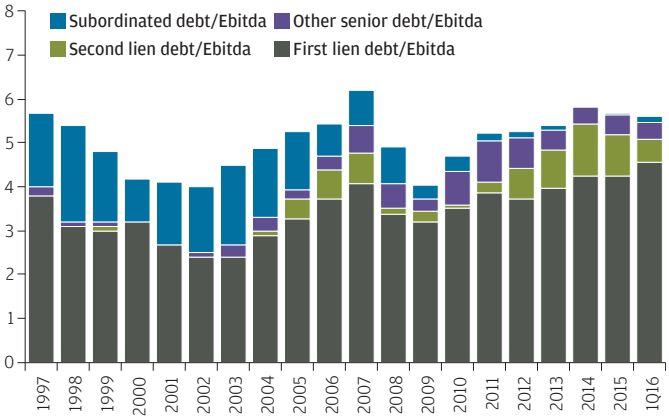
Source: S&P Capital IQ, J.P. Morgan Asset Management; data as of March 31, 2016. Number of deals shown in parentheses.

[1] Fund size and underlying company investment are closely correlated.

On the positive side, resourceful operators within the private equity industry still have several opportunities to generate a premium to the public markets: taking on more operating risk (but not more leverage [**Exhibit 3**]), aggregating fragmented industries, focusing on higher growth consumer segments and increasing allocation to direct investments.

Debt multiples do not suggest overreliance on debt to boost returns

EXHIBIT 3: AVERAGE DEBT MULTIPLE OF ISSUERS (EBITDA > $50M)



Source: S&P Capital IQ, J.P. Morgan Asset Management; data as of March 31, 2016.

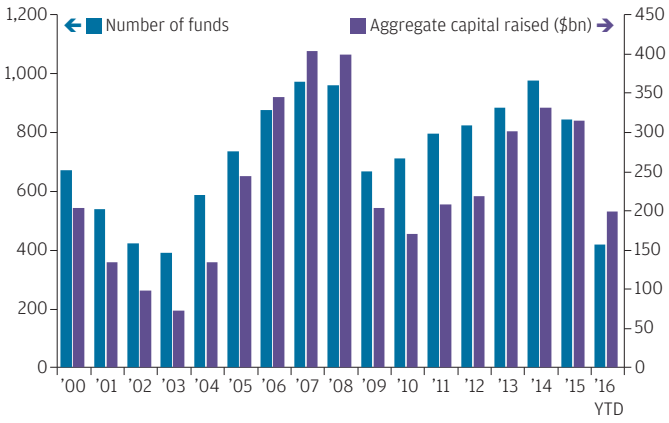
The theme of deploying a growing share of assets outside the relatively picked-over U.S. mid cap market segment remains operative. While the eurozone beta outlook is relatively flat compared with the U.S. mid cap beta outlook, private equity investments implementing basic operating improvements in the eurozone—where economic recovery is less advanced and competition less formidable—may achieve stronger results than in the U.S. However, increasing competition for private equity opportunities is a factor in the European region as well.

Beyond the U.S. and eurozone, our statistical work does register an emerging and developed Asian countries ex-Japan beta in the large capitalization segment, but at this point we see only a rounding up of our core beta estimate as warranted.

Alpha trend estimations, having decayed over multiple cycles, should slow their pace of decline if not stabilize, helped by new alpha opportunities and a potential peak in new funds raised. However, the multi-year buildup of new assets to be deployed by existing players as well as new entrants into the direct investment market (such as sovereign wealth funds and large pension plans) is a challenge to the industry (**Exhibit 4**).

The buildup of assets to be deployed is a headwind for private equity alpha generation

EXHIBIT 4: HISTORICAL PRIVATE EQUITY FUNDRAISING BY YEAR



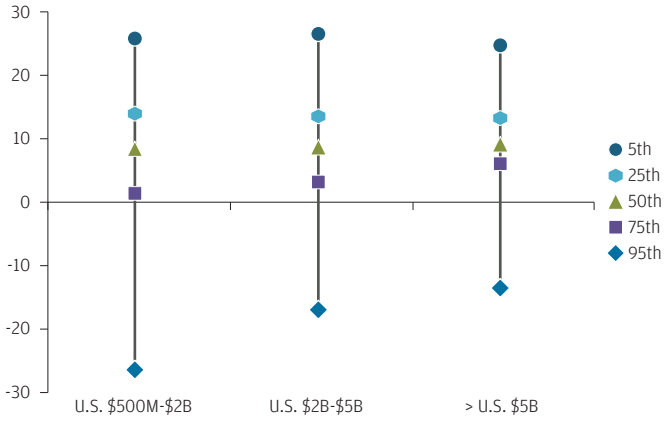
Source: Preqin, J.P. Morgan Asset Management; data as of July 21, 2016.

Dispersion of private equity returns

We have, for over 10 years, estimated only a small and shrinking alpha attributable to the average sponsor's performance. As industry and market conditions continue to press on absolute returns, private equity returns meaningfully in excess of public markets increasingly will accrue to the top tier of skillful, resourceful and niche operators. Dispersion of returns remains a key attribute of the private equity industry, most pronounced among small cap funds (**Exhibit 5**). Investing in a merely "average" manager is unlikely to justify allocation to the strategy class. Successful diligence is essential to ensure that the additional risks inherent in these leveraged, illiquid strategies are properly rewarded.

Manager selection remains a key determinant of success, particularly when investing in smaller funds

EXHIBIT 5: HISTORICAL PRIVATE EQUITY DISPERSION BY SIZE OF FUND, ANNUALIZED RETURN (2005-15) %



Source: Burgiss, J.P. Morgan Asset Management; data as of December 30, 2015.

Methodology

Our statistical approach to estimating private equity representative pooled internal rates of return (IRRs) indicates that beta (vs. alpha) is the principal driver of return, with U.S. mid cap beta and, increasingly, European beta the primary sources of risk taken. We use proprietary regression models to derive our betas for each strategy class and then multiply by the relevant long-term assumptions for public market returns to arrive at the beta component of our private equity return projections (**Exhibit 6**).

Private equity returns are marked down, given lower public equity assumptions and other return pressures

EXHIBIT 6: RETURN ASSUMPTIONS AND BETA BUILDING BLOCKS—PRIVATE EQUITY

	Private equity fund size (capitalization)			
	Small	Mid	Large	Cap-weighted*
U.S. small cap beta	0.14		0.16	
U.S. mid cap beta	0.60	0.77	0.42	
European equity beta			0.43	
Adjusted R^2	0.62	0.56	0.70	
Total return estimate (%)	**7.50**	**7.75**	**8.00**	**8.00**

Source: J.P. Morgan Asset Management; regression data from June 30, 2006, to March 31, 2016; estimates as of September 30, 2016.

*Capitalization (AUM)-weighted private equity composite is 60% large and very large funds, 30% mid-size funds and 10% small funds.

Estimations for alpha, the non-beta component of historical returns, have been in decline for a number of years. A standard decay function, a form of trend calculation, is applied to the adjusted historical data to estimate the alpha component of return. We estimate a capitalization-weighted alpha of 1.00%.

Cyclical and secular forces—such as purchase price multiples, industry size and competition—are assessed to arrive at a final adjustment to the primarily quantitatively derived components of return.

DIRECT LENDING

This year, we have extended our LTCMA alternatives coverage to include direct lending. Following the 2008 financial crisis, government regulation curtailing traditional bank financing has fueled the rapid growth of this fragmented, non-bank source of credit that largely services middle market companies. The industry's lack of scale, illiquidity and the unrated, one-off nature of the debt have kept returns in excess of high yield.

We anticipate that the global search for yield will put downward pressure on credit yields generally, even as slower global growth increases default rates above the level experienced over the past 10 to 12 years. In the initial years of our 10- to 15-year assumptions time frame, we expect some compression in yields as the industry grows to fill the void left by receding traditional bank lenders. In the later years, default assumptions should rise as the investment set expands and increasingly marginal credits are included in the index. On balance, we project a 6.75% compound annual return for direct lending.

Methodology

We model direct lending returns based on the broad characteristics of the Cliffwater Direct Lending Index (CDLI), one of the largest, longest-running and most transparent data sets available for this small, fragmented yet quickly growing micro-asset strategy. Underlying the CDLI composite are unrated floating rate loans, selectively extended to middle market companies. The index is weighted approximately 50% to first lien and senior secured loans and 25% to second lien and junior secured loans, with the balance in mezzanine, structured product and equity exposure. The average loan is in the $5 million to $15 million range, with a five-year maturity, though prepayments and refinancing reduce the average loan to a three-year life. Condensed to its core attributes, direct lending is a slightly better credit than high yield, with a premium yield to compensate for the nature of the debt: unrated, less liquid, smaller size loans.

The starting points for our assumptions are the characteristics of the CDLI, which are currently 9.00% cash yields, 75-plus basis points of fee income (and other concessions, such as original issue discounts and equity participation) and a 1.00% net credit loss. Our return assumptions reduce cash yields to 8.00% and fees and concessions to 50bps—as we believe both will come under some pressure over the next two credit cycles—and increase net credit loss assumptions to approximately 1.75%, slightly superior to the high yield index, recognizing the importance of the credit function to the strategy's success (**Exhibit 7**).

Return estimates assume compression in yields in the near term but increasing credit losses in later years

EXHIBIT 7: RETURN ASSUMPTION AND BUILDING BLOCKS—DIRECT LENDING (%)

Cash yields	8.00
Fees and other concessions	0.50
Credit loss	-1.75
Projected return	6.75

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

HEDGE FUNDS

Overall market conditions for generating hedge fund returns have not improved over the past few years, with a limited number of exceptions. Industry trends are making it more difficult for individual funds to generate alpha. At the same time, we have lowered our outlook for the core drivers of hedge fund returns—risks taken in the public markets (or basic long equity and fixed income beta). Relative to last year's projections, our 2017 Long-Term Capital Market Assumptions call for reduced returns across most of the public market investment spectrum. Taking into consideration these expectations for the alpha and beta components of return, we have reduced our 10- to 15-year assumptions for major hedge fund strategies by 75 to 125 basis points.

General hedge fund industry conditions

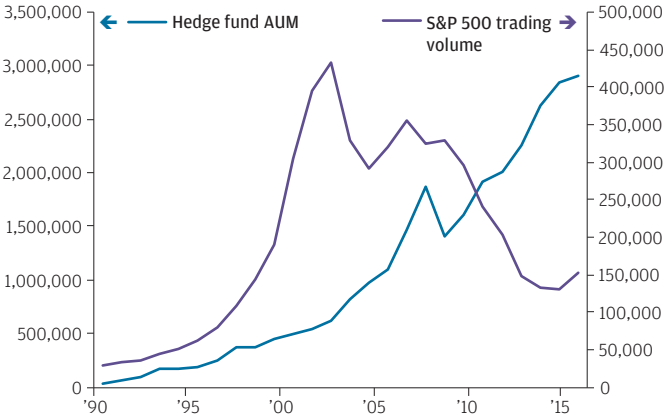
The market environment continues to hamper the average operator's ability to generate the portfolio performance advantages hedge funds are designed to deliver: better risk-adjusted returns than a traditional stock-bond mix, with modest correlations. Correlations between and within markets should approach historical levels, but other issues persist, including growth of assets under management, increased competition from traditional and non-traditional hedge fund-like players, regulatory constraints and declining equity market liquidity (Exhibit 8).

Self-inflicted industry wounds, such as "crowding trades" (Exhibit 9), are adding to the industry's poor performance. Disappointing beta-adjusted performance may be another symptom of hedge fund market saturation. And regardless of fund format or fee structure, all investors are experiencing an investment environment today that is top-down and macro-driven vs. the bottom-up and fundamentally driven hedge fund heydays of the past.

On the positive side, hedge funds are continuing to innovate—both in the analytical techniques they are using and the areas of the economy they are exploring. For example, advanced data modeling and mining techniques, traditionally applied within quantitative and macro strategies, are now being implemented across a wider range of strategy classes, including relative value and event driven strategies. At the same time, opportunities in private lending, litigation finance and investments in areas such as social media and cloud computing are opening new avenues for generating alpha. The hybridization of alternative investing—hedge funds investing in a private equity-like manner, for example—also hold some promise, along with some peril. Many of these strategy innovations are not suited to a liquid mutual fund format, at least for now. For the most part, they belong to the upper strata of hedge fund resources and are not a positive development for the industry as a whole. What is more important for hedge funds overall is that industry asset size appears to have peaked and fee structures are slowly being adjusted.

Increasing industry size and competition amid declining equity market liquidity is a challenge for hedge fund alpha generation

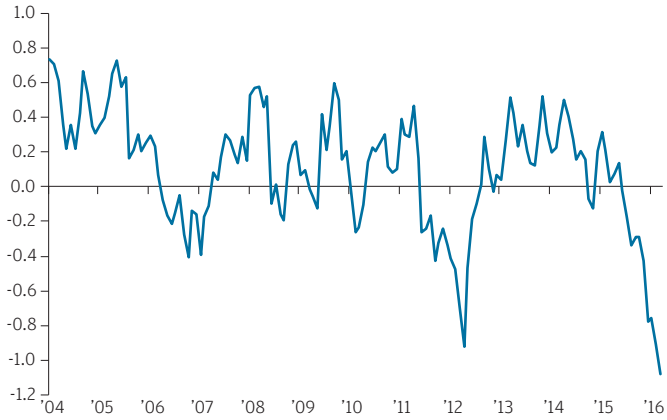
EXHIBIT 8: HEDGE FUND ASSETS SIZE VS. MARKET LIQUIDITY



Source: Hedge Fund Research (HFR), Bloomberg, J.P. Morgan Asset Management; data as of December 31, 2015.

Declining alpha contributions from top stock holdings of fundamentally driven hedge funds are indicative of a broad industry trend

EXHIBIT 9: ALPHA FOR THE HEDGE FUND VERY IMPORTANT POSITION (VIP) LIST* (12-MONTH ROLLING AVERAGE, %)



Source: Bloomberg, Goldman Sachs, J.P. Morgan Asset Management; data as of June 30, 2016.

*The Goldman Sachs VIP index is an equally weighted portfolio of the 50 U.S.-listed equities that most frequently appear as top 10 holdings among fundamentally driven hedge funds. Alpha is calculated by J.P. Morgan Asset Management, based on the Goldman Sachs Hedge Fund VIP list, as a rolling average 12-month Jensen's alpha to the S&P 500.

Deriving the beta component of hedge fund returns

As stated above, the core driver of hedge fund returns will continue to be risks taken in the public markets—that is, basic long equity and fixed income beta. We employ a beta estimation methodology as our prime statistical approach in discerning market risks within historical hedge fund composites. This factor approach uses regression analysis to determine the overriding sources of hedge fund returns by finding the best fit of a hedge fund strategy composite return vs. a representative set of traditional market returns (large cap, mid cap, high yield, etc.).

As can be seen in **Exhibit 10**, equity beta-based strategies such as equity long bias and event driven can be explained with a high degree of accuracy by a handful of equity and related betas. Likewise, relative value-based strategies have a significant relationship to fixed income and credit. The more fluid and multi-asset investment approach of macro strategies is less predictable as a beta play but still measurable.

Having derived the beta exposures for each strategy, we multiply them by the LTCMAs for the relevant traditional asset classes. This provides the core building blocks of our hedge fund strategy assumptions. While the beta exposures vary over shorter periods of time, they are relatively consistent over long-term rolling periods.

In general, hedge fund returns can be explained to a large extent by a limited number of traditional asset class exposures

EXHIBIT 10: DERIVED BETA EXPOSURES (COEFFICIENTS) AND GOODNESS OF FIT (R^2) STATISTICS

	Equity long bias	Event driven	Diversified	Macro	Relative value	Conservative
Constant	0.00	0.00	0.00	0.00	0.00	0.00
Large cap core	-0.16					
Mid cap	0.34	0.11	0.27			0.32
Small cap			-0.23	-0.05		-0.28
EAFE	0.20		0.28	0.12		0.25
Europe		0.19				
Japan						
Asia ex-Japan	0.22		0.09	0.05		
Emerging market equity		0.13				
Blended commodities	0.06		0.08	0.08		0.08
U.S. aggregate	-0.35					
U.S. high yield	-0.15		-0.10	-0.16	0.15	-0.19
Euro aggregate		-0.19	-0.26	-0.15		-0.42
Euro high yield		0.13			0.19	0.23
World government ex-U.S.				0.22	-0.46	
U.S. long-duration government/credit						0.15
Emerging markets local currency debt					0.13	
Emerging markets corporate bonds					0.29	
Adjusted R^2	**0.88**	**0.79**	**0.66**	**0.23**	**0.69**	**0.66**

Source: Bloomberg, J.P. Morgan Asset Management. The time frame for regression analysis is June 2006 through May 2016; data as of June 28, 2016.

Assessing the alpha component of hedge fund returns

Our qualitatively estimated alpha adjustments (positive or negative) to projected hedge fund total returns are small overall and differ by strategy class. In determining these adjustments, we start by examining recent historical trends in alpha, which have been generally negative over the past five to six years, except for the trend in relative value, which has been slightly positive (**Exhibit 11**).

A further adjustment to alpha is made to account for the above-mentioned general hedge fund industry conditions, which we believe are unlikely to change materially over the next few years.

Building blocks of hedge fund return estimation

In summary, the building blocks of our hedge fund projections are:

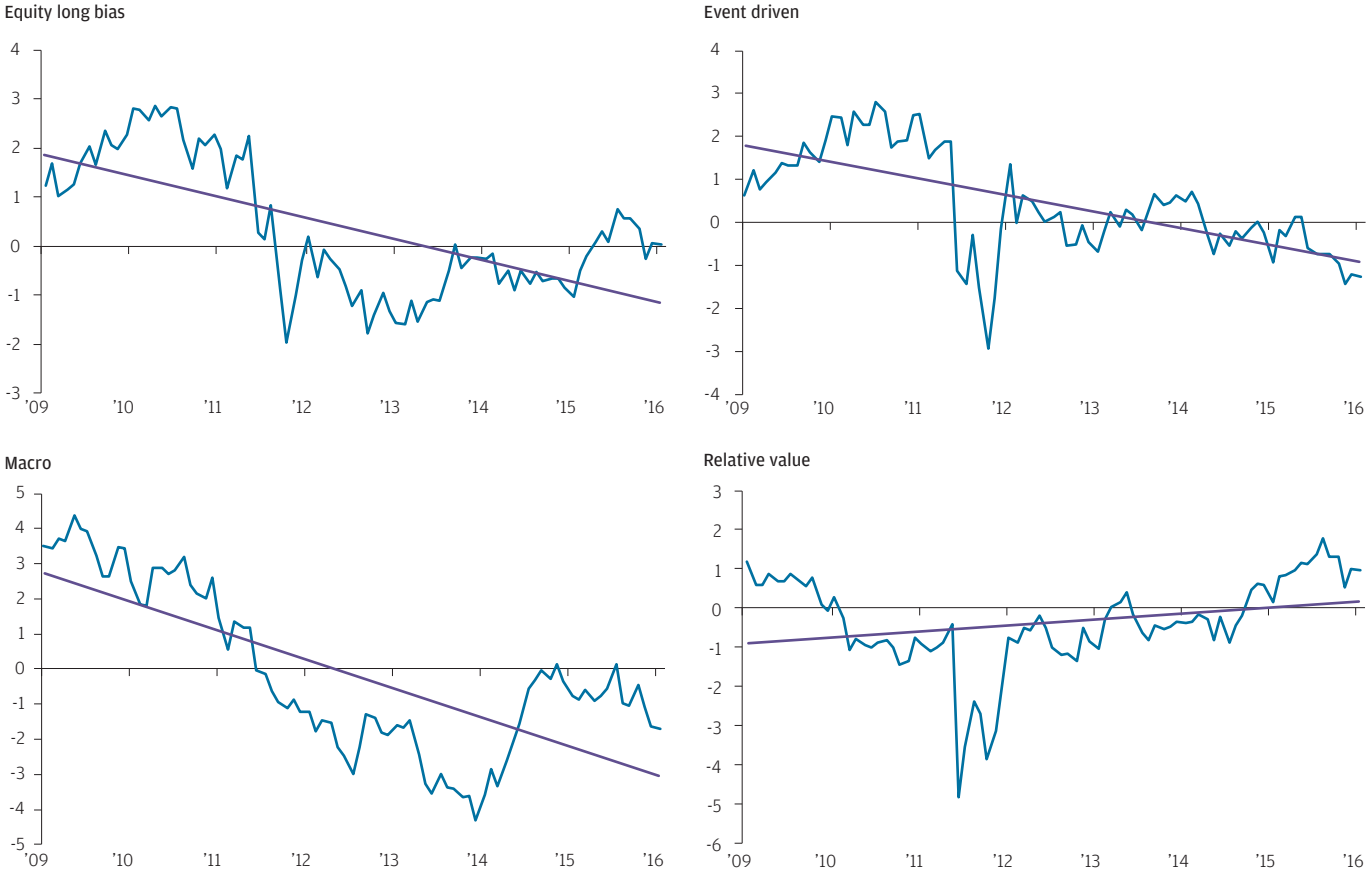
(1) **Core beta returns**: the primary component of our projected hedge fund returns—estimated as the product of beta exposures (from our proprietary regression models) and our long-term return assumptions for traditional asset classes

(2) **Alpha trends**: qualitative adjustments to core beta returns, based on historical alpha trends

(3) **Alpha potential**: further adjustments, based on our interpretation of the impact of industry conditions on the forward-looking alpha potential of each strategy class

Alpha has been trending down, except in the case of relative value strategies

EXHIBIT 11: TREND LINES FOR 36-MONTH ROLLING ALPHAS (%)* BY MAJOR HEDGE FUND STRATEGY CLASS



Source: Hedge Fund Research (HFR), Bloomberg, J.P. Morgan Asset Management for estimates; data as of June 28, 2016.

*Alpha is defined here as the difference between actual composite returns and estimated core beta returns for a given hedge fund strategy. Core beta returns are estimated using J.P. Morgan Asset Management proprietary regression models and actual historical values for the traditional asset class/market drivers of return.

In line with beta reductions and modest alpha downgrades, we have reduced our long-term hedge fund return assumptions this year (**Exhibit 12**).

EXHIBIT 12: HEDGE FUND RETURN ASSUMPTIONS (%)

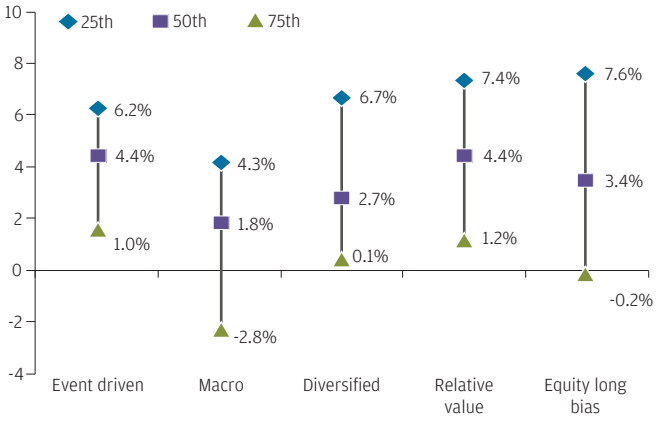
	2017	2016
Equity long bias	4.50	5.50
Event driven	4.75	6.00
Diversified	3.50	4.25
Macro	4.00	5.00
Relative value	4.25	5.25
Conservative	3.00	n/a

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016, and September 30, 2015.

Manager selection matters

As we have emphasized for a number of years, the dispersion of manager returns within the hedge fund universe remains a key factor in whether hedge funds realize their potential to generate returns equivalent to a stock-bond combination and to diversify and risk-adjust multi-asset class portfolio performance (**Exhibit 13**). Likewise, superior performance may be realized by choosing fund structures where more fee-efficient/performance-netting approaches are employed. This is clearly the case as it relates to diversified funds of funds vs. single manager diversified strategies.

EXHIBIT 13: DISPERSION OF MANAGER RETURN BY STRATEGY CLASS (TRAILING FIVE-YEAR ANNUALIZED, AS OF JULY 2016, %)



Source: Bloomberg, J.P. Morgan Asset Management; data as of July 15, 2016.

REAL ESTATE

In general, real estate valuations look relatively attractive vs. the upward pricing in many capital market sectors. This is particularly true for U.S. real estate, where a slowdown in new construction and an unusually favorable demand/supply balance this late in the cycle should support prices as the economic expansion gradually winds down. With real estate markets around the globe at various cyclical stages, our return assumptions across regions (in local currency terms) range from 5.00% to 5.50% for core assets to 7.00% for value-added and non-prime sectors.

U.S. markets

The U.S. core and to a lesser extent value-added real estate markets are experiencing a highly atypical pause in late-cycle supply and an improvement in operating cash flow. Even within the apartment sector, where supply had been growing strongly, new construction permits have declined sharply. Overall, the slowdown in construction activity suggests there will be little oversupply when the economic expansion comes to an end, and this may well play a supportive role during the course of the next recession.

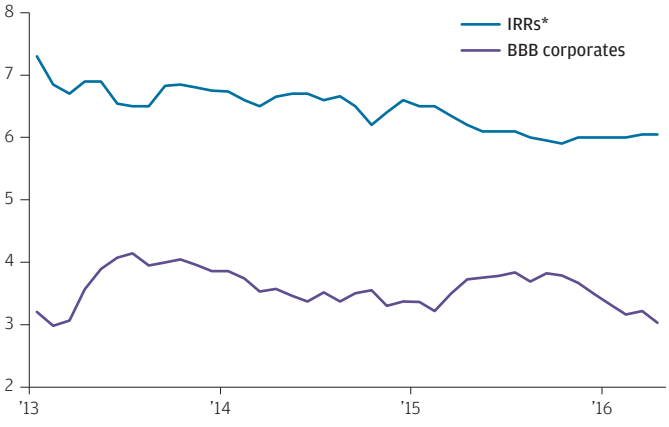
There are several reasons for the supply pullback: The risk appetite of the development community appears muted in response to cautious signals from corporate profits—a leading indicator of real estate demand. Additionally, debt financing continues to decline: Construction loans are now harder to procure due to increasing regulatory pressure on banks as well as rising lender concerns about ultimately completing construction in a future recession. Lending standards for mortgages on existing properties have risen incrementally, though loans are readily available for borrowers willing to keep loan-to-value ratios at or below 60%. Regulatory changes have upended the commercial mortgage-backed securities (CMBS) market, but it is on the mend. The behavior of debt/Ebitda ratios—flat to down in recent quarters—is symptomatic of these credit constraints and greater caution among developers.

Forward-looking internal rates of return for commercial real estate have moved up modestly due to relatively flat pricing and surprisingly strong net operating income growth in the mid-single digits (about 6%) year-over-year, as of midyear. The forward spread between underwriting IRRs and BBB corporate yields to maturity has widened significantly in recent months (**Exhibit 14**). Two trends will likely impact IRRs over the longer term: urbanization, with a clearly positive effect, and densification—fewer square feet of space per person, with a less certain net effect. While densification suggests a more efficient use of space, that efficiency may slow the pace of absorption. However, slower construction activity, along with the increase in economic activity per unit of space resulting from densification, should help support higher equilibrium rents per unit, providing some offset to the negative absorption effect. On balance, we have left our long-term return assumption for core real estate unchanged from last year at 5.50%.

Value-added real estate has seen a more prominent flow of funds, investment activity and risk increase over the recent past; as a result, we have marked down our long-term return assumption from 7.25% to 7.00%.

Modest valuations and strong net operating growth are leading to attractive spreads for core real estate

EXHIBIT 14: U.S. CORE REAL ESTATE IRRS VS. BBB CORPORATE BOND YIELDS TO MATURITY (%)



Source: J.P. Morgan Asset Management; data as of June 30, 2016.
*IRRs refer to forward-looking underwriting internal rates of return.

Europe/UK

European real estate investors' preferences for safety in assets can be seen in the bifurcation of European ex-UK core assets into prime and non-prime subgroups, with different valuation dynamics. A few major cities are trading at low yields and high valuations by historical standards while the majority of assets in less prominent cities are trading at unusually wide yield spreads to the highest quality assets. We would expect better relative performance from this non-prime subgroup going forward as the economy strengthens, investors' risk appetite improves and prime asset valuations become stretched. The combination of the prime and non-prime outlook produces a blended return assumption of 6.25% for core assets, in local currency terms.

The UK market has experienced a price correction since the Brexit referendum, leaving return expectations broadly in line with core markets globally, if not at a slight discount to reflect the prospect of lower growth over the forecast period. There is considerable uncertainty around this forecast due to the difficulty of predicting the outcome of the multi-year Brexit negotiations. While the short-term impact should be negative, there is a case for stronger growth in the medium to long term. Our assumption is for a 5.25% return, in local currency terms.

Asia Pacific core

The Asia Pacific core real estate category comprises a wide range of return expectations, reflecting the divergent economic outlooks within the region. The return outlook spans both developing and developed economies and incorporates a wide spectrum of real estate fundamentals.

In general, fundamentals remain strong despite concerns about the pace of growth in two of the region's largest economies—China and Japan. Strong investor interest and low cost of capital continue to underscore capital value growth in Asia Pacific. A lack of prime assets with stable, income-producing characteristics has driven investors further out on the risk-return spectrum to look for potential investment opportunities, such as secondary grade assets with long-weighted average lease expiry and strong lease covenants. As such, average yields for prime and secondary assets are expected to tighten further in the near term. The varied timing, length and amplitude of the individual real estate market cycles continue to bode well for Asia Pacific core real estate investments as an additional dimension of diversification. Return outcomes range from 5.00% to 6.00% for the major developed markets of the Asia Pacific region.

Real estate investment trusts (REITs)

Publicly traded real estate prices ultimately converge with the value of the real assets included in the REIT index. Over the past 20 years, REITs have averaged an approximate 3% to 5% premium valuation to the underlying assets. Our methodology has been to amortize the excess vs. the historical average premium (or underage) of publicly traded values over the assumptions time frame. The historical premium can be attributed to the value of REIT management and, more recently, to the absolute yield afforded by real estate securities vs. other yield options. The current U.S. premium to net asset value of approximately 0% to 2%, we believe, will rise above the average premium of 3% to 5% and thus be accretive to the real asset projection of 5.75% (85% core + 15% value-added) to reflect the changing nature of the REIT index, resulting in a U.S. REIT return of 6.00%.

Real estate should offer relatively appealing long-term returns, given improved fundamentals and attractive valuations compared with other asset classes

EXHIBIT 15: REAL ESTATE AND REIT RETURN ASSUMPTIONS (IRR%)

	2017 assumptions	2016 assumptions
Real estate-direct (unlevered, local currency)		
U.S. core	5.50	5.50
U.S. value-added	7.00	7.25
European ex-UK prime	5.00	5.50
European ex-UK non-prime	7.00	n/a
UK core	5.25	n/a
Asia Pacific core	5.50	n/a
REITs (unlevered, USD)		
U.S.	6.00	6.00
Global	6.00	7.25

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016, and September 30, 2015.

INFRASTRUCTURE EQUITY

Over the past couple of years, infrastructure assets generally underwent only modest changes to their base operating fundamentals, except in the case of contracted power, where changes were more pronounced. From a long-term perspective, these fundamentals are just beginning to change across all aspects of the industry. Our expectation is that lower OECD growth will put pressure on returns for more cyclical assets. Meanwhile, we expect lower OECD inflation to weigh modestly on nominal returns for highly regulated assets by limiting inflation allowances (Exhibit 16).

Our 2017 assumption is for a slight decline in infrastructure equity returns

EXHIBIT 16: RETURN ASSUMPTION AND BUILDING BLOCKS—OECD INFRASTRUCTURE EQUITY*

	2017 assumptions (%)	2016 assumptions (%)
Valuation impact	1.25	1.50
Average yield	3.25	3.00
OECD/developed inflation	1.75	2.00
Infrastructure equity return (levered)*	6.25	6.50

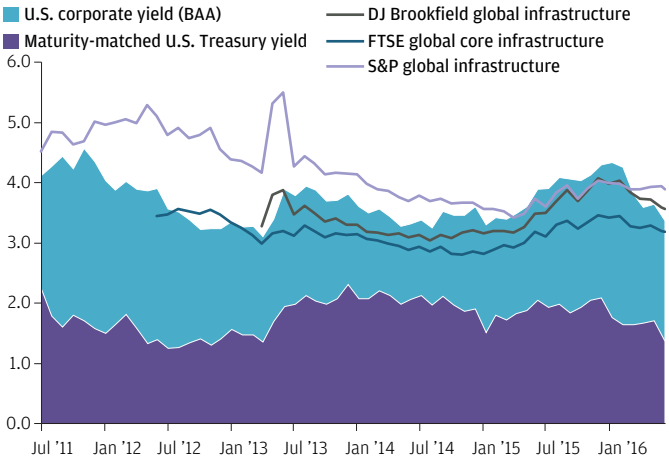
Source: J.P. Morgan Asset Management; estimates as of September 30, 2016, and September 30, 2015.

*Infrastructure equity assumption is for OECD countries with high GDP per capita. Sector allocations are 40% regulated power, 30% transportation assets, 20% contracted power and 10% social infrastructure.

What we do not expect to change in the near term is the healthy investor demand for the characteristics of the asset class. With few geographic exceptions, infrastructure as an asset class is a relatively new, attractive long-term investment option. Its appeal to investors is based on its leveraged absolute high yields and the stability of those yields (Exhibit 17), as well as the inflation pass-through accorded selected infrastructure assets. Of course, in an illiquid asset class such as infrastructure equity where wide bid-ask spreads exist, above-average execution capabilities may be required to achieve the expected returns.

Infrastructure equity has offered relatively high and stable yields

EXHIBIT 17: LISTED INFRASTRUCTURE DIVIDEND YIELDS VS. BOND YIELDS (%)

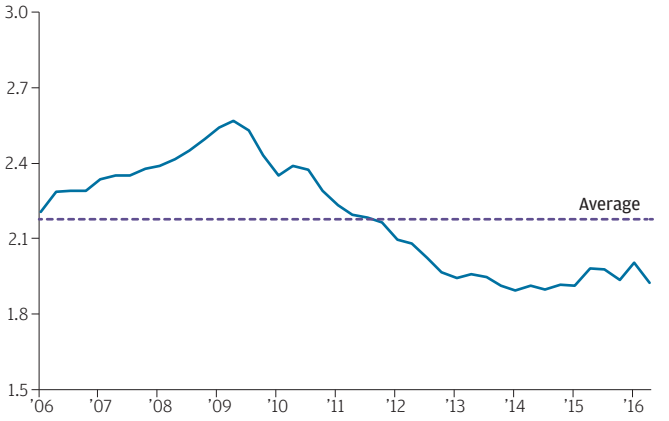


Source: Barclays, DJ Brookfield, FTSE, Standard & Poor's. Bond yields shown for Barclays U.S. Aggregate Corporate (BAA) Index; data as of June 30, 2016, except for DJ Brookfield and FTSE indices, which are as of July 12, 2016. Infrastructure indices represent publicly listed infrastructure companies.

At the sector level, multiple changes to fundamentals within the utility and contracted power segments are likely to gain traction. The utility regulatory cycle turned with the Great Recession as regulators put off authorizing capital expenditures to keep end-user rates low and affordable. We see seven to eight years of regulators' reluctance to authorize capital commitments giving way to new authorizations as the decreasing reliability of an aging physical infrastructure becomes an even more critical issue. We expect the pace of those upgrades, however, to be very slow, at least over the next couple of years (**Exhibit 18**).

Capital commitments in the utility sector should pick up, though slowly, after multi-year postponements

EXHIBIT 18: STATE AND LOCAL INVESTMENT IN CAPITAL PROJECTS AS A PERCENTAGE OF GDP (%)



Source: Bureau of Economic Analysis; data as of June 30, 2016.

A question worth considering is whether the segment's current business model—capital intensive, highly regulated, with a high dividend payout—is sustainable, especially in the face of falling demand. Disruptive technological advancements in the field of energy storage and the potential for development of municipality-controlled micro-grids could force the current model to give way to more economically feasible alternatives, but the impact is not likely to be felt until the later years of our 10- to 15-year assumptions time frame.

Outside of the U.S., the falling cost of debt over the past several years has allowed franchise operators to outperform regulator estimates of the cost of debt. With rising rates in the forecast, that component of outperformance is unlikely to be replicated going forward.

Within the contracted power segment (carbon-based or renewable), we see declining asset prices—precipitated by a cascade of falling natural gas, crude oil and electricity prices—stabilizing, based on our assumption of a gentle rise in overall commodity prices, including crude oil. As a consequence of the last five to seven years of price turbulence and subsequent write-downs, discount rates in the space can be expected to rise.

INFRASTRUCTURE DEBT

We view infrastructure debt as essentially an "A" credit (based on long-term credit loss statistics from rating agency data) but with a "BBB" yield. The extra spread above the extrapolated credit rating represents a premium demanded by investors for the relative illiquidity of infrastructure debt with more than seven years to maturity. The illiquidity spread emanates from the original sourcing of debt as project finance loans underwritten by banks and generally kept on their books. The increasing secondary market liquidity and secondary market issuance of these loans may eventually reduce the required illiquidity premium, but until there is broader investment experience with these strategies, the required illiquidity premium should remain somewhat elevated at approximately 100bps (**Exhibit 19**).

Infrastructure debt—an A rated credit with a BBB yield

EXHIBIT 19: RETURN ASSUMPTION AND BUILDING BLOCKS—GLOBAL INFRASTRUCTURE DEBT (%)

A rated credit total return assumption	3.25
Required illiquidity premium	1.00
Infrastructure debt return	4.25

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

COMMODITIES

Over the past year, commodity demand has expanded modestly while supply indicators have contracted sharply. The magnitude of the energy complex price rebound thus far in 2016 may overstate the supply and demand rebalancing of commodities in general, but most extraction industry gauges are pointing to an almost complete correction of past supply excesses (depending upon the individual commodity). Indeed, they are signaling not only nominal price gains but slight real gains vs. U.S. and global inflation, on average, over our 10- to 15-year assumptions time frame. Our 2017 long-term commodity compound annual return assumption of 3.75% represents a 75bps increase vs. our 2016 assumption and a 150bps return over U.S. inflation.

It is unlikely that the dynamic of the 2000-10 cycle can be re-created. A full replacement for the rapid growth of the large Chinese economy, its inclusion into the world trade network and its gravitational pull on global growth is just not on the horizon. Nevertheless, on balance, we believe that the corner has been turned on the past super cycle down leg, and the commencement of the old pattern of smaller, shallower cycles, similar to those prior to 2000, seems the most likely scenario. The wild cards remain geopolitical and regulatory risk and the scaling function needed to deliver higher commodity output in each successive mini cycle as the global economy changes in complexion and grows in absolute size.

The 2017 Long-Term Capital Market Assumptions downgrade of growth and inflation globally and particularly for China—the key absolute source of metals demand and the largest source of marginal energy demand—creates a forward trajectory of price expectations much less exciting than in the past up cycle.

Rapid growth in India and among aspiring emerging economies (assuming their experience will replicate the success of other emerging markets that have climbed the middle-income ladder) should add to the demand outlook. Our expectation on this score is restrained, however. As an offset, the Paris Agreement on climate change, if met, should exert downward pressure on traditional commodity usage as a combination of improving technology, local regulation and changing social attitudes continues to advance the cause of efficiency and slow the growth of demand. Regulatory attempts to constrict carbon and commodity production may also work to lift prices on the margin for some commodities.

While our assumptions are meant to imply that traditional cyclical patterns of demand and supply imbalances will be met by the normal economic capital and technology response, the next two cycles may see a less robust response to demand growth despite growing per capita emerging consumer demand. We expect the net result of lagging supply and growing global demand to be an investible index commodity return in excess of both U.S. and global inflation, rather than merely a match to inflation, as experienced over the long sweep of average commodity price history.

Building blocks of return

We build our assumption upon the long-term record of the Bloomberg Commodity Total Return Index (a collateralized, investible index). We start with our LTCMA for U.S. inflation (2.25% annually) and adjust for:

(1) the differential between the 25-year collateralized commodity index return and **inflation** in the U.S. (which we estimate netted to 0.00 for the 1991-2015 period, despite interim differentials)

(2) where we are in the current **commodity cycle**

(3) a **scaling effect** to account for the absolute increment in commodity usage of key marginal consumers (namely, emerging Asian economies)

(4) the inverse relationship between commodity returns and the **U.S. trade-weighted dollar**

(5) the potential contribution from **roll yields**

As in the past, we do not embed in our estimates pricing theories based on the economics of non-renewable resources in finite supply.

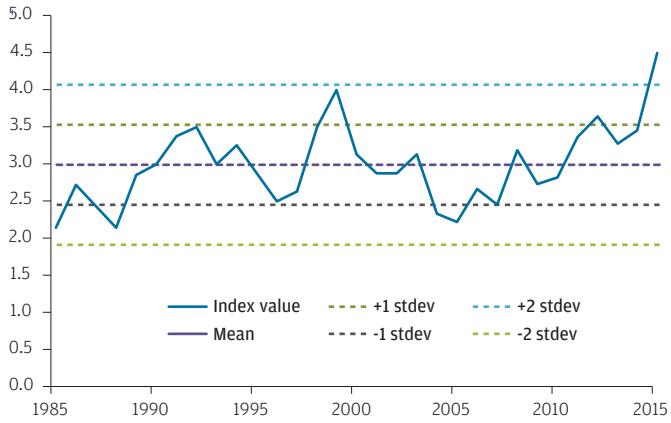
Current state of the commodity cycle

The multiple components of the commodity index are in various stages of demand/supply balance. Oil, in particular, has reached equilibrium sooner because the new marginal producer, U.S. shale, has adjusted more rapidly to changing price signals. Roving output disruptions, most notably in Iraq, Libya and Nigeria, have contributed to the near-term supply reduction. On the other hand, industrial metals dominated by China are earlier in the supply rationalization process because cutting output has implications for national employment and growth, not just profitability.

Rather than building the case for a cyclical turn commodity by commodity, we instead derive an "event," or change, index that seeks to judge the magnitude of this cycle's adjustments vs. those of past cycles. We believe the index's breakout (as seen in **Exhibit 20**) signals a complete retracing of past excesses and then some. We ascribe a modest 25bps increment to the base return, given our bottom-of-cycle starting point premise.

The Commodity Event Index, at more than 2 standard deviations above its mean, suggests the demand/supply adjustment is complete across much of the commodity complex

EXHIBIT 20: THE COMMODITY EVENT INDEX



COMMODITY EVENT INDEX COMPONENTS

The Commodity Event Index is designed to capture producer sentiment around the loosening/tightening of production constraints within commodity markets. Higher values indicate a more constrained environment, supportive of increasing commodity prices.

The event index utilizes equal-weighted, as available (inclusion date in parentheses), quintile data components for our universe of energy and materials companies, including:

Index component	Change in component	Impact on index value
Credit rating (1985)	lower	higher
Age of capital stock (1985)	older	higher
Financial leverage (1985)	higher	higher
Capital expenditure to sales (1985)	higher	higher
Oil rig count (1991)	lower	higher
Volume of bankruptcies, takeovers, debt-for-equity swaps (2004)	higher	higher
CEO turnover (2007)	higher	higher

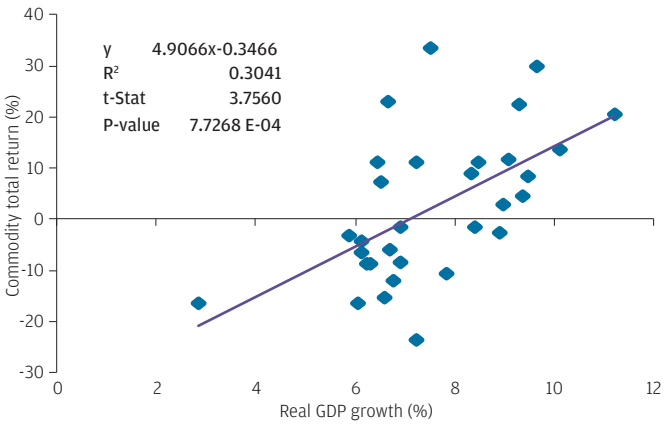
Source: Baker Hughes, Bloomberg, Bureau of Economic Analysis, J.P. Morgan Asset Management; data as of December 31, 2015.

The scaling function

In examining the price trend in commodities from 1985 through 2015, we find a strong, positive relationship between real growth in emerging and developing Asian economies and commodity returns (Exhibit 21). Our projection for emerging markets real growth, at 4.50%, remains robust relative to our 1.5% growth projection for developed markets. To account for the absolute increment in commodity demand from these key marginal consumers and the pressure it is likely to place on scaled down, last-cycle-shy producers, we add a directional adjustment of 25bps to our commodity return estimate.

Incremental demand from emerging markets is a key marginal driver of commodity returns

EXHIBIT 21: BLOOMBERG COMMODITY TOTAL RETURN INDEX VS. EMERGING AND DEVELOPING ASIA REAL GDP GROWTH (1985-2015)



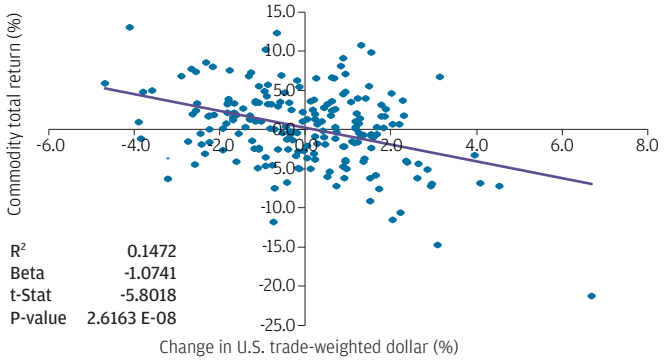
Source: Bloomberg, International Monetary Fund, J.P. Morgan Asset Management; data as of December 31, 2015.

U.S. trade-weighted dollar return projection

Even though the inverse relationship between the U.S. dollar (USD) and commodity prices is weaker from 1991 through 2016 (beta = -0.8080; R^2 = .0994) than from 2000 through 2016 (**Exhibit 22**), the negative beta is the defining relationship in both periods. We assign a -0.9 beta for the USD to the index relationship. Our projection is for a 1.00% annualized decline for the USD on a trade-weighted basis, adding an incremental 1.00% to our commodity return projection.

Our commodity return assumption is adjusted upward to reflect our projected 1.00% annualized decline for the U.S. dollar

EXHIBIT 22: REGRESSION OF BLOOMBERG COMMODITY TOTAL RETURN INDEX VS. U.S. TRADE-WEIGHTED DOLLAR (2000-16)



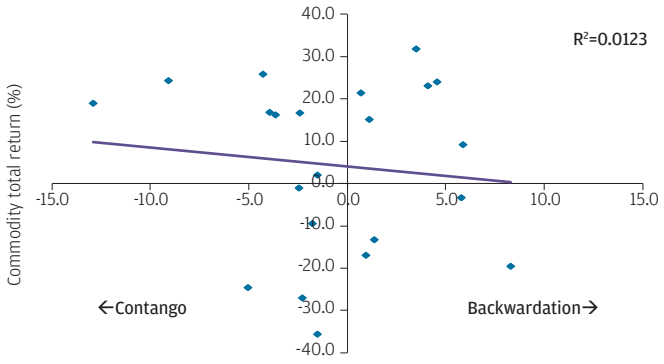
Source: Bloomberg, J.P. Morgan Asset Management; data as of May 31, 2016.

Roll yield

We find the return contribution from roll yields to be inconsistent and statistically negligible over time and assume no return contribution from this source (**Exhibit 23**).

We assume no contribution to commodity returns from roll yields

EXHIBIT 23: BLOOMBERG COMMODITY TOTAL RETURN INDEX—DEGREE OF BACKWARDATION VS. SUBSEQUENT ONE-YEAR RETURN (1994-2015)



Source: Bloomberg, J.P. Morgan Asset Management; data as of December 31, 2015.
The degree of backwardation (and contango) = (Bloomberg commodity index spot price minus 1-year-out futures contract price) as a percentage of Bloomberg commodity index spot price. By construction, positive readings are associated with backwardation and negative readings are associated with contango.

Assembling the pieces

Our 2017 commodity return projection (**Exhibit 24**) represents a tradable index assumption based upon the Bloomberg Commodity Total Return Index (31% energy, 16% precious metals, 17% industrial metals, 36% agricultural/livestock).

Our commodity return assumption is 1.5% in excess of inflation

EXHIBIT 24: TOTAL RETURN ASSUMPTION AND BUILDING BLOCKS—COMMODITIES (%)

U.S. inflation assumption	+2.25
Adjustment for historical 25-year investible index return above inflation	0.00
Position in current cycle premium/discount	+0.25
Scaling function adjustment	+0.25
USD decline impact (projected incremental annual decline vs. historical base period)	+1.00
Impact of roll yield	0.00
Commodity investible index return	**+3.75**

Source: J.P. Morgan Asset Management; estimates as of September 30, 2016.

GOLD

Gold constitutes approximately 11% of the Bloomberg Commodity Total Return Index, and as a result trends in gold demand in part reflect those of commodities in general. In addition, we estimate that the high growth, high per capita gold consumption countries, particularly India and China; marginal increments to central bank reserves; and positive but ephemeral developed market investor demand add a minimum of 25bps to the core commodity return assumption, for an estimated 4.00% return for gold.

Unwinding the overvalued dollar will take time

Michael Feser, CFA, *Portfolio Manager, Multi-Asset Solutions*
Jonathon Griggs, *Head of Applied Research, Global Fixed Income, Currency and Commodities*

IN BRIEF

- Volatility, resulting from a divergence in the speed of economic recoveries among developed countries, has driven exchange rates significantly away from their long-term equilibriums.
- The moves away from fair value have been short and sharp, suggesting that the cyclical realignment is already well advanced, although it may take several years for the trend to revert toward fair value.
- Long-term equilibriums point in the direction of future dollar weakness.
- Although the result of the Brexit referendum has adversely affected sterling's long-term fair value, we believe the currency's recent weakness in response to the Bank of England's easing represents an undershoot. Sterling has therefore ample room to rise over the assumptions horizon.

THE FAIR VALUE FRAMEWORK

As in prior years, we have determined the fair value exchange rates for G10 currencies through a relative purchasing power parity (PPP) approach, based on the long-term average of each currency's real exchange rate. According to relative PPP theory, exchange rates and goods prices will change over time in a way that maintains a constant ratio of each currency's domestic and foreign purchasing power. For emerging market currencies, we have adopted a somewhat different method. We use an absolute PPP-based approach to account for changing levels of relative GDP per capita over time. We calculate our initial fair value exchange rates from the absolute PPP exchange rates published by the International Comparisons Program and adjusted by GDP per capita levels published by the International Monetary Fund.[1]

The annualized compound rate of change expresses the difference between two currencies' current exchange rate and our estimate of their fair value exchange rate at the end of our assumptions horizon—for consistency we use 12½ years.

BUILDING BLOCKS–CURRENCY EXCHANGE RATES

A Developed markets

- Relative PPP, based on long-term average of each currency's real exchange rate
- Expected inflation rate differential among domestic economies
- Review qualitatively and adjust currencies selectively to ensure internal consistency and incorporate secular factors and trends that would otherwise not be captured
- The prevailing spot exchange rate level on September 30, 2016

B Emerging markets

- Starting fair value exchange rate based on the actual individual consumption estimates
- Expected future differentials of GDP-per-capita growth and inflation rates
- Review qualitatively and adjust currencies selectively to ensure internal consistency and incorporate secular factors and trends that would otherwise not be captured
- The prevailing spot exchange rate level on September 30, 2016

[1] These estimates are published with an 18- to 36-month lag, so we adjust them to today's level through consumer price index data from national sources and historical GDP-per-capita data from the International Monetary Fund's *World Economic Outlook*.

LONG-TERM CURRENCY EXCHANGE RATE ASSUMPTIONS

In last year's edition of our Long-Term Capital Market Assumptions (LTCMAs), we identified significant divergences in the cyclical positions of developed economies, together with the beginning of the end of zero interest rate policies and quantitative easing (QE) in the U.S., as triggers for an increase in overall exchange rate volatility and a significant move away from long-term fair value. We expect that several more years will likely have to pass before a broader-based reversal of the U.S. dollar's strength gains traction. Nevertheless, we expect that the cyclical divergences are close to their peak and the Federal Reserve (Fed) will have to carefully balance the trade-off between normalizing policy rates and an undesirably large appreciation of the U.S. dollar. As a result, a number of exchange rates have moved sideways or have rebounded to an extent from their prior weakening over the last year (**Exhibit 1**). Sterling, impaired by Brexit fears, was the exception to this trend—it weakened significantly in the aftermath of the June 23 UK referendum.

For emerging economies, the overall outlook is more mixed. The exchange rate adjustment process is very well advanced in some cases, but the reforms required for sustained recovery from the cyclical economic slowdown are unfolding only very gradually. Additionally, elevated inflation continues to constrain monetary policy options, even if the Fed's slow-moving normalization process limits the strain on global liquidity.

Euro

The expansion of QE by the European Central Bank (ECB), along with the ECB's foray into negative interest rate policies earlier this year, is just one more sign of how much the policy toolbox of the major central banks has changed. They have turned to what were considered to be primarily hypothetical monetary policy tools before the global financial crisis to create financial accommodation far more extensive than hitherto thought possible. The tools have brought about a significant reduction in funding costs that has begun to materially improve the fiscal position of the EU region's governments, even though the cyclical economic recovery has been much slower.

Brexit, the refugee and immigration crisis, and upcoming elections in France and Germany are replacing economic uncertainty with political uncertainty as the eurozone's largest near-term concern, further distracting attention from institution-building and domestic reform. The political uncertainties, together with an ECB that is willing to provide further easing if needed, make it only to be expected that the euro trades well below fair value, virtually unchanged from

The foreign exchange rate forecast has not changed much since the last edition of LTCMAs, but it is increasingly pointing toward future U.S. dollar weakness

EXHIBIT 1: ASSUMPTIONS FOR SELECTED CURRENCY EXCHANGE RATES

(According to market convention, CURRENCY A/CURRENCY B means one unit of CURRENCY A is worth the stated number of units of CURRENCY B. EUR/USD = 1.30 means EUR 1.00 is worth USD 1.30.)

Currency		Current levels (September 30, 2016)	2017 Per annum % change from current*	2017 FX rates assumptions	2016 FX rates assumptions
Euro	EUR/USD	1.12	+1.25	1.31	1.34
Japanese yen	USD/JPY	101	-1.00	89	110
Swiss franc	USD/CHF	0.97	-0.75	0.88	0.92
Sterling	GBP/USD	1.30	+1.25	1.52	1.60
Canadian dollar	USD/CAD	1.31	-1.25	1.12	1.15
Australian dollar	AUD/USD	0.77	-0.25	0.74	0.70
Brazilian real	USD/BRL	3.26	+1.50	3.94	4.13
Mexican peso	USD/MXN	19.44	-1.25	16.65	18.00

Source: J.P. Morgan, Bloomberg; estimates as of September 30, 2016.

*For consistency and ease of conversion, we have assumed that the forecast horizon for the per annum change in percentage terms is 12.5 years.

last year at EUR/USD 1.12 as of the end of September. Toward the latter half of the assumptions horizon, however, we expect that the eurozone's current account surplus and lower levels of inflation than in the U.S. will result in an appreciation of the euro by 1.25% annually to the equivalent of a EUR/USD 1.31 exchange rate.

Japanese yen

As the narrow scope and restricted impact of the Abenomics "third arrow" deregulation agenda have become more apparent, the monetary policy arrow has become ever more critical to stimulating the Japanese economy. Yet the Bank of Japan has repeatedly failed to live up to the market's lofty expectations for further easing and breaking new ground through a higher degree of coordination between fiscal and monetary policy. As a result, the yen has unwound a significant portion of its recent weakness. Even with the currency's appreciation, however, its current level remains significantly below the long-term average in real terms.

While it remains to be seen whether Japan's current corporate profit levels are sustainable, record overall employment implies an economy closer to full capacity than recent GDP growth figures might suggest. Achieving inflation closer to the 2% target could therefore take a lower priority, even if a prolonged period of financial repression through extensive QE will still be necessary to erode Japan's high level of sovereign debt. We therefore expect the yen to trade closer to fair value and lower our exchange rate estimate over the LTCMA horizon for USD/JPY from 110 to 89.

Swiss franc

The Swiss franc has traded in the narrow range it entered after the short-term surge following the Swiss National Bank's surprise announcement that it would no longer maintain its cap relative to the euro. The Swiss franc has now settled in just above our long-term fair value estimate. Over the LTCMA horizon, we expect the Swiss franc to continue to benefit from a relatively more benign inflation outlook than the U.S., suggesting a rise at a long-term annualized rate of 0.75% against the dollar to USD/CHF 0.88.

Sterling

The unexpected outcome of the UK's European Union referendum upended foreign exchange markets, which bore the brunt of the realignment and ongoing anxiety about the longer-term consequences of Brexit. After the vote, the perceived increase of recession risk and a much shallower path for monetary policy rates in the UK relative to the U.S. drove the pound down to GBP/USD 1.30. A more muted longer-term outlook for growth well after Brexit suggests to us that the fair value for the pound has indeed fallen to some extent from the 1.60 we had it at in our last edition. Taking into account the current depressed levels, however, this still implies a considerable rise to reach our exchange rate assumption of GBP/USD 1.52.

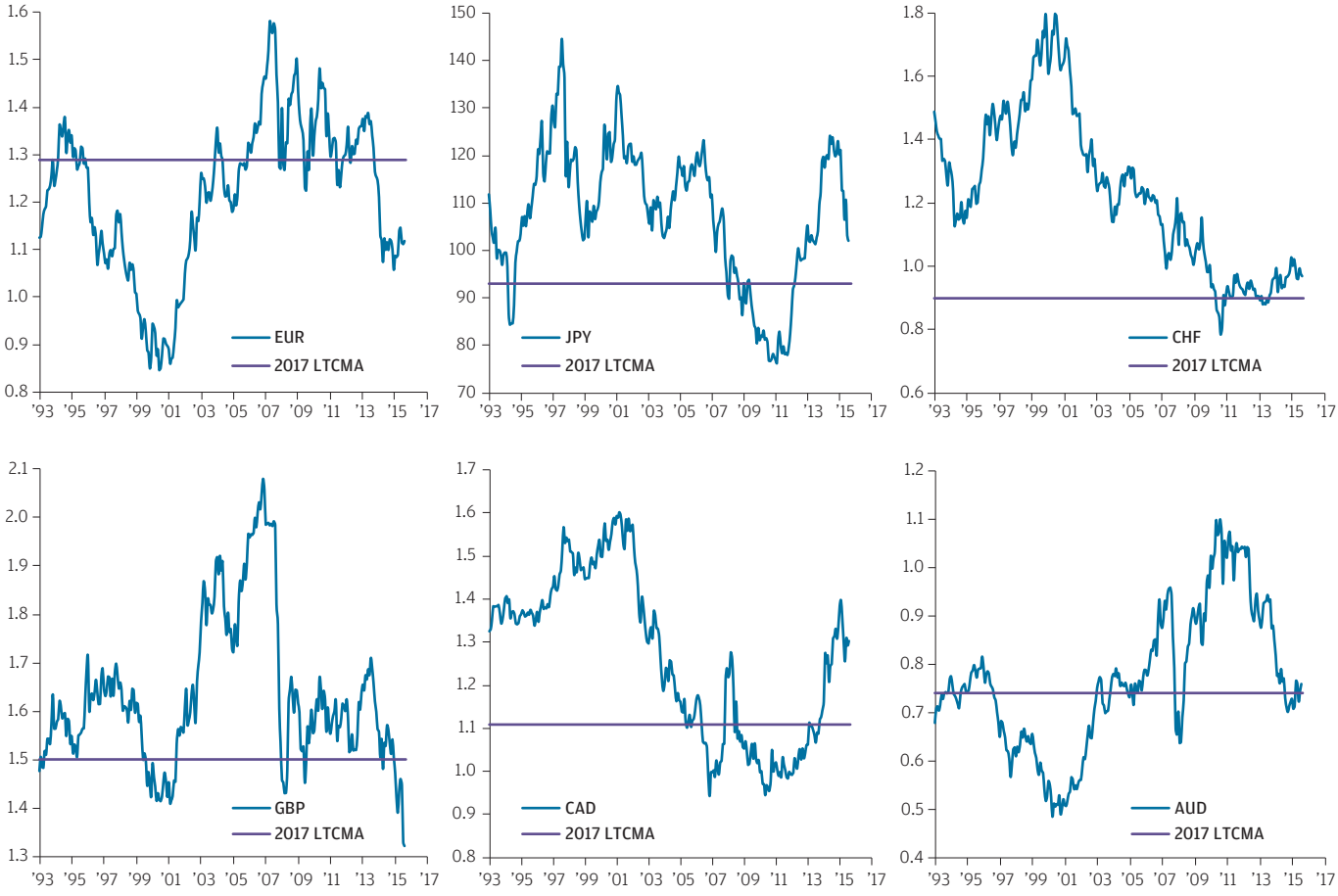
Commodity currencies

With commodity prices bottoming out, the Canadian dollar has recovered from some of its prior underperformance relative to the U.S. dollar. Nevertheless, there is still considerable need for domestic rebalancing in an economy that has accumulated large amounts of household credit. House prices are elevated and core inflation is high. As with the euro, the Canadian dollar may therefore have to trade at a reasonable discount relative to fair value for some time longer before starting a broader cyclical recovery. In fact, the loonie continues to trade well below our long-term fair value assumption of USD/CAD 1.12, and we therefore expect it to appreciate by 1.25% per annum.

Given its exposure to the Chinese economic slowdown, elevated house prices and sensitivity to a change in the U.S. rate cycle, the Australian dollar has traded in a surprisingly narrow range, near its 2003 levels and closely in line with our long-term assumption of AUD/USD 0.74. We still believe a near-term overshoot to the downside is likely, similar to that already experienced by the Canadian dollar.

In Brazil, the focus is finally shifting toward dealing with the political and economic fallout from the drop in commodity prices and moving on to undertake policy changes to end the cyclical downturn and poor inflation trajectory. Currency markets, however, seem to have discounted a substantially higher level of progress than what we consider sustainable over the LTCMA forecast horizon. We therefore expect a much weaker Brazilian real falling to a rate of USD/BRL 3.94 vs. the current spot level of 3.26.

SELECTED EXCHANGE RATE HISTORIES RELATIVE TO 2017 LTCMAs



Source: Bloomberg, J.P. Morgan Asset Management; data as of September 30, 2016.

Moving toward a (slightly) more volatile future

Grace Koo, PhD, *Quantitative Analyst and Portfolio Manager, Multi-Asset Solutions*

IN BRIEF

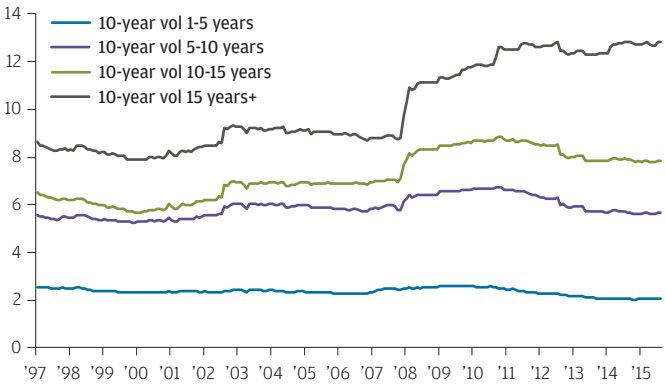
- Volatility forecasts are marginally higher this year for most asset classes, which is unsurprising given the two market corrections and the unexpected Brexit vote experienced in the last 12 months.
- Along with the broad decline in expected returns for asset classes across the risk spectrum, risk-adjusted returns have been lowered once again in this year's Long-Term Capital Market Assumptions.
- Credit continues to steal the spotlight as one of the most attractive risk-adjusted asset classes, along with alternatives for investors that are willing to bear the illiquidity premium.
- Government bond risks are no longer compensated as the duration premium erodes, with Sharpe ratios at or below zero.

EXPECT HIGHER VOLATILITY FOR SHORT-DURATION INSTRUMENTS AND HIGHER QUALITY CREDITS

Volatility will likely be higher for short-duration instruments as quantitative easing (QE) unwinds, and for higher quality credits as corporate behavior evolves. The unconventional central bank policies of recent years are creating unusually low volatility in fixed income markets, especially in the short end of the curve. **Exhibit 1** shows the historical 10-year rolling volatility by bond maturity. The bottom line (in blue) highlights this distortion, with volatility breaking its historical range. Our volatility assumptions incorporate normalizing volatility levels for short-duration instruments to reflect the gradual removal of QE and other central bank stimulus measures over our forecast horizon.

Volatility is unusually low at the short end of the Treasury curve

EXHIBIT 1: ROLLING 10-YEAR HISTORICAL VOLATILITY BASED ON MONTHLY DATA (%)



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data from December 1997 to July 2016.

Selective credit markets are also likely to experience higher volatility over the forecast horizon. The investment grade corporate bond market has been experiencing a gradual decline in quality over the past decade. **Exhibit 2** shows the composition of the investment grade corporate bond market over time. With cheap financing readily available for a wide spectrum of borrowers, including those with relatively lower quality balance sheets and a poorer ability to pay, companies have little incentive to pursue the elite rating status. AAA rated companies have become a rarity, and the majority of U.S. investment grade bonds are now BBB rated vs. A rated in the early 2000s. A similar decline in credit quality is observed in Europe as well.

Corporates are also lengthening the maturity of their new issuance to lock in low rates. We do not expect a change in these behaviors as rates stay low relative to history and credit remains the bright spot in the fixed income market, generating solid demand. As a result, the volatility of investment grade credits is expected to be higher than history. We see a similar deterioration in credit quality in the leveraged loan market, with an increase in issuance by lower-rated companies and an increase in loans with fewer investor protections, and thus we forecast leveraged loan volatility to be higher than historical levels.

Our volatility and correlation methodology anchors off historical experiences

Long-term asset class volatilities and correlations tend to exhibit stability when measured over multiple cycles. As such, we use the following estimation process for the main asset classes:

1. **Monthly historical return data**
   - The starting point for our forward-looking risk forecasts in the capital market assumption process
2. **Filter data outliers**
   - Raw data is winsorized to improve robustness
3. **Construct anchor matrix**
   - Variance-covariance is calculated using the filtered data set
4. **Adjustment for key themes and structural changes**
   - Key themes and structural changes that are expected in the forecast horizon, such as those highlighted in this article, are reflected in the long-term risk forecast accordingly

This year's capital market assumption matrix includes the monthly volatilities annualized by the widely used square root of 12 factor. We continue to recommend the use of annualized volatilities based on log-returns for the appropriate users, such as those focused on simulations and other algorithms. Our 2015 Long-Term Capital Market Return Assumptions publication contains more details on our volatility and correlation methodology.[1]

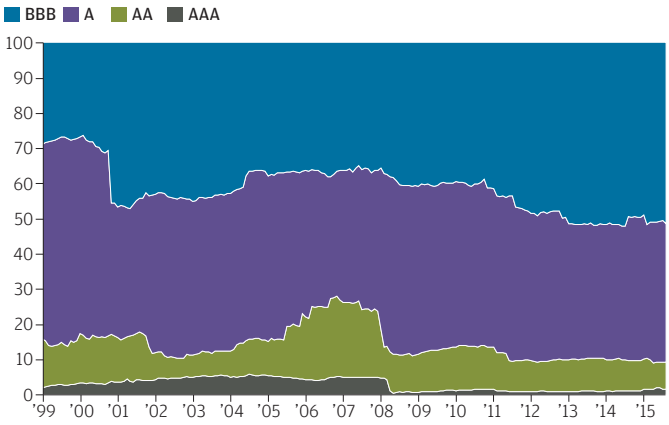
A look into hedge fund volatility: Standard hedge fund return indices such as HFRI may be a good measure of industry-wide performance. However, most hedge fund allocators hold about 15 to 25 funds. The broad industry composite return diversifies away most of the idiosyncratic (or uncorrelated) returns and therefore underestimates the volatility of hedge fund investments for typical investors. To address this, we use a random bootstrapping method to create 1,000 unique, equally weighted portfolios containing three to five funds. Volatility is then estimated for the portfolios using up to 10 years of monthly return history. We analyze the distribution of the 1,000 volatility estimates to create volatility projections. For further details, please see our publication "Focusing on hedge fund volatility: Keeping alpha with the beta."

[1] See "Creating more robust forward-looking risk statistics," Daniel Scansaroli and Michael Feser, J.P. Morgan Asset Management Long-Term Capital Market Return Assumptions 2015.

Investment grade credit markets are declining in quality, and maturities are lengthening

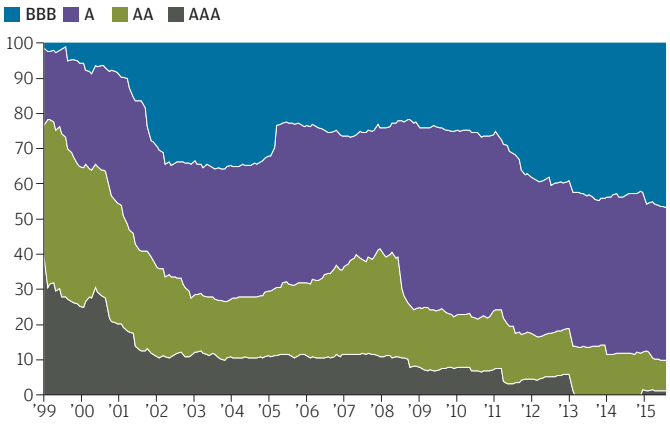
EXHIBIT 2: EVOLUTION OF THE INVESTMENT GRADE CORPORATE BOND MARKET

Market share by credit rating for U.S. corporate investment grade



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data from December 1999 to July 2016.

Market share by credit rating for European corporate investment grade



Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data from December 1998 to July 2016.

An increase in emerging market debt (EMD) volatility relative to history is consistent with our gradually declining outlook for emerging markets. The EMD market experienced a boost in the past decade as the ratings of many emerging countries migrated from below investment grade to investment grade. This tailwind is no longer in place and may partially reverse (**Exhibit 3**). Along with headwinds such as deleveraging, volatility is likely to be higher than historical levels for the asset class.

The tailwinds behind the drop in EMD volatility may partially reverse

EXHIBIT 3: EMD ROLLING 10-YEAR HISTORICAL VOLATILITY BASED ON MONTHLY DATA (%)

Source: J.P. Morgan Securities LLC, J.P. Morgan Asset Management; data from December 1999 to July 2016.

Not all roads lead to an increase in volatility relative to historical standards in credit markets. European high yield, for example, is expected to be less volatile in the future, as the quality of the market has improved in recent years and fallen angels are expected to regain their investment grade status over the forecast horizon.

LITTLE CHANGE IN EQUITY VOLATILITY, FOR MOST

Equity volatility is expected to be broadly in line with history, in our view, with the exception of European equities for dollar investors, where volatility is expected to be lower. The historical long-run co-movement (based on 10 years of monthly data) between European currencies and their respective equity markets may be higher than expected in the future. A number of crises have hit the European region over the past decade, creating bearish sentiment and sparking outflows from both the region's equity and foreign exchange markets. Shorter-term measures also suggest a more normalized co-movement behavior, and we concur. This translates to lower volatility for U.S. dollar investors investing into European/UK equities relative to history. The U.S. REITs market also experienced an extreme crisis in recent history, which we do not expect to reoccur in our forecast horizon. Historical volatility of U.S. REITs would therefore overstate the likely future volatility, in our opinion.

III. ASSUMPTIONS MATRICES

HOW TO USE THE NUMBERS

Our assumptions can be used to:

- Develop or review a strategic asset allocation
- Understand the risk and return trade-offs across and within asset classes and regions
- Assess the risk characteristics of a strategic asset allocation
- Review relative value allocation decisions

The assumptions are not designed to inform short-term tactical allocation decisions. Our assumptions process is carefully calibrated and constructed to aid investors with strategic asset allocation or policy-level decisions over a 10- to 15-year investment horizon.

U.S. DOLLAR ASSUMPTIONS

Note: All estimates on this page are in U.S. dollar terms. Given the complex risk-reward trade-offs involved, we advise clients to rely on judgment as well as quantitative optimization approaches in setting strategic allocations to all of these asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on this information is not advised. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Note that these asset class and strategy assumptions are passive only-they do not consider the impact of active management. References to future returns are not promises or even estimates of actual returns a client portfolio may achieve. Assumptions, opinions and estimates are provided for illustrative purposes only. They should not be relied upon as recommendations to buy or sell securities. Forecasts of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. We believe the information provided here is reliable, but do not warrant its accuracy or completeness. This material has been prepared for information purposes only and is not intended to provide, and should not be relied on for, accounting, legal or tax advice.

		Compound Return 2016 (%)	Annualized Volatility	Arithmetic Return 2017 (%)	Compound Return 2017 (%)	Inflation	U.S. Cash	U.S. Intermediate Treasuries	U.S. Long Treasuries	TIPS	U.S. Aggregate Bonds	U.S. Short Duration Government/Credit	U.S. Long Duration Government/Credit	U.S. Inv Grade Corporate Bonds	U.S. Long Corporate Bonds	U.S. High Yield Bonds	U.S. Leveraged Loans	World Government Bonds hedged	World Government Bonds	World ex-U.S. Government Bonds hedged	World ex-U.S. Government Bonds	Emerging Markets Sovereign Debt	Emerging Markets Local Currency Debt	Emerging Markets Corporate Bonds	U.S. Muni 1-15-Yr Blend	U.S. Muni High Yield	U.S. Large Cap	U.S. Mid Cap	U.S. Small Cap	U.S. Large Cap Value	U.S. Large Cap Growth	Euro Area Large Cap	Japanese Equity	Hong Kong Equity	UK Large Cap	EAFE Equity hedged	EAFE Equity	Emerging Markets Equity	AC Asia ex-Japan Equity	AC World Equity	Private Equity	U.S. Core Direct Real Estate	U.S. Value-Added Real Estate	European ex-UK Prime Direct Real Estate	Asia Pacific Core Direct Real Estate	U.S. REITs	Global Direct Infrastructure Equity	Global Infrastructure Debt	Diversified Hedge Funds	Event Driven Hedge Funds	Equity Long Bias Hedge Funds	Relative Value Hedge Funds	Macro Hedge Funds	Direct Lending	Commodities	Gold
FIXED INCOME	Inflation	2.25	2.26	1.25	2.25	1.00																																																				
	U.S. Cash	2.00	2.00	0.50	2.25	0.08	1.00																																																		
	U.S. Intermediate Treasuries	2.25	2.44	6.25	3.00	-0.20	0.09	1.00																																																
	U.S. Long Treasuries	2.00	2.81	13.00	2.50	-0.26	0.03	0.91	1.00																																															
	TIPS	3.50	3.66	5.75	2.75	0.05	0.07	0.66	0.50	1.00																																													
	U.S. Aggregate Bonds	3.00	3.06	3.50	3.75	-0.15	0.09	0.87	0.77	0.78	1.00																																												
	U.S. Short Duration Government/Credit	3.25	3.26	1.75	3.75	-0.11	0.41	0.62	0.39	0.66	0.74	1.00																																										
	U.S. Long Duration Government/Credit	3.25	3.66	9.25	4.25	-0.20	-0.02	0.82	0.88	0.65	0.91	0.49	1.00																																									
	U.S. Inv Grade Corporate Bonds	3.25	3.44	6.25	4.25	-0.13	-0.05	0.48	0.43	0.64	0.82	0.59	0.78	1.00																																								
	U.S. Long Corporate Bonds	3.75	4.25	10.25	4.75	-0.17	-0.07	0.52	0.56	0.57	0.80	0.46	0.88	0.96	1.00																																							
	U.S. High Yield Bonds	5.75	6.13	9.00	6.75	0.13	-0.10	-0.23	-0.30	0.31	0.19	0.14	0.11	0.58	0.47	1.00																																						
	U.S. Leveraged Loans	5.00	5.16	5.75	5.25	0.21	-0.12	-0.35	-0.32	0.07	0.00	-0.13	0.02	0.37	0.34	0.78	1.00																																						
	World Government Bonds hedged	1.75	1.79	3.00	2.75	-0.29	0.09	0.88	0.85	0.52	0.80	0.57	0.79	0.50	0.55	-0.21	-0.34	1.00																																						
	World Government Bonds	2.00	2.21	6.50	2.75	-0.04	0.12	0.60	0.44	0.66	0.68	0.67	0.56	0.56	0.52	0.17	-0.12	0.55	1.00																																						
	World ex-U.S. Government Bonds hedged	1.75	1.79	3.00	2.50	-0.29	0.05	0.75	0.75	0.42	0.72	0.48	0.73	0.48	0.53	-0.16	-0.29	0.97	0.49	1.00																																						
	World ex-U.S. Government Bonds	2.00	2.31	8.00	2.50	0.00	0.10	0.48	0.32	0.60	0.59	0.61	0.47	0.53	0.48	0.25	-0.05	0.44	0.99	0.39	1.00																																					
	Emerging Markets Sovereign Debt	5.50	5.95	9.75	6.50	-0.02	-0.02	0.24	0.11	0.57	0.57	0.45	0.47	0.75	0.66	0.72	0.46	0.25	0.53	0.26	0.55	1.00																																				
	Emerging Markets Local Currency Debt	6.50	7.25	12.75	7.00	0.11	0.13	0.11	-0.03	0.45	0.38	0.40	0.28	0.55	0.47	0.62	0.37	0.11	0.58	0.11	0.63	0.81	1.00																																			
	Emerging Markets Corporate Bonds	5.50	5.84	8.50	6.50	0.04	-0.06	0.11	-0.02	0.49	0.50	0.44	0.38	0.78	0.66	0.75	0.52	0.10	0.42	0.12	0.45	0.89	0.73	1.00																																			
	U.S. Muni 1-15-Yr Blend	2.50	2.54	3.00	3.25	-0.09	0.02	0.50	0.45	0.52	0.64	0.43	0.55	0.56	0.51	0.25	0.07	0.50	0.39	0.48	0.34	0.48	0.23	0.37	1.00																																			
	U.S. Muni High Yield	4.25	4.48	7.00	5.50	0.19	-0.13	0.02	0.01	0.29	0.25	0.03	0.22	0.37	0.31	0.44	0.35	0.06	0.03	0.09	0.04	0.40	0.19	0.38	0.56	1.00																																		
EQUITIES	U.S. Large Cap	6.25	7.25	14.75	7.00	0.06	-0.06	-0.30	-0.36	0.06	0.00	-0.04	-0.04	0.28	0.23	0.70	0.61	-0.25	0.15	-0.19	0.23	0.54	0.62	0.57	-0.01	0.21	1.00																																	
	U.S. Mid Cap	6.75	8.03	16.75	7.25	0.08	-0.08	-0.31	-0.37	0.08	0.00	-0.04	-0.04	0.31	0.25	0.75	0.65	-0.28	0.11	-0.21	0.19	0.55	0.61	0.58	0.02	0.23	0.96	1.00																																
	U.S. Small Cap	7.00	8.67	19.25	7.25	0.07	-0.07	-0.33	-0.39	0.00	-0.08	-0.10	-0.10	0.22	0.17	0.68	0.60	-0.30	0.06	-0.24	0.14	0.46	0.57	0.49	-0.05	0.13	0.91	0.95	1.00																															
	U.S. Large Cap Value	6.25	7.32	15.25	7.25	0.06	-0.06	-0.30	-0.35	0.04	0.00	-0.03	-0.03	0.28	0.24	0.69	0.59	-0.24	0.16	-0.17	0.24	0.53	0.62	0.56	-0.02	0.19	0.98	0.95	0.92	1.00																															
	U.S. Large Cap Growth	6.25	7.25	14.75	6.75	0.08	-0.06	-0.31	-0.38	0.09	-0.01	-0.04	-0.06	0.28	0.22	0.72	0.63	-0.28	0.12	-0.22	0.20	0.54	0.59	0.56	0.00	0.23	0.98	0.96	0.90	0.93	1.00																															
	Euro Area Large Cap	7.25	9.00	19.75	8.50	0.05	0.04	-0.24	-0.33	0.14	0.07	0.12	0.00	0.36	0.28	0.70	0.59	-0.22	0.32	-0.17	0.39	0.62	0.70	0.62	0.02	0.16	0.86	0.84	0.77	0.85	0.85	1.00																														
	Japanese Equity	5.75	6.82	15.25	6.50	0.02	-0.08	-0.22	-0.23	0.11	0.07	0.05	0.07	0.38	0.33	0.60	0.53	-0.19	0.16	-0.14	0.22	0.49	0.57	0.55	-0.01	0.13	0.69	0.68	0.63	0.68	0.68	0.70	1.00																													
	Hong Kong Equity	7.50	9.69	22.25	-	-0.01	0.09	-0.17	-0.26	0.17	0.14	0.16	0.09	0.45	0.39	0.64	0.52	-0.16	0.23	-0.12	0.29	0.62	0.70	0.65	0.04	0.22	0.68	0.66	0.60	0.66	0.70	0.73	0.62	1.00																											
	UK Large Cap	7.50	8.80	17.00	7.75	0.10	0.00	-0.32	-0.39	0.12	0.04	0.05	-0.02	0.38	0.30	0.74	0.63	-0.29	0.25	-0.24	0.33	0.61	0.68	0.65	0.02	0.29	0.86	0.83	0.74	0.84	0.86	0.91	0.71	0.79	1.00																											
	EAFE Equity hedged	6.50	7.47	14.50	7.75	0.01	-0.03	-0.36	-0.37	-0.02	-0.03	-0.07	-0.03	0.32	0.28	0.70	0.68	-0.27	-0.02	-0.19	0.04	0.54	0.56	0.59	-0.02	0.25	0.89	0.87	0.80	0.87	0.88	0.88	0.79	0.74	0.88	1.00																											
	EAFE Equity	6.75	7.95	16.25	7.75	0.06	0.01	-0.25	-0.33	0.16	0.09	0.11	0.04	0.42	0.35	0.75	0.62	-0.22	0.31	-0.17	0.39	0.66	0.74	0.68	0.03	0.21	0.89	0.87	0.79	0.87	0.88	0.97	0.81	0.80	0.95	0.92	1.00																											
	Emerging Markets Equity	9.25	11.45	22.50	10.00	0.08	0.08	-0.20	-0.29	0.25	0.13	0.18	0.06	0.44	0.35	0.73	0.55	-0.19	0.32	-0.15	0.40	0.69	0.81	0.70	0.05	0.26	0.77	0.79	0.71	0.75	0.79	0.82	0.65	0.89	0.83	0.76	0.87	1.00																											
	AC Asia ex-Japan Equity	9.25	11.36	22.00	10.25	0.01	0.07	-0.17	-0.25	0.24	0.15	0.18	0.10	0.47	0.39	0.72	0.55	-0.15	0.29	-0.10	0.35	0.67	0.77	0.69	0.06	0.25	0.75	0.76	0.69	0.73	0.77	0.80	0.65	0.92	0.80	0.77	0.85	0.98	1.00																											
	AC World Equity	6.75	7.88	15.75	7.50	0.07	-0.01	-0.28	-0.36	0.14	0.05	0.06	0.00	0.38	0.31	0.76	0.63	-0.25	0.26	-0.19	0.34	0.64	0.73	0.67	0.02	0.23	0.96	0.94	0.87	0.94	0.95	0.94	0.77	0.81	0.94	0.92	0.98	0.90	0.87	1.00																											
ALTERNATIVES	Private Equity	8.00	9.86	20.50	8.50	0.07	-0.02	-0.25	-0.32	0.10	0.03	0.03	-0.01	0.31	0.25	0.65	0.56	-0.22	0.19	-0.18	0.25	0.52	0.58	0.54	0.02	0.20	0.81	0.82	0.76	0.80	0.81	0.80	0.62	0.63	0.79	0.78	0.82	0.72	0.70	0.84	1.00																											
	U.S. Core Direct Real Estate	5.50	6.04	10.75	5.50	-0.01	-0.03	-0.04	-0.06	0.05	0.05	0.00	0.03	0.11	0.10	0.24	0.18	-0.02	0.08	0.00	0.10	0.19	0.22	0.16	0.05	0.08	0.30	0.31	0.31	0.31	0.31	0.29	0.26	0.20	0.18	0.23	0.26	0.22	0.21	0.28	0.25	1.00																											
	U.S. Value-Added Real Estate	7.00	7.87	13.75	7.25	-0.01	-0.03	-0.04	-0.07	0.04	0.04	-0.01	0.03	0.12	0.10	0.25	0.19	-0.02	0.08	0.00	0.10	0.20	0.24	0.16	0.05	0.08	0.33	0.34	0.34	0.34	0.31	0.28	0.22	0.19	0.25	0.28	0.28	0.23	0.23	0.30	0.27	0.95	1.00																											
	European ex-UK Prime Direct Real Estate	6.25	7.22	14.50	5.50	-0.02	0.00	-0.20	-0.19	-0.08	-0.08	-0.09	-0.08	0.05	0.03	0.28	0.29	-0.17	-0.08	-0.13	-0.05	0.17	0.18	0.18	-0.04	0.08	0.40	0.40	0.39	0.39	0.40	0.40	0.30	0.27	0.37	0.45	0.39	0.30	0.30	0.39	0.35	0.30	0.30	1.00																											
	Asia Pacific Core Direct Real Estate	5.50	6.07	11.00	-	-0.01	0.05	-0.15	-0.15	-0.02	-0.07	-0.05	-0.06	0.04	0.03	0.23	0.19	-0.12	0.05	-0.10	0.08	0.14	0.26	0.10	-0.07	0.04	0.33	0.33	0.32	0.32	0.34	0.32	0.25	0.36	0.31	0.32	0.33	0.39	0.40	0.36	0.29	0.40	0.39	0.21	1.00																											
	U.S. REITs	6.00	7.32	17.00	6.00	-0.05	-0.07	0.01	-0.03	0.21	0.25	0.07	0.23	0.43	0.41	0.63	0.48	0.06	0.28	0.10	0.31	0.56	0.60	0.48	0.20	0.23	0.75	0.77	0.76	0.77	0.70	0.65	0.53	0.49	0.60	0.64	0.67	0.57	0.57	0.71	0.63	0.40	0.43	0.32	0.29	1.00																											
	Global Direct Infrastructure Equity	6.25	6.89	11.75	6.50	0.10	-0.01	-0.09	-0.12	0.03	0.00	-0.02	-0.02	0.08	0.06	0.22	0.20	-0.09	0.05	-0.07	0.07	0.16	0.20	0.17	0.00	0.08	0.30	0.30	0.28	0.30	0.29	0.26	0.20	0.19	0.26	0.26	0.27	0.23	0.22	0.29	0.25	0.30	0.29	0.16	0.17	0.26	1.00																											
	Global Infrastructure Debt	4.25	4.39	5.50	-	-0.07	-0.05	0.51	0.48	0.67	0.81	0.56	0.77	0.92	0.88	0.47	0.30	0.52	0.46	0.50	0.42	0.64	0.37	0.66	0.61	0.42	0.09	0.12	0.03	0.07	0.11	0.15	0.19	0.28	0.21	0.14	0.21	0.25	0.28	0.17	0.14	0.03	0.03	-0.04	-0.05	0.24	0.02	1.00																											
	Diversified Hedge Funds	3.50	3.70	6.50	4.25	0.20	0.09	-0.40	-0.42	0.06	-0.11	-0.07	-0.12	0.22	0.16	0.60	0.59	-0.37	-0.05	-0.31	0.02	0.36	0.40	0.45	-0.07	0.38	0.66	0.69	0.59	0.61	0.72	0.66	0.60	0.62	0.73	0.75	0.72	0.69	0.67	0.73	0.61	0.13	0.14	0.31	0.27	0.34	0.20	0.16	1.00																											
	Event Driven Hedge Funds	4.75	5.09	8.50	6.00	0.24	0.00	-0.45	-0.51	0.07	-0.10	-0.04	-0.14	0.29	0.20	0.78	0.69	-0.41	0.05	-0.34	0.13	0.49	0.55	0.60	-0.05	0.39	0.80	0.83	0.76	0.79	0.82	0.77	0.66	0.70	0.84	0.81	0.83	0.79	0.76	0.85	0.73	0.21	0.22	0.34	0.29	0.52	0.25	0.17	0.88	1.00																											
	Equity Long Bias Hedge Funds	4.50	5.02	10.50	5.50	0.15	0.01	-0.42	-0.49	0.09	-0.07	0.00	-0.13	0.31	0.22	0.75	0.65	-0.40	0.11	-0.33	0.20	0.54	0.64	0.63	-0.06	0.29	0.86	0.89	0.82	0.83	0.89	0.84	0.72	0.80	0.88	0.86	0.90	0.89	0.87	0.93	0.78	0.22	0.24	0.36	0.35	0.56	0.26	0.14	0.87	0.94	1.00																											
	Relative Value Hedge Funds	4.25	4.47	6.75	5.25	0.26	-0.01	-0.38	-0.44	0.16	0.02	0.03	-0.04	0.42	0.31	0.84	0.76	-0.35	0.02	-0.29	0.10	0.57	0.55	0.66	0.07	0.51	0.68	0.73	0.63	0.66	0.71	0.69	0.63	0.69	0.78	0.76	0.76	0.76	0.74	0.77	0.65	0.17	0.18	0.29	0.25	0.45	0.22	0.34	0.85	0.93	0.87	1.00																											
	Macro Hedge Funds	4.00	4.27	7.50	5.00	-0.10	0.17	0.07	0.07	0.25	0.18	0.26	0.17	0.26	0.23	0.16	0.03	0.14	0.30	0.16	0.31	0.22	0.32	0.20	0.09	0.14	0.21	0.21	0.12	0.17	0.24	0.28	0.23	0.27	0.30	0.24	0.32	0.37	0.34	0.31	0.23	0.03	0.04	0.08	0.13	0.12	0.05	0.20	0.54	0.31	0.38	0.29	1.00																											
	Direct Lending	6.75	7.19	9.75	-	-0.05	-0.08	0.34	0.30	0.60	0.73	0.52	0.68	0.97	0.91	0.69	0.48	0.37	0.47	0.37	0.46	0.77	0.56	0.80	0.54	0.44	0.33	0.37	0.28	0.32	0.34	0.39	0.40	0.49	0.44	0.37	0.45	0.49	0.51	0.43	0.35	0.12	0.12	0.08	0.06	0.44	0.10	0.92	0.30	0.39	0.39	0.54	0.23	1.00																											
	Commodities	3.75	5.18	17.50	3.00	0.26	0.08	-0.16	-0.27	0.28	0.07	0.18	-0.01	0.26	0.19	0.48	0.29	-0.25	0.38	-0.26	0.45	0.42	0.56	0.45	-0.08	0.13	0.46	0.48	0.39	0.45	0.47	0.50	0.36	0.51	0.62	0.36	0.56	0.63	0.55	0.57	0.46	0.10	0.11	0.10	0.19	0.27	0.15	0.15	0.54	0.59	0.63	0.56	0.42	0.29	1.00																											
	Gold	4.00	5.67	19.00	3.50	0.02	0.07	0.32	0.21	0.48	0.39	0.39	0.29	0.35	0.28	0.11	-0.12	0.22	0.51	0.16	0.50	0.33	0.39	0.32	0.22	0.07	-0.01	0.02	-0.01	-0.01	0.01	0.06	-0.03	0.18	0.11	-0.12	0.08	0.23	0.19	0.08	0.04	0.00	0.00	-0.11	0.00	0.05	0.00	0.34	0.10	0.08	0.15	0.09	0.41	0.32	0.48	1.00

Source: J.P. Morgan Asset Management; data as of September 30, 2016, except hedge funds, private equity, real estate and infrastructure, as of June 30, 2016. Alternative asset index. The return estimates for these alternative asset classes and strategies are estimates of the industry average, net of manager fees. The dispersion of return among are renaming some of the alternative asset classes this year. U.S. Core Direct Real Estate is equivalent to U.S. Direct Real Estate last year. Similar changes are made across real shown above are rounded to 2 significant figures, which may cause a loss of information. All returns are nominal. For reference index information, please visit our website.

classes (including hedge funds, private equity, real estate, direct lending and infrastructure) are unlike other asset categories shown above in that there is no underlying investible managers of these asset classes and strategies is typically significantly wider than that of traditional asset classes. To further clarify the asset classes provided in the matrix, we estate assets. Global Direct Infrastructure Equity is equivalent to Global Infrastructure last year. Return estimates for direct real estate and REITs are unlevered. Correlation figures

STERLING ASSUMPTIONS

Note: All estimates on this page are in sterling terms. Given the complex risk-reward trade-offs involved, we advise clients to rely on judgment as well as quantitative optimization approaches in setting strategic allocations to all of these asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on this information is not advised. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Note that these asset class and strategy assumptions are passive only-they do not consider the impact of active management. References to future returns are not promises or even estimates of actual returns a client portfolio may achieve. Assumptions, opinions and estimates are provided for illustrative purposes only. They should not be relied upon as recommendations to buy or sell securities. Forecasts of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. We believe the information provided here is reliable, but do not warrant its accuracy or completeness. This material has been prepared for information purposes only and is not intended to provide, and should not be relied on for, accounting, legal or tax advice.

		Compound Return 2016 (%)	Annualized Volatility	Arithmetic Return 2017 (%)	Compound Return 2017 (%)	UK Inflation	UK Cash	U.S. Aggregate Bonds hedged	Euro Aggregate Bonds hedged	U.S. Inv Grade Corporate Bonds hedged	Euro Inv Grade Corp Bonds hedged	UK Inv Grade Corporate Bonds	U.S. High Yield Bonds hedged	European High Yield Bonds	U.S. Leveraged Loans hedged	Euro Government Bonds hedged	UK Gilts	UK Government Inflation-Linked Bonds	World Government Bonds hedged	World Government Bonds	World ex-UK Government Bonds hedged	World ex-UK Government Bonds	Emerging Markets Sovereign Debt hedged	Emerging Markets Local Currency Debt	Emerging Markets Corporate Bonds hedged	UK All Cap	UK Large Cap	UK Small Cap	U.S. Large Cap	U.S. Large Cap hedged	Euro Area Large Cap	Euro Area Large Cap hedged	Euro Area Small Cap	Euro Area Small Cap hedged	Japanese Equity	Japanese Equity hedged	AC Asia ex-Japan Equity	Emerging Markets Equity	AC World Equity	AC World ex-UK Equity	Developed World Equity	Private Equity	U.S. Core Direct Real Estate	European ex-UK Prime Direct Real Estate	European ex-UK Non-Prime Real Estate	UK Core Direct Real Estate	U.S. REITs	European REITs	Global Direct Infrastructure Equity	Diversified Hedge Funds hedged	Event Driven Hedge Funds hedged	Equity Long Bias Hedge Funds hedged	Relative Value Hedge Funds hedged	Macro Hedge Funds hedged	Commodities	Gold
FIXED INCOME	UK Inflation	2.00	2.01	1.25	2.25	1.00																																																								
	UK Cash	1.75	1.75	0.75	2.25	-0.09	1.00																																																					
	U.S. Aggregate Bonds hedged	2.75	2.81	3.50	3.75	-0.22	0.14	1.00																																																					
	Euro Aggregate Bonds hedged	2.25	2.32	3.75	3.00	-0.26	0.03	0.64	1.00																																																				
	U.S. Inv Grade Corporate Bonds hedged	3.00	3.19	6.25	4.25	-0.18	0.00	0.81	0.57	1.00																																																			
	Euro Inv Grade Corp Bonds hedged	2.75	2.86	4.75	3.75	-0.13	-0.11	0.51	0.71	0.78	1.00																																																		
	UK Inv Grade Corporate Bonds	2.50	2.79	7.75	-	-0.07	-0.17	0.59	0.55	0.77	0.77	1.00																																																		
	U.S. High Yield Bonds hedged	5.50	5.88	9.00	6.75	0.03	-0.12	0.17	0.03	0.56	0.56	0.43	1.00																																																				
	European High Yield Bonds	4.25	4.87	11.50	6.00	-0.01	-0.06	0.22	0.13	0.52	0.52	0.48	0.77	1.00																																																			
	U.S. Leveraged Loans hedged	4.75	4.91	5.75	5.25	0.13	-0.21	0.00	-0.12	0.36	0.38	0.40	0.78	0.60	1.00																																																			
	Euro Government Bonds hedged	2.00	2.09	4.25	2.75	-0.26	0.03	0.60	0.97	0.45	0.55	0.44	-0.11	0.03	-0.23	1.00																																																	
	UK Gilts	1.00	1.21	6.50	2.50	-0.22	0.06	0.70	0.56	0.42	0.21	0.52	-0.22	-0.08	-0.24	0.59	1.00																																																
	UK Government Inflation-Linked Bonds	0.25	0.59	8.25	1.25	-0.14	-0.05	0.56	0.33	0.42	0.24	0.50	0.16	0.20	0.11	0.33	0.70	1.00																																															
	World Government Bonds hedged	1.50	1.54	3.00	2.75	-0.27	0.15	0.81	0.82	0.51	0.36	0.43	-0.21	-0.06	-0.34	0.85	0.84	0.54	1.00																																														
	World Government Bonds	0.75	1.19	9.50	2.25	-0.25	0.22	0.48	0.43	0.16	-0.04	0.12	-0.37	-0.02	-0.44	0.50	0.67	0.38	0.71	1.00																																													
	World ex-UK Government Bonds hedged	1.50	1.54	2.75	2.75	-0.27	0.17	0.81	0.83	0.50	0.37	0.41	-0.20	-0.06	-0.34	0.87	0.80	0.50	1.00	0.69	1.00																																													
	World ex-UK Government Bonds	0.75	1.22	9.75	2.25	-0.25	0.23	0.46	0.42	0.15	-0.05	0.10	-0.37	-0.02	-0.44	0.49	0.64	0.37	0.69	1.00	0.68	1.00																																													
	Emerging Markets Sovereign Debt hedged	5.25	5.70	9.75	6.50	-0.10	0.03	0.57	0.37	0.75	0.65	0.56	0.72	0.70	0.46	0.27	0.17	0.27	0.25	0.01	0.26	0.00	1.00																																													
	Emerging Markets Local Currency Debt	5.25	5.82	11.00	6.50	-0.11	0.19	0.46	0.35	0.46	0.37	0.39	0.32	0.52	0.17	0.32	0.33	0.35	0.38	0.44	0.37	0.44	0.65	1.00																																												
	Emerging Markets Corporate Bonds hedged	5.25	5.59	8.50	6.50	-0.12	0.00	0.49	0.31	0.78	0.72	0.58	0.73	0.71	0.52	0.17	0.06	0.20	0.11	-0.12	0.12	-0.12	0.89	0.54	1.00																																												
EQUITIES	UK All Cap	6.25	7.09	13.50	7.25	0.12	-0.15	0.06	0.05	0.38	0.45	0.44	0.68	0.73	0.63	-0.04	-0.13	0.14	-0.17	-0.17	-0.17	-0.17	0.60	0.49	0.62	1.00																																											
	UK Large Cap	6.25	7.12	13.75	7.25	0.12	-0.14	0.09	0.06	0.39	0.45	0.44	0.67	0.72	0.61	-0.02	-0.10	0.17	-0.14	-0.14	-0.14	-0.14	0.61	0.51	0.61	0.99	1.00																																										
	UK Small Cap	6.75	7.99	16.50	7.50	0.12	-0.20	-0.05	-0.03	0.29	0.42	0.35	0.65	0.63	0.62	-0.13	-0.22	0.01	-0.27	-0.32	-0.27	-0.32	0.49	0.29	0.55	0.85	0.80	1.00																																										
	U.S. Large Cap	5.00	5.91	14.00	6.50	0.05	-0.17	0.05	0.08	0.21	0.28	0.30	0.47	0.57	0.46	0.05	0.05	0.27	-0.03	0.14	-0.04	0.14	0.41	0.58	0.40	0.79	0.79	0.62	1.00																																										
	U.S. Large Cap hedged	6.00	6.97	14.50	7.00	0.14	-0.21	-0.03	-0.04	0.27	0.39	0.31	0.69	0.66	0.60	-0.12	-0.25	0.06	-0.27	-0.33	-0.27	-0.33	0.53	0.38	0.56	0.87	0.86	0.76	0.80	1.00																																									
	Euro Area Large Cap	6.00	7.72	19.50	8.00	0.01	-0.06	0.11	0.06	0.35	0.36	0.40	0.62	0.78	0.55	0.01	-0.07	0.17	-0.09	-0.06	-0.09	-0.05	0.60	0.54	0.57	0.89	0.89	0.75	0.77	0.83	1.00																																									
	Euro Area Large Cap hedged	6.75	8.10	17.25	8.00	0.05	-0.18	-0.02	0.03	0.31	0.45	0.41	0.68	0.60	0.65	-0.06	-0.22	0.04	-0.25	-0.38	-0.25	-0.38	0.51	0.30	0.55	0.87	0.85	0.79	0.66	0.85	0.88	1.00																																								
	Euro Area Small Cap	6.50	8.43	20.75	8.50	0.02	-0.10	0.07	0.03	0.35	0.37	0.38	0.64	0.81	0.54	-0.03	-0.12	0.12	-0.13	-0.07	-0.13	-0.07	0.57	0.50	0.58	0.86	0.84	0.84	0.70	0.76	0.93	0.81	1.00																																							
	Euro Area Small Cap hedged	7.25	8.75	18.25	8.50	0.06	-0.22	-0.06	0.00	0.31	0.44	0.40	0.68	0.64	0.64	-0.10	-0.27	0.00	-0.29	-0.38	-0.29	-0.38	0.48	0.26	0.55	0.84	0.80	0.89	0.60	0.78	0.81	0.92	0.89	1.00																																							
	Japanese Equity	4.50	5.35	13.50	6.00	-0.04	-0.12	0.09	0.13	0.30	0.31	0.33	0.38	0.40	0.40	0.09	0.04	0.23	0.00	0.06	0.00	0.07	0.34	0.45	0.37	0.58	0.58	0.46	0.63	0.50	0.56	0.52	0.54	0.50	1.00																																							
	Japanese Equity hedged	5.75	7.43	19.25	7.25	0.12	-0.20	-0.20	-0.08	0.13	0.29	0.22	0.49	0.37	0.58	-0.14	-0.34	-0.03	-0.37	-0.57	-0.36	-0.57	0.29	0.12	0.38	0.60	0.58	0.60	0.44	0.65	0.56	0.70	0.53	0.66	0.70	1.00																																							
	AC Asia ex-Japan Equity	8.00	9.69	19.50	9.75	-0.01	0.00	0.20	0.14	0.46	0.43	0.37	0.62	0.68	0.48	0.07	0.03	0.21	0.01	0.00	0.00	0.00	0.63	0.66	0.62	0.74	0.74	0.61	0.67	0.66	0.73	0.64	0.73	0.63	0.53	0.45	1.00																																							
	Emerging Markets Equity	8.00	9.74	19.75	9.50	0.06	0.01	0.18	0.09	0.43	0.41	0.35	0.65	0.72	0.49	0.01	-0.01	0.21	-0.04	-0.03	-0.05	-0.03	0.67	0.70	0.64	0.77	0.77	0.63	0.68	0.70	0.76	0.65	0.76	0.65	0.52	0.45	0.97	1.00																																						
	AC World Equity	5.50	6.41	14.00	7.00	0.05	-0.11	0.12	0.09	0.36	0.39	0.39	0.62	0.72	0.55	0.04	0.01	0.26	-0.05	0.05	-0.06	0.05	0.58	0.65	0.57	0.91	0.91	0.73	0.94	0.85	0.90	0.78	0.85	0.74	0.69	0.55	0.83	0.85	1.00																																						
	AC World ex-UK Equity	5.50	6.44	14.25	7.00	0.05	-0.11	0.12	0.10	0.35	0.38	0.39	0.61	0.72	0.54	0.04	0.02	0.27	-0.04	0.07	-0.05	0.07	0.58	0.66	0.56	0.89	0.89	0.72	0.95	0.85	0.89	0.77	0.84	0.72	0.70	0.54	0.83	0.85	1.00	1.00																																						
	Developed World Equity	5.25	6.13	13.75	6.75	0.05	-0.13	0.10	0.09	0.33	0.37	0.39	0.59	0.70	0.54	0.04	0.01	0.27	-0.05	0.06	-0.06	0.06	0.55	0.63	0.54	0.90	0.90	0.72	0.96	0.86	0.89	0.78	0.84	0.73	0.70	0.55	0.78	0.80	1.00	1.00	1.00																																						
ALTERNATIVES	Private Equity	6.75	8.55	20.00	8.00	0.05	-0.11	0.08	0.05	0.29	0.32	0.33	0.55	0.63	0.50	0.00	-0.02	0.21	-0.07	0.01	-0.08	0.01	0.48	0.52	0.47	0.79	0.78	0.66	0.80	0.74	0.79	0.70	0.76	0.67	0.56	0.47	0.66	0.69	0.85	0.84	0.85	1.00																																						
	U.S. Core Direct Real Estate	4.25	5.05	13.00	5.00	0.00	-0.07	0.09	0.06	0.14	0.13	0.17	0.20	0.20	0.16	0.06	0.08	0.15	0.06	0.06	0.05	0.06	0.18	0.22	0.14	0.24	0.24	0.19	0.30	0.25	0.25	0.21	0.23	0.19	0.19	0.11	0.21	0.22	0.29	0.29	0.30	0.26	1.00																																						
	European ex-UK Prime Direct Real Estate	5.00	5.88	13.75	5.00	0.02	-0.06	-0.01	-0.02	0.11	0.13	0.15	0.28	0.27	0.27	-0.05	-0.07	0.05	-0.10	-0.11	-0.10	-0.11	0.22	0.17	0.20	0.38	0.37	0.33	0.33	0.37	0.40	0.41	0.37	0.37	0.25	0.28	0.29	0.30	0.37	0.36	0.37	0.33	0.30	1.00																																						
	European ex-UK Non-Prime Real Estate	7.00	8.13	15.75	-	0.02	-0.06	-0.01	-0.03	0.11	0.13	0.15	0.29	0.27	0.27	-0.05	-0.07	0.05	-0.10	-0.12	-0.10	-0.12	0.22	0.17	0.21	0.39	0.38	0.34	0.33	0.38	0.41	0.42	0.38	0.38	0.25	0.29	0.30	0.30	0.38	0.37	0.38	0.34	0.30	0.98	1.00																																						
	UK Core Direct Real Estate	5.25	6.23	14.50	-	0.05	-0.05	-0.01	-0.02	0.10	0.12	0.10	0.26	0.28	0.23	-0.04	-0.08	0.05	-0.09	-0.05	-0.09	-0.05	0.22	0.21	0.20	0.40	0.40	0.32	0.35	0.36	0.36	0.34	0.34	0.31	0.24	0.23	0.30	0.32	0.38	0.38	0.38	0.33	0.35	0.21	0.21	1.00																																						
	U.S. REITs	4.75	6.24	18.00	5.50	-0.02	-0.16	0.27	0.20	0.36	0.33	0.43	0.48	0.49	0.37	0.18	0.24	0.40	0.19	0.20	0.17	0.20	0.45	0.58	0.34	0.59	0.59	0.45	0.76	0.59	0.60	0.50	0.56	0.45	0.50	0.26	0.53	0.53	0.73	0.73	0.74	0.64	0.40	0.29	0.29	0.29	1.00																																						
	European REITs	6.25	8.01	19.75	7.75	-0.01	-0.18	0.20	0.20	0.40	0.45	0.47	0.57	0.63	0.42	0.14	0.05	0.20	0.06	-0.02	0.06	-0.02	0.56	0.48	0.49	0.71	0.69	0.68	0.59	0.65	0.76	0.69	0.74	0.66	0.41	0.39	0.51	0.52	0.67	0.66	0.67	0.61	0.28	0.32	0.32	0.29	0.69	1.00																																						
	Global Direct Infrastructure Equity	5.00	5.91	14.00	6.00	0.10	-0.06	0.01	0.01	0.06	0.08	0.10	0.16	0.17	0.15	0.00	0.01	0.08	-0.02	0.02	-0.02	0.02	0.13	0.17	0.11	0.24	0.25	0.19	0.30	0.25	0.23	0.20	0.21	0.18	0.18	0.14	0.20	0.21	0.28	0.29	0.29	0.25	0.30	0.14	0.15	0.17	0.26	0.20	1.00																																					
	Diversified Hedge Funds hedged	3.25	3.45	6.50	4.25	0.22	-0.14	-0.13	-0.11	0.21	0.34	0.30	0.60	0.50	0.60	-0.22	-0.34	0.01	-0.39	-0.51	-0.38	-0.51	0.36	0.12	0.44	0.67	0.65	0.70	0.42	0.66	0.56	0.70	0.62	0.77	0.38	0.64	0.54	0.58	0.56	0.55	0.54	0.49	0.08	0.26	0.27	0.24	0.18	0.35	0.13	1.00																																					
	Event Driven Hedge Funds hedged	4.50	4.84	8.50	6.00	0.23	-0.19	-0.13	-0.12	0.27	0.43	0.33	0.77	0.66	0.69	-0.24	-0.42	-0.05	-0.43	-0.53	-0.42	-0.52	0.49	0.22	0.59	0.76	0.74	0.77	0.51	0.80	0.66	0.77	0.72	0.84	0.40	0.64	0.61	0.66	0.66	0.64	0.64	0.58	0.15	0.30	0.31	0.29	0.33	0.49	0.17	0.89	1.00																																					
	Equity Long Bias Hedge Funds hedged	4.25	4.77	10.50	5.50	0.17	-0.14	-0.10	-0.13	0.29	0.40	0.29	0.75	0.68	0.65	-0.25	-0.38	-0.04	-0.41	-0.49	-0.40	-0.49	0.54	0.30	0.62	0.81	0.79	0.79	0.57	0.86	0.74	0.80	0.77	0.84	0.46	0.69	0.73	0.78	0.74	0.73	0.71	0.64	0.16	0.33	0.34	0.31	0.36	0.51	0.18	0.87	0.94	1.00																																					
	Relative Value Hedge Funds hedged	4.00	4.22	6.75	5.25	0.18	-0.16	-0.01	-0.05	0.40	0.51	0.40	0.84	0.66	0.76	-0.18	-0.37	0.03	-0.36	-0.54	-0.35	-0.54	0.56	0.22	0.64	0.69	0.67	0.69	0.41	0.68	0.57	0.71	0.62	0.76	0.37	0.62	0.59	0.64	0.57	0.56	0.54	0.50	0.12	0.27	0.27	0.25	0.28	0.44	0.14	0.85	0.93	0.87	1.00																																					
	Macro Hedge Funds hedged	3.75	4.02	7.50	5.00	0.00	0.17	0.17	0.18	0.25	0.19	0.24	0.16	0.26	0.02	0.14	0.15	0.23	0.15	0.12	0.14	0.11	0.22	0.26	0.19	0.31	0.32	0.19	0.15	0.20	0.27	0.22	0.29	0.25	0.18	0.10	0.33	0.37	0.28	0.28	0.26	0.21	0.03	0.08	0.09	0.10	0.07	0.12	0.04	0.53	0.30	0.37	0.28	1.00																																					
	Commodities	2.50	3.53	14.75	2.50	0.16	0.03	0.13	-0.11	0.22	0.09	0.12	0.33	0.40	0.18	-0.14	-0.06	0.18	-0.07	0.08	-0.07	0.08	0.35	0.42	0.35	0.40	0.42	0.24	0.32	0.32	0.32	0.16	0.34	0.20	0.16	0.04	0.42	0.51	0.42	0.42	0.40	0.35	0.09	0.09	0.09	0.17	0.22	0.19	0.11	0.37	0.39	0.44	0.37	0.41	1.00																																					
	Gold	2.75	4.52	19.50	3.00	-0.16	0.16	0.42	0.19	0.27	0.05	0.13	-0.08	0.07	-0.25	0.19	0.40	0.27	0.39	0.49	0.38	0.49	0.20	0.41	0.14	-0.06	-0.03	-0.15	0.01	-0.20	-0.07	-0.28	-0.04	-0.23	-0.07	-0.42	0.12	0.14	0.03	0.04	0.01	0.00	0.02	-0.09	-0.09	-0.02	0.09	-0.06	-0.01	-0.11	-0.17	-0.11	-0.14	0.34	0.46	1.00																																					

Source: J.P. Morgan Asset Management; data as of September 30, 2016, except hedge funds, private equity, real estate and infrastructure, as of June 30, 2016. Alternative asset index. The return estimates for these alternative asset classes and strategies are estimates of the industry average, net of manager fees. The dispersion of return among are renaming some of the alternative asset classes this year. U.S. Core Direct Real Estate is equivalent to U.S. Direct Real Estate last year. Similar changes are made across real shown above are rounded to 2 significant figures, which may cause a loss of information. All returns are nominal. For reference index information, please visit our website.

classes (including hedge funds, private equity, real estate, direct lending and infrastructure) are unlike other asset categories shown above in that there is no underlying investible managers of these asset classes and strategies is typically significantly wider than that of traditional asset classes. To further clarify the asset classes provided in the matrix, we estate assets. Global Direct Infrastructure Equity is equivalent to Global Infrastructure last year. Return estimates for direct real estate and REITs are unlevered. Correlation figures

EURO ASSUMPTIONS

Note: All estimates on this page are in euro terms. Given the complex risk-reward trade-offs involved, we advise clients to rely on judgment as well as quantitative optimization approaches in setting strategic allocations to all of these asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on this information is not advised. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Note that these asset class and strategy assumptions are passive only-they do not consider the impact of active management. References to future returns are not promises or even estimates of actual returns a client portfolio may achieve. Assumptions, opinions and estimates are provided for illustrative purposes only. They should not be relied upon as recommendations to buy or sell securities. Forecasts of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. We believe the information provided here is reliable, but do not warrant its accuracy or completeness. This material has been prepared for information purposes only and is not intended to provide, and should not be relied on for, accounting, legal or tax advice.

		Compound Return 2016 (%)	Annualized Volatility	Arithmetic Return 2017 (%)	Compound Return 2017 (%)	Euro Inflation	Euro Cash	U.S. Aggregate Bonds hedged	Euro Aggregate Bonds	U.S. Inv Grade Corporate Bonds hedged	Euro Inv Grade Corp Bonds	U.S. High Yield Bonds hedged	European High Yield Bonds	U.S. Leveraged Loans hedged	Euro Government Bonds	Euro Government Inflation-Linked	World Government Bonds hedged	World Government Bonds	World ex-Euro Government Bonds hedged	World ex-Euro Government Bonds	Emerging Markets Sovereign Debt hedged	Emerging Markets Local Currency Debt	Emerging Markets Corporate Bonds hedged	European Large Cap	European Small Cap	U.S. Large Cap	U.S. Large Cap hedged	Euro Area Large Cap	Euro Area Small Cap	UK Large Cap	UK Large Cap hedged	Japanese Equity	Japanese Equity hedged	Emerging Markets Equity	AC Asia ex-Japan Equity	AC World Equity	AC World ex-EMU Equity	Developed World Equity	Private Equity	U.S. Core Direct Real Estate	European ex-UK Prime Direct Real Estate	European ex-UK Non-Prime Real Estate	U.S. REITs	Global ex-U.S. REITs	Global Direct Infrastructure Equity	Diversified Hedge Funds hedged	Event Driven Hedge Funds hedged	Equity Long Bias Hedge Funds hedged	Relative Value Hedge Funds hedged	Macro Hedge Funds hedged	Commodities	Gold
FIXED INCOME	Euro Inflation	1.50	1.52	1.75	1.50	1.00																																													
	Euro Cash	1.00	1.00	0.50	1.25	0.01	1.00																																												
	U.S. Aggregate Bonds hedged	2.00	2.06	3.50	2.75	-0.25	0.11	1.00																																										
	Euro Aggregate Bonds	1.50	1.57	3.75	2.00	-0.24	0.02	0.64	1.00																																									
	U.S. Inv Grade Corporate Bonds hedged	2.25	2.44	6.25	3.25	-0.23	0.01	0.82	0.57	1.00																																								
	Euro Inv Grade Corp Bonds	2.00	2.11	4.75	2.75	-0.19	-0.11	0.51	0.71	0.78	1.00																																							
	U.S. High Yield Bonds hedged	4.75	5.13	9.00	5.75	0.01	-0.12	0.17	0.03	0.56	0.57	1.00																																						
	European High Yield Bonds	4.25	4.72	10.00	5.00	-0.03	-0.22	0.05	0.11	0.48	0.67	0.88	1.00																																					
	U.S. Leveraged Loans hedged	4.00	4.19	6.25	4.25	0.07	-0.22	0.00	-0.11	0.36	0.39	0.78	0.75	1.00																																				
	Euro Government Bonds	1.25	1.34	4.25	1.75	-0.22	0.03	0.59	0.97	0.44	0.54	-0.11	-0.06	-0.23	1.00																																			
	Euro Government Inflation-Linked	1.75	1.87	5.00	1.50	-0.06	0.07	0.57	0.75	0.60	0.66	0.33	0.30	0.13	0.72	1.00																																		
	World Government Bonds hedged	0.75	0.79	3.00	1.75	-0.24	0.12	0.81	0.82	0.50	0.36	-0.22	-0.29	-0.34	0.85	0.57	1.00																																	
	World Government Bonds	0.75	1.07	8.00	1.25	-0.26	0.08	0.33	0.45	0.12	0.09	-0.37	-0.30	-0.39	0.47	0.14	0.57	1.00																																
	World ex-Euro Government Bonds hedged	0.50	0.54	3.00	1.75	-0.20	0.16	0.82	0.58	0.46	0.17	-0.27	-0.40	-0.36	0.61	0.39	0.93	0.53	1.00																																
	World ex-Euro Government Bonds	0.25	0.82	10.75	1.00	-0.25	0.07	0.25	0.31	0.04	-0.01	-0.38	-0.31	-0.38	0.33	0.02	0.45	0.99	0.45	1.00																																
	Emerging Markets Sovereign Debt hedged	4.50	4.95	9.75	5.50	-0.01	0.02	0.56	0.37	0.75	0.66	0.72	0.57	0.46	0.26	0.56	0.24	-0.23	0.18	-0.30	1.00																														
	Emerging Markets Local Currency Debt	5.25	5.67	9.50	5.50	-0.05	0.06	0.33	0.35	0.46	0.52	0.40	0.37	0.27	0.27	0.41	0.22	0.27	0.13	0.24	0.55	1.00																												
	Emerging Markets Corporate Bonds hedged	4.50	4.84	8.50	5.50	-0.06	-0.01	0.49	0.31	0.77	0.72	0.74	0.69	0.53	0.16	0.48	0.10	-0.25	0.05	-0.30	0.89	0.51	1.00																											
EQUITIES	European Large Cap	5.75	6.79	15.00	6.75	0.05	-0.26	-0.02	0.05	0.33	0.50	0.69	0.75	0.67	-0.06	0.29	-0.26	-0.32	-0.36	-0.33	0.51	0.44	0.56	1.00																											
	European Small Cap	6.50	7.78	16.75	7.25	0.09	-0.25	-0.06	-0.02	0.30	0.45	0.70	0.73	0.66	-0.12	0.24	-0.31	-0.46	-0.38	-0.46	0.50	0.28	0.57	0.89	1.00																										
	U.S. Large Cap	5.00	5.88	13.75	5.50	0.08	-0.31	-0.11	0.04	0.13	0.36	0.48	0.53	0.52	-0.03	0.16	-0.21	0.02	-0.32	0.03	0.24	0.50	0.31	0.79	0.65	1.00																									
	U.S. Large Cap hedged	5.25	6.26	14.75	6.00	0.19	-0.25	-0.02	-0.03	0.27	0.40	0.69	0.62	0.60	-0.12	0.23	-0.26	-0.54	-0.33	-0.55	0.54	0.30	0.57	0.84	0.81	0.73	1.00																								
	Euro Area Large Cap	6.00	7.36	17.25	7.00	0.07	-0.23	-0.02	0.04	0.31	0.45	0.67	0.70	0.64	-0.05	0.32	-0.24	-0.41	-0.34	-0.43	0.52	0.36	0.55	0.97	0.89	0.71	0.85	1.00																							
	Euro Area Small Cap	6.50	8.01	18.25	7.50	0.06	-0.26	-0.05	0.02	0.31	0.45	0.68	0.74	0.64	-0.09	0.28	-0.28	-0.43	-0.37	-0.44	0.49	0.30	0.57	0.90	0.98	0.63	0.78	0.92	1.00																						
	UK Large Cap	6.25	7.25	14.75	6.25	0.01	-0.27	-0.06	0.03	0.31	0.50	0.65	0.74	0.65	-0.09	0.20	-0.29	-0.19	-0.39	-0.19	0.43	0.47	0.51	0.94	0.79	0.80	0.74	0.84	0.78	1.00																					
	UK Large Cap hedged	5.50	6.38	13.75	6.25	0.06	-0.18	0.09	0.07	0.39	0.45	0.66	0.60	0.61	-0.02	0.30	-0.14	-0.42	-0.21	-0.45	0.61	0.37	0.61	0.87	0.83	0.64	0.86	0.86	0.80	0.80	1.00																				
	Japanese Equity	4.50	5.55	15.00	5.00	-0.03	-0.22	-0.05	0.08	0.22	0.34	0.36	0.44	0.42	0.01	0.19	-0.16	0.13	-0.25	0.14	0.16	0.49	0.27	0.60	0.46	0.67	0.39	0.51	0.48	0.64	0.39	1.00																			
	Japanese Equity hedged	5.00	6.70	19.25	6.25	0.14	-0.23	-0.19	-0.07	0.13	0.30	0.49	0.53	0.58	-0.13	0.17	-0.36	-0.52	-0.46	-0.53	0.30	0.25	0.38	0.71	0.66	0.55	0.66	0.70	0.66	0.64	0.58	0.73	1.00																	
	Emerging Markets Equity	8.00	9.49	18.25	8.50	0.12	-0.11	0.06	0.06	0.39	0.49	0.68	0.68	0.56	-0.05	0.31	-0.20	-0.24	-0.28	-0.25	0.57	0.64	0.61	0.76	0.71	0.63	0.68	0.71	0.71	0.75	0.70	0.50	0.56	1.00																
	AC Asia ex-Japan Equity	8.00	9.53	18.50	8.75	0.04	-0.12	0.09	0.12	0.41	0.51	0.64	0.65	0.54	0.01	0.32	-0.13	-0.15	-0.22	-0.17	0.53	0.63	0.59	0.74	0.68	0.65	0.63	0.69	0.68	0.73	0.65	0.53	0.54	0.97	1.00														
	AC World Equity	5.50	6.35	13.50	6.00	0.08	-0.28	-0.05	0.06	0.28	0.48	0.64	0.69	0.63	-0.04	0.26	-0.24	-0.13	-0.35	-0.13	0.43	0.57	0.50	0.92	0.80	0.94	0.81	0.85	0.79	0.91	0.78	0.72	0.68	0.82	0.81	1.00												
	AC World ex-EMU Equity	5.50	6.32	13.25	6.00	0.08	-0.28	-0.06	0.06	0.27	0.47	0.62	0.67	0.61	-0.04	0.24	-0.24	-0.08	-0.34	-0.07	0.40	0.59	0.48	0.89	0.76	0.95	0.77	0.80	0.75	0.90	0.74	0.73	0.66	0.81	0.81	1.00	1.00											
	Developed World Equity	5.25	6.07	13.25	5.75	0.07	-0.30	-0.07	0.06	0.26	0.46	0.61	0.67	0.62	-0.04	0.24	-0.24	-0.11	-0.35	-0.11	0.39	0.54	0.47	0.92	0.78	0.96	0.80	0.84	0.78	0.91	0.77	0.73	0.68	0.76	0.76	1.00	0.99	1.00										
ALTERNATIVES	Private Equity	6.75	8.46	19.50	7.00	0.07	-0.25	-0.05	0.02	0.24	0.39	0.58	0.61	0.58	-0.06	0.21	-0.23	-0.17	-0.31	-0.17	0.37	0.43	0.43	0.82	0.73	0.80	0.72	0.77	0.73	0.79	0.70	0.57	0.58	0.66	0.65	0.85	0.84	0.85	1.00									
	U.S. Core Direct Real Estate	4.25	5.23	14.50	4.00	0.00	-0.10	0.08	0.08	0.13	0.16	0.19	0.17	0.16	0.06	0.13	0.04	0.04	0.01	0.03	0.15	0.22	0.13	0.24	0.19	0.29	0.23	0.22	0.20	0.22	0.21	0.19	0.14	0.19	0.19	0.27	0.27	0.28	0.24	1.00							
	European ex-UK Prime Direct Real Estate	5.00	5.52	10.50	4.00	0.05	-0.10	-0.05	-0.05	0.06	0.10	0.25	0.24	0.25	-0.07	0.08	-0.13	-0.17	-0.15	-0.17	0.17	0.13	0.17	0.39	0.35	0.31	0.35	0.40	0.36	0.33	0.34	0.21	0.28	0.27	0.26	0.35	0.33	0.35	0.32	0.30	1.00					
	European ex-UK Non-Prime Real Estate	7.00	7.96	14.50	-	0.05	-0.10	-0.05	-0.05	0.06	0.10	0.25	0.25	0.26	-0.07	0.08	-0.14	-0.17	-0.16	-0.17	0.17	0.13	0.17	0.40	0.36	0.31	0.36	0.41	0.37	0.34	0.35	0.21	0.28	0.28	0.27	0.36	0.34	0.36	0.33	0.30	0.98	1.00				
	U.S. REITs	4.75	5.97	16.25	4.50	-0.02	-0.24	0.20	0.21	0.34	0.40	0.47	0.41	0.41	0.16	0.33	0.12	0.12	0.04	0.11	0.36	0.55	0.31	0.58	0.47	0.72	0.56	0.54	0.48	0.54	0.52	0.48	0.33	0.47	0.48	0.68	0.69	0.70	0.61	0.40	0.26	0.26	1.00			
	Global ex-U.S. REITs	4.50	6.00	18.00	5.00	-0.02	-0.35	0.11	0.20	0.38	0.53	0.60	0.63	0.49	0.11	0.34	-0.04	-0.17	-0.15	-0.20	0.49	0.40	0.47	0.77	0.74	0.59	0.63	0.74	0.74	0.70	0.65	0.43	0.48	0.51	0.51	0.68	0.64	0.68	0.62	0.27	0.30	0.30	0.67	1.00		
	Global Direct Infrastructure Equity	5.00	6.15	15.75	5.00	0.10	-0.09	-0.03	0.01	0.04	0.10	0.15	0.16	0.16	-0.01	0.06	-0.06	-0.01	-0.09	-0.01	0.09	0.16	0.10	0.24	0.20	0.30	0.24	0.22	0.19	0.23	0.20	0.19	0.17	0.20	0.19	0.28	0.29	0.29	0.24	0.30	0.14	0.15	0.26	0.19	1.00	
	Diversified Hedge Funds hedged	2.50	2.71	6.50	3.25	0.10	-0.17	-0.13	-0.11	0.21	0.34	0.60	0.67	0.60	-0.21	0.15	-0.39	-0.47	-0.43	-0.46	0.38	0.23	0.46	0.73	0.78	0.51	0.66	0.70	0.77	0.70	0.65	0.42	0.64	0.69	0.64	0.69	0.66	0.66	0.60	0.10	0.26	0.27	0.24	0.48	0.15	1.00
	Event Driven Hedge Funds hedged	3.75	4.10	8.50	5.00	0.17	-0.21	-0.12	-0.11	0.28	0.44	0.77	0.79	0.69	-0.24	0.17	-0.43	-0.55	-0.48	-0.55	0.50	0.29	0.61	0.79	0.84	0.56	0.80	0.77	0.84	0.74	0.74	0.40	0.65	0.74	0.68	0.73	0.70	0.70	0.66	0.15	0.29	0.30	0.36	0.57	0.18	0.88
	Equity Long Bias Hedge Funds hedged	3.50	4.03	10.50	4.50	0.17	-0.17	-0.10	-0.13	0.29	0.40	0.75	0.72	0.64	-0.24	0.20	-0.41	-0.62	-0.46	-0.62	0.55	0.30	0.63	0.80	0.85	0.56	0.86	0.80	0.84	0.73	0.79	0.40	0.69	0.81	0.74	0.75	0.72	0.71	0.66	0.15	0.31	0.32	0.35	0.54	0.17	0.87
	Relative Value Hedge Funds hedged	3.25	3.47	6.75	4.25	0.07	-0.15	0.00	-0.04	0.40	0.52	0.84	0.86	0.76	-0.19	0.24	-0.36	-0.45	-0.43	-0.45	0.57	0.39	0.66	0.75	0.76	0.51	0.68	0.71	0.76	0.74	0.67	0.43	0.62	0.76	0.70	0.70	0.68	0.67	0.62	0.14	0.25	0.26	0.33	0.56	0.15	0.85
	Macro Hedge Funds hedged	3.00	3.27	7.50	4.00	-0.05	0.15	0.16	0.17	0.24	0.18	0.15	0.14	0.02	0.13	0.27	0.13	-0.05	0.12	-0.08	0.22	0.16	0.19	0.23	0.24	0.04	0.20	0.22	0.26	0.20	0.32	0.07	0.10	0.31	0.27	0.19	0.17	0.16	0.14	0.00	0.07	0.07	0.01	0.10	0.01	0.53
	Commodities	2.50	3.47	14.25	1.50	0.01	-0.09	-0.01	-0.15	0.17	0.16	0.36	0.32	0.24	-0.22	0.08	-0.24	-0.07	-0.21	-0.04	0.21	0.31	0.30	0.31	0.24	0.28	0.25	0.19	0.23	0.43	0.29	0.20	0.13	0.46	0.39	0.38	0.40	0.35	0.30	0.06	0.07	0.07	0.14	0.18	0.08	0.47
	Gold	2.75	4.35	18.50	2.00	-0.24	0.13	0.31	0.17	0.22	0.10	-0.09	-0.10	-0.23	0.14	0.05	0.27	0.42	0.31	0.43	0.07	0.31	0.09	-0.20	-0.23	-0.10	-0.29	-0.28	-0.23	-0.08	-0.16	-0.08	-0.38	0.02	0.02	-0.10	-0.06	-0.11	-0.12	-0.01	-0.12	-0.13	-0.01	-0.16	-0.04	-0.06

		Commodities	Gold
ALTERNATIVES	Commodities	1.00	
	Gold	0.39	1.00

Source: J.P. Morgan Asset Management; data as of September 30, 2016, except hedge funds, private equity, real estate and infrastructure, as of June 30, 2016. Alternative asset index. The return estimates for these alternative asset classes and strategies are estimates of the industry average, net of manager fees. The dispersion of return among are renaming some of the alternative asset classes this year. U.S. Core Direct Real Estate is equivalent to U.S. Direct Real Estate last year. Similar changes are made across real shown above are rounded to 2 significant figures, which may cause a loss of information. All returns are nominal. For reference index information, please visit our website.

classes (including hedge funds, private equity, real estate, direct lending and infrastructure) are unlike other asset categories shown above in that there is no underlying investible managers of these asset classes and strategies is typically significantly wider than that of traditional asset classes. To further clarify the asset classes provided in the matrix, we estate assets. Global Direct Infrastructure Equity is equivalent to Global Infrastructure last year. Return estimates for direct real estate and REITs are unlevered. Correlation figures

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IV. APPENDIX

GLOSSARY

BACKWARDATION Describes the state of a commodities market in which the futures price is below the spot price expected at the expiration of the futures contract. (See also: **CONTANGO**.)

BETA EXPOSURE Risk taken in the public market.

BOND TOURISM Venturing into unfamiliar geographies and durations in the search for yield.

CAPITAL DEEPENING Rise in the ratio of capital to labor. An increase in capital intensity.

CAPITAL MARKETS UNION European Commission program to develop a more diversified financial system complementing bank financing with deep and developed capital markets, to unlock the capital around Europe, currently frozen, and put it to work for the economy, giving savers more investment choices and offering businesses a greater choice of funding at lower costs.

CENTRAL LIMIT THEOREM In probability theory, states that given certain conditions, the arithmetic mean, or average, of a large number of independent random variables will be approximately normally distributed, regardless of the underlying distribution.

COMMODITY SUPERCYCLE The rise and fall of primary commodities prices over an extended period around a slow-moving underlying trend; often in reference to 2000s commodities boom, when oil and metal prices roughly quadrupled and food prices doubled, attributed largely to demand from emerging markets.

CONTANGO Describes the state of a commodities market in which the futures price is greater than the spot price expected at the expiration of the futures contract. (See also: **BACKWARDATION**.)

DEBT SERVICE RATIO The ratio of interest payments plus amortizations to income.

DE-RATING A fall in the valuation multiple that investors are prepared to pay for a security or investment.

DUPONT ANALYSIS Breaking return on equity (RoE) into three component parts. Specifically, RoE = profit margins (earning-to-sales) × asset turnover (sales-to-assets) × financial leverage (assets-to-equity).

EQUILIBRIUM LEVEL The average or cycle-neutral value for a market or macroeconomic variable (for example, yield or credit spread) expected to prevail over the long term.

FINANCIAL REPRESSION A set of conditions that channel to the government funds that would otherwise flow elsewhere. Measures typically designed to boost reserves and/or reduce debt and facilitate a captive domestic market for government debt. Includes capping interest rates, especially on government debt; high reserve requirements for banks; and "prudential" regulatory measures (e.g., requiring pension funds to hold a proportion of assets in government bonds).

ILLIQUIDITY PREMIUM/LIQUIDITY PREMIUM The extra return investors demand for holding an asset, such as private equity or real estate, that is less readily convertible to cash than another.

MULTIFACTOR PRODUCTIVITY The increase in the efficiency of workers over and above that which can be explained by better workers or an increase in the capital/labor ratio.

NIRP Negative interest rate policy. Overnight interest rates in negative territory, so that bank depositors must pay for, rather than receive interest on, funds deposited with central banks.

OUTPUT GAP The difference between an economy's actual and potential output.

ROLL YIELD The yield resulting from shifting between futures (usually commodities) contracts when they expire. If the futures curve is in backwardation, the investor earns a positive roll yield. If the futures curve is in contango, the investor incurs a negative roll yield.

SPREAD DURATION The sensitivity of a bond price to spread changes.

SUSTAINABLE GROWTH RATE (SGR) A concept developed by Robert C. Higgins (1977). The assumed maximum rate of growth in earnings a company can sustain without issuing new equity; equal to return on equity (RoE) × portion of earnings not paid out to shareholders. It assumes that future earnings can only grow by re-investing the retained proportion of earnings at a stable RoE, thereby expanding book value at the same rate as earnings. For a given RoE, slower earnings growth thus implies a higher payout ratio.

TAIL RISK The risk of the value of an asset, or portfolio of assets, moving more than 3 standard deviations from its current value.

WINSORIZATION Applies a cap and a floor to extreme data values to remove the impact of potentially spurious outlier data on statistical results.

Z-SCORE The number of standard deviations above or below the mean, used for comparing a data point to the population.

ZIRP Zero interest rate policy. Unconventional instrument of monetary policy pioneered in Japan. The central bank maintains nominal overnight interest rates at or around zero with the aim of stimulating the economy by encouraging investments in risk assets that will lift corporate investments, employment and consumer demand.

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