# 2016 Long-Term Capital Market Assumptions



Time-tested projections to build resilient portfolios





# NAVIGATING THE LONG-TERM CAPITAL MARKET ASSUMPTIONS WHITE PAPER

### SECTION I: THEMATIC ARTICLES

- Analyze long-term market trends across asset classes and the global economy
- Understand the research and other aspects of the concepts underlying our assumptions
- Discuss strategic asset allocation and portfolio construction issues facing long-term investors

#### SECTION II: RATIONALE AND METHODOLOGY ARTICLES

Understand how we arrive at our assumptions for:

- Macroeconomic fundamentals
- Fixed income
- Equities
- Alternatives
- Foreign exchange
- Volatilities and correlations

#### SECTION III: LONG-TERM CAPITAL MARKET ASSUMPTIONS

- Explore our return and volatility projections for approximately 50 asset classes in USD/EUR/GBP
- Find the cross-asset correlation assumptions for our entire data set

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ACKNOWLEDGMENTS

### FOREWORD



CHRIS WILLCOX

**WE ARE PLEASED TO INTRODUCE** J.P. Morgan Asset Management's Long-Term Capital Market Assumptions for 2016, marking the 20th anniversary of our estimates.

Investors and advisors around the world have come to rely on our assumptions to guide their strategic asset allocation and set realistic expectations for risks and returns over a 10- to 15-year time frame. The assumptions encompass more than 50 asset and strategy classes and are available in 10 base currencies. We believe they are one of the most established and comprehensive sets of capital market estimates in the industry.

The assumptions are a core element of our framework for designing, building and analyzing solutions that are aligned with clients' specific investment needs. This is why, in an ever-changing market environment, we devote extensive effort and resources each year to developing an updated set of long-term estimates.

Our assumptions are informed by a process that carefully balances quantitative and qualitative inputs, both of which have been rigorously researched and continuously refined over the past two decades. The Assumptions Committee driving this process includes some of the most senior investors from our Global Investment Management and Global Wealth Management businesses and draws on the best thinking of our global network of asset class and market specialists.

Our 2016 assumptions anticipate a challenging investment environment as policy and economic conditions globally continue to diverge and many asset returns fall short of those achieved over the past 30 years. The lack of a uniform global business cycle will increase the importance of diversification and careful navigation across regions and asset classes.

We value our dialogue with you and look forward to putting these Assumptions to work to help you achieve your investment objectives.

On behalf of J.P. Morgan Asset Management, thank you for your continued trust and confidence. As always, we welcome your feedback.

Chris Willcox Chief Executive Officer Global Investment Management

Note to readers: All assessments, data and forecasts in this document are made using data and information up to and including September 30, 2015, unless stated otherwise.

# EXECUTIVE SUMMARY

# 2016 Long-Term Capital Market Assumptions

Michael Feser, Portfolio Manager, Multi-Asset Solutions Michael Hood, Global Strategist, Multi-Asset Solutions Patrik Schöwitz, Global Strategist, Multi-Asset Solutions Anthony Werley, Chief Portfolio Strategist, Endowment and Foundations Group

#### IN BRIEF

This Executive Summary is designed to provide a broad view of our 2016 Long-Term Capital Market Assumptions (LTCMAs) and concludes with an assessment of how our assumptions have fared over the last 20 years:

- **Macro overview**: The backdrop for this year's LTCMAs is best described as an environment of steady inflation and subdued long-term growth in the face of very divergent cyclical starting points across economies globally.
- **Major asset class assumptions**: Changes to our assumptions year-over-year are nuanced and include: a deteriorating outlook for U.S. Treasury returns; improving but, in nominal return terms, still uninspiring public and private equity market return expectations; and relatively more attractive assumptions for credit, value-added real estate and infrastructure.
- **Implications:** Based on a synthesis of results across our full data set of over 50 asset classes, we find that the outlook for the 60% equity/40% fixed income investor has improved slightly in terms of risk-adjusted returns. At the same time, the efficient frontier has rotated counterclockwise, in a way that suggests the expected return for relatively safer assets has fallen further, while the expected return for riskier assets has improved relative to last year.

Beyond this Executive Summary, our full report provides comprehensive articles on our macro outlook and asset class estimates. Also included are thematic articles on: regulatory change and its implications for financial markets, the evolution and current state of emerging market (EM) equities, the source of the private equity premium and an approach to portfolio construction that accounts for asset classes with fat-tailed return distributions—issues and trends incorporated into the thinking behind our 2016 assumptions.

# MACRO OVERVIEW-SUBDUED BUT STEADY GROWTH

The 2016 LTCMAs begin with our baseline expectation for moderate growth and generally stable inflation in coming years (**Exhibit 1**). For most developed market (DM) economies, growth forecasts lie below their 25-year historical averages, primarily reflecting slower population and labor force expansion. Still, we expect several DM countries to grow more strongly than during the past 10 years, as they leave behind the Great Recession and the subsequent period of private sector deleveraging. Indeed, although our projections for GDP growth have edged lower this year for four of the seven DM economies covered, these changes owe more to continued population aging and the successful absorption of cyclical slack than to any broader worsening in the environment.

By contrast, we continue to lower our fundamental sights on the emerging economies, which are adjusting to a less friendly global environment while also confronting various homegrown challenges. In particular, following a lengthy domestic credit boom, we expect many emerging market countries to enter deleveraging periods of their own, with this retrenchment likely to weigh on growth for several years to come. Among our sample of EM economies, we see India leading the way in growth terms, partly reflecting its ample room for convergence with DM living standards. Although we do not expect a collapse in Chinese growth, the gradual deceleration evident since 2011 will likely continue. These contrasting dynamics imply considerable growth desynchronization in the next several years. Policy divergence will likely follow as the U.S. Federal Reserve begins to raise interest rates while other DM central banks consider additional easing measures. Varying local conditions will likely prevent a unified global business cycle from appearing, and overall global growth will likely remain fairly close to our long-term assumption.

Despite enormously easy monetary policy stances across DM economies in recent years, inflation has generally run below central bank targets. As economic slack diminishes, we expect gradual inflation acceleration. Given well-anchored inflation expectations and independent, mandate-focused central banks, we do not envision significant or persistent overshooting. That said, risks exist on either side of this benign view. On the one hand, political or social pressure for higher inflation could mount. On the other hand, although the Japanese descent into deflation remains poorly understood, many DM economies will be following in Japan's footsteps in some ways. For EM economies, we expect inflation to run somewhat above official targets but to remain in single-digit territory. Despite disappointing growth and occasional political stress, very few EM governments have shown any sign of abandoning the commitment to broadly sustainable financial policies adopted in recent decades.

2015 assumptions 2016 assumptions **Change (percentage points)** Real GDP (%) Core inflation (%) Real GDP (%) Core inflation (%) Real GDP (%) Core inflation (%) **Developed markets** 0.00 2.00 2.00 1.75 2.00 -0.25 U.S. 2.50 2.25 2.25 2.25 -0.25 0.00 0.00 Furozone 1.50 1.75 1.50 1.50 -0.25 UΚ 2.00 2.25 1.50 2.25 -0.50 0.00 1.00 1.25 0.50 1.50 -0.50 0.25 Japan Australia 2.00 2.50 2.00 2.50 0.00 0.00 Canada 2.25 2.00 1.75 2.00 -0.50 0.00 Switzerland 0.75 1.75 0.75 0.00 0.00 1.75 **Emerging markets** 5.00 4.00 5.00 3.75 0.00 -0.25 0.50 Brazil 3.25 4.75 3.00 5.25 -0.25 China 6.25 3.00 6.00 3.00 -0.25 0.00 India 7.00 7.00 7.25 5.00 0.25 -2.00 Russia 3.00 5.50 2.75 5.50 -0.25 0.00

Our 2016 assumptions call for moderate growth overall, with real growth expectations mostly flat to slightly down and inflation generally stable EXHIBIT 1: MACROECONOMIC ASSUMPTIONS

Source: J.P. Morgan Asset Management; estimates as of September 30, 2014 and September 30, 2015.

# 2016 LONG-TERM CAPITAL MARKET ASSUMPTIONS-MAJOR ASSET CLASSES

This year's assumptions, as did last year's, reflect an environment with more-moderate global growth cycles and lower inflation than in the past. Developed economies are enjoying a cyclical uplift in the face of increasingly apparent demographic drag on potential economic growth rates, while emerging economies are only beginning to rebalance their economies, in order to capitalize again on their superior demographic trends over the outer years of our assumptions time frame.

Over the last year, the starting point has moved for a number of asset classes, with commodity prices now fully discounting a lower growth trajectory and foreign exchange markets realigning significantly to reflect the incipient policy divergence. The U.S. equity markets, however, have moved sideways, as lower energy prices fed into lower current earnings and a less sanguine growth outlook dampened expectations for near-term earnings growth. The U.S. bond market has slowly begun to prepare for a life after the end of the zero interest rate policy with somewhat higher rates at the front end, but low inflation expectations have kept long-term interest rates well anchored. Given this backdrop, nominal return expectations improve for equities and high yield bonds, are little changed for cash and deteriorate for Treasuries and investment grade debt (**Exhibit 2A**). Premiums for credit and equity risk improve significantly, primarily driven by a reduction in the duration premium, while small cap and private equity premiums remain unchanged year-over-year (**Exhibit 2B**).

# Fixed income-A staggered liftoff

The asynchronous pattern of global growth will begin to materialize in diverging monetary policy rates across developed markets. Short-term rates will begin to rise in the near term in the U.S. and UK, while easing will not only continue but is likely to expand further in the eurozone and Japan. A lack of inflation and a more benign growth outlook will put downward pressure on short- and long-term equilibrium yields and returns globally, further aggravated by easy monetary conditions in the near term. In this environment, returns on cash will struggle to exceed the rate of inflation, while longer-duration government debt should be able to overcome near-term mark-to-market losses from the limited rise in yields and earn a moderate premium over cash. Corporate credit returns will remain relatively more attractive, supported by ongoing demand for yield and limited credit losses during a long but shallow economic cycle. Emerging market debt (EMD) yields are already reflecting weaker economic fundamentals and rising credit risks, but value will only begin to emerge slowly as the rebalancing process progresses.



 Attractive equity and credit risk premiums drive improvements in nominal performance prospects

 EXHIBIT 2A: SELECTED LTCMA RETURNS (%)

 EXHIBIT 2B: SELECTED LTCMA RISK PREMIUMS (%)

Source: J.P. Morgan Asset Management; estimates as of September 30, 2014, and September 30, 2015.

# Equity-Still subdued

Similar to fixed income, equity return assumptions again paint a slightly disappointing picture relative to history. Developed market returns in particular remain constrained as earnings growth is dampened by a modest economic growth environment and starting valuations remain elevated. We continue to expect payouts to shareholders rather than earnings growth to be the main component of total returns. Our emerging market equity return assumption ticks up marginally in local currency terms compared with last year due to more attractive valuations. In U.S. dollar terms, our assumptions rise more significantly, reflecting a substantial realignment in currency exchange rates over the last year.

# Alternatives-Outlook varies across strategy classes; manager choice is key

Our assumptions for private equity increase marginally, benefiting from a moderate rise in our public market return assumptions for U.S. mid cap and European equities, while the return assumptions for real assets decline, reflecting rising valuations and a slowly aging economic cycle. Sluggish global economic growth, especially in China, will weaken the rate at which the demand for commodities grows and suppress prices in the near term. While still in the early innings of the demand/supply adjustment process, prices will ultimately have to rise to provide sufficient incentive for supply to keep up with long-term demand. Demand for infrastructure investments remains strong among liability-driven investors and those seeking income-generating assets. Midmarket, non-trophy assets should benefit from this trend and provide attractive investment returns.

Our hedge fund composite return assumptions are driven by public market beta exposures, the dominant source of risk taking for most strategies. The environment for alpha generation for traditional hedge funds and liquid alternative strategies remains challenging in the near term. Over the full assumptions period, however, we expect conditions for generating alpha to improve as rates rise, volatility increases and inter-asset-class and intra-sector relationships revert toward their means.

As in prior years, our assumptions for private equity, infrastructure and hedge funds represent composite returns at the industry level, across managers with widely divergent skill sets. Therefore, manager selection remains the critical determinant of success when investing in alternatives.

# Foreign exchange—Further away from long-term equilibriums

Policy divergences and further economic rebalancing have led to an increase in currency volatility over the last year, driving exchange rates significantly away from their long-term equilibriums. The move away from fair value in developed market currencies has been short and sharp, and at this stage the realignment of foreign exchange rates to a diverging economic and monetary policy environment appears already well advanced. We expect, however, that given the ongoing need for easy monetary policy in much of the developed world, it will take several years for this trend to reverse and the U.S. dollar (USD) to weaken back toward long-term equilibrium levels. In emerging market and commodity-related economies, currencies appear to have rebalanced from overvalued to close to fairly valued levels. Given the ongoing cyclical slowdown in these countries, we expect further currency weakening relative to the USD before these currencies rise more gradually back to fair value in the later years of our assumptions time frame.

# A RISK-ADJUSTED RETURN PERSPECTIVE

Low starting yields and a reduced duration premium lead to significant declines in the expected risk-adjusted returns for Treasuries and Treasury Inflation Protected Securities (TIPS). The more diversified U.S. Aggregate Bond Index, emerging market debt and diversified hedge fund strategies, as well as commodities, are expected to experience a smaller decline, driven by a higher risk-free rate. The risk-adjusted returns for the riskiest assets—equities and high yield—improve slightly year-over-year, benefiting from an improvement in their return outlook in excess of the rise in the expected cash return (**Exhibit 3**). The most significant improvements in return per unit of risk appear to be for U.S. high yield bonds and equities

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



Source: J.P. Morgan Asset Management; estimates as of September 30, 2014 and September 30, 2015.

## **OPPORTUNITIES FOR INVESTORS**

While still uninspiring, the outlook has improved a little for the 60/40 portfolio investor, given this year's and last year's LTCMAs. As **Exhibit 4** shows, the 2016 portfolio plots a little up and to the left of the 2015 point in risk/return space, suggesting that both nominal return expectations and the risk profile are improving somewhat.

Another way to look at it is that the entire efficient frontier has rotated counterclockwise, almost exactly around a 35/65 reference point. This counterclockwise rotation implies that the expected return on relatively safer assets has fallen further, while the expected return for riskier assets has improved relative to last year.

Starting at the lower end of the risk spectrum, Treasuries and TIPS are likely to generate only a small premium over cash. Skill-based strategies—such as diversified hedge funds as well as, but somewhat less significantly, liquid alternatives—should achieve superior returns with a similar level of risk relative to Treasuries and TIPS, albeit at the expense of a reduced level of liquidity.

Investors with the flexibility and wherewithal to tolerate higher levels of volatility can position their portfolios to capture these increased equity and credit risk premiums by stepping further out on the risk curve. High yield and, to a lesser degree, emerging market debt appear attractive, offering close to equity-like returns with superior risk characteristics. For investors who can be flexible and withstand higher volatility, and have low liquidity requirements and the research capabilities to identify abovemedian managers, private equity markets offer expected returns north of 8%—an elusive barrier in recent years.

Finally, after multiple years of relative underperformance, improving valuations and significant currency realignment relative to the U.S. dollar, international equities—and emerging market equities in particular—are increasingly attractive, with the pickup in expected returns offering a more adequate compensation for the incremental risk taken than it has in the recent past.

Our 2016 vs. 2015 assumptions suggest that long-term investors willing to step out on the risk curve can expect to be better compensated for that incremental risk





Source: J.P. Morgan Asset Management; estimates as of September 30, 2014, and September 30, 2015

# LONG-TERM CAPITAL MARKET ASSUMPTIONS: A TIME-TESTED PROCESS

J.P. Morgan Asset Management has produced its Long-Term Capital Market Assumptions in a broadly unchanged format since 2004. With an assumption horizon of 10-15 years, it seems reasonable to assess how a portfolio would have actually fared compared with our expectations in 2004 and 2005, respectively.

Each bar in the chart in **Exhibit 5** shows the return expectation for a reference portfolio\* based on the LTCMAs of that year, shown as a white horizontal line. The surrounding shaded area reflects the range in which actual outcomes may fall within a certain confidence interval. The range shrinks as the time horizon lengthens.

The **blue** triangles depict the actual return that the reference portfolio would have achieved from the time of the publication of the LTCMAs until the end of 2014. The closer the **blue** triangle to the horizontal line, the more reliable the assumptions of that year have turned out to be.

#### For example:

In 2004, using our long-term projections for that year, we estimated the reference portfolio would achieve a compound annual return of 7.1% over our assumptions time frame. The actual compound annual return of the reference portfolio over the subsequent 11 years, from 2004 to 2014, was 6.9%.

While this is certainly too small a sample to draw statistically significant conclusions, we are pleased to see how well the assumptions have stood the test of time in one of the most volatile investment environments in a generation.

\* The asset allocation of the reference portfolio reflects JP Morgan Private Bank's default Balanced Portfolio asset allocation mix of the respective year, with a risk profile equivalent to that of a portfolio with a 55/45 equity/bond mix.



#### EXHIBIT 5: EXPECTED PORTFOLIO RETURN BASED ON LONG-TERM CAPITAL MARKET ASSUMPTIONS RELATIVE TO ACTUAL PERFORMANCE

Source: J.P. Morgan Asset Management; data as of September 30, 2014. **Note:** This is a projection used for illustrative purposes only and does not represent investment in any particular vehicle. References to future asset values are not promises or even estimates of actual returns you may experience. Past performance is no guarantee of future results. It is not possible to invest directly in an index. \* "Most probable returns," denoted by the darkly shaded area, indicates the range around the 50th percentile. The "50th percentile" indicates the middle wealth value of the entire range of probable asset values. The "95th percentile" wealth value indicates that 95% of the probable asset values will be equal to or below that number; the "5th percentile" wealth value indicates that 5% of the probable asset values will be equal to or below that number, the "5th percentile" wealth value indicates that 5% of the probable asset values will be equal to or below that number, sterile "sub that number, the "5th percentile" wealth value indicates that 5% of the probable asset values will be equal to or below that number, sterile "sub that number, the "5th percentile" wealth value indicates that 5% of the probable asset values will be equal to or below that number, sterile "sub that number, the "5th percentile" wealth value indicates that 5% of the probable asset values. Indices used: Barclays Capital Global & US Aggregate Bond Indices, S&P 500, Russell 1000 Value, Russell Midcap, Russell 2000, MSCI EAFE, MSCI Japan, MSCI Asia ex-Japan, MSCI Emerging Markets, HFRI Fund of Funds Diversified , HFRI Event Driven , HFRI Equity Hedge, HFRI Relative Macro, Venture Economics US Buyouts, NCREIF Property TR, DJUBS Commodity.

# I. THEMATIC ARTICLES: CONSIDERATIONS FOR LONG-TERM INVESTORS

# Uncertain harvest: The intended and unintended consequences of regulation

John Bilton, Head of Global Multi-Asset Strategy Group Dr. David Kelly, CFA, Chief Global Strategist, J.P. Morgan Funds Alex Christie, Senior Strategist, Global Pension Solutions Thushka Maharaj, Global Strategist, Multi-Asset Solutions

### IN BRIEF

- A post-financial crisis wave of regulation, at both the local and global levels, has had a major impact on financial firms. It presents complex implications for economic growth, interest rates and market liquidity.
- In the U.S., credit constrained by regulation may have contributed to weak consumer spending. Consumer spending drives the U.S. economy and has, in this expansion, lagged every other expansion in the modern era.
- In financial markets, the key effect of increased regulation appears to be on liquidity, principally via reduced dealer balance sheets. With financial intermediaries less able to deploy their balance sheets, bull market corrections may become more accentuated. A higher natural level of volatility during a bull market phase would in turn drag down Sharpe ratios for risky assets, which may inhibit the ability to allocate optimally to them.
- The complexity of global markets means that no regulatory policy can be introduced without some risk of unintended consequences. The impact of regulation will, at some level, limit financial activity. For an economy underpinned by credit formation, this naturally creates a drag on growth.

Since the global financial crisis, financial firms have witnessed an unprecedented surge in regulations, on both a local and a global level. As multiple national and supra-national lawmakers design regulations with similar goals of stability and probity, it inevitably creates complexity (Exhibit 1). Although the new regulations (the Dodd-Frank Act in the U.S., the European Union banking union and global initiatives such as Basel III. among others) are well intentioned, it takes the financial sector considerable time to identify and adjust for their impact. Certainly, the financial sector's interactions with the real economy via lending and through secondary markets are influenced by recent regulatory changes. Additionally, perceived over-regulation can lead to the emergence of alternative transaction mechanisms that are currently beyond the reach of regulators. For example, recent growth in crowdfunding, peer-to-peer lending and direct lending via hedge funds may be linked, in part, to regulatory constraints on traditional lenders.

In this section, we explore how the regulatory environment has developed since the global financial crisis and consider what the long run implications may be for economic growth, interest rates and market liquidity. In the real economy, constraints on lending activity may restrict consumer and small business activity; in financial markets, the liquidity implications of reduced financial intermediary balance sheets are already a subject of concern.

#### New regulations are far more complex than older rules





Source: American Bankers Association, J.P. Morgan Asset Management; data as of August 21, 2015.

### IMPACT OF REGULATION ON THE REAL ECONOMY

One area where new regulations may have slowed economic growth is in consumer spending. The current U.S. expansion<sup>1</sup> has been one of the slowest on record. Consumer spending drives the U.S. economy and has, in this expansion, lagged every other expansion in the modern era (**Exhibit 2**).

Consumer spending growth in this recovery has been the slowest since World War II





Source: Bureau of Economic Analysis, J.P. Morgan Asset Management; data as of August 21, 2015.

Few topics in macroeconomics have been explored as thoroughly as U.S. consumer spending; as a result, we have some idea of what drives it.<sup>2</sup> Consumer sentiment and the growth in disposable income, household net worth, employment and home buying can explain about 73% of the variation in the quarterly growth of real consumer spending between the first quarter of 1985 and the

<sup>&</sup>lt;sup>1</sup> Expansion refers to a period of sustained economic growth as defined by the National Bureau of Economic Research business cycle dating committee from the previous cycle trough to the current peak. Data shown reflects quarterly numbers for the first six years, or less if the expansion lasted less than six years, for ease of comparison.

Our consumer spending model is based on a multivariate regression analysis of quarterly data between the first quarter of 1985 and the second quarter of 2009. The dependent variable is growth in consumer spending ex-autos, and the independent variables are growth in real disposable income, real disposable income lagged one quarter, real household net worth, nonfarm payrolls, new home purchases and the level of consumer sentiment. Dummy variable controls are used for consumer sentiment in 4Q1991 and 1Q1992 to account for an outlying unexplained surge and drop in confidence. The model has an R-squared value of 0.7282 and all t-stats meet the 2.00 threshold of significance, other than non-lagged growth in real disposable income, which has a t-stat of 1.77. Forecasted values were obtained by holding regression coefficients constant and applying the model to the most recently available independent variable data, from 3Q2009 to 2Q2015.

second quarter of 2009. However, after the current expansion began, the relationship broke down. Consumer sentiment, household net worth, employment and home buying have all grown at respectable rates in the past six years, while the growth in disposable income has been weak. However, even accounting for the depressed level of income, consumer spending has lagged expectations since mid-2012. By our estimates, \$269 billion in consumer spending was "missing" by 2Q2015.

Credit constrained by post-crisis regulation may be part of the problem (**Exhibit 3**). Pre-crisis, personal income and credit card debt grew at roughly the same rate. Once the expansion began, one would have expected this trend to resume—but it hasn't. Even when depressed levels of income are taken into account, we would have expected about an additional \$349 billion in credit card debt to have been amassed by now.

Two forces have likely caused the gap between projected and actual credit card debt: consumers focusing on digging themselves out of debt and regulatory changes like the Credit Card Accountability Responsibility and Disclosure Act of 2009, which makes it harder to obtain credit and more expensive to use it.

Changes in regulation have also impacted small businesses. Typically, in an expansionary phase, small businesses are the first to respond to changes in economic conditions and lead growth. However, small-business conditions in this recovery have lagged those for large businesses for longer than at any time since the National Federation of Independent Business began tracking small-business conditions (**Exhibit 4**).

Conditions for small businesses have only *very* recently caught up to those for large businesses



EXHIBIT 4: BUSINESS CONDITIONS<sup>3</sup> FOR SMALL AND LARGE BUSINESSES, 1990-2014

Source: NFIB, Aruoba-Diebold-Scotti Business Conditions Index, J.P. Morgan Asset Management; data as of August 21, 2015.

#### Falling access to credit may be constraining consumer spending EXHIBIT 3: U.S. CREDIT CARD DEBT. U.S. DOLLARS



Source: Bureau of Economic Analysis, Consumer Financial Protection Bureau, CCDB, Federal Reserve, J.P. Morgan Asset Management. Data as of August 21, 2015. Projected using a simple regression model relating credit growth to personal income.

Moreover, in a few key areas, small businesses still face stiff obstacles. One of the biggest problems is a lack of credit (**Exhibit 5**). Part of the problem is that the small loan size required by small businesses does not offer the same profit opportunity to banks and that stricter regulations also require more stringent examination of loan applications for credit quality. This naturally restricts credit to smaller or younger businesses that lack stable cash flow or a long financial history.

#### Access to credit for small businesses has become tougher





Source: Cleveland Federal Reserve Bank, FDIC, J.P. Morgan Asset Management; data as of August 21, 2015.

<sup>3</sup> Business conditions are a composite index indicator based on plans to increase employment, to make capital outlays and to increase inventories and expectations that the economy will improve, real sales will increase, credit conditions will improve, earnings trends will improve and that current inventories and job openings reflect a good economy, and the survey responses in the affirmative to the statement "now is a good time to expand." The large-businesses index also makes use of industrial production, personal income less transfer payments and real GDP data and does not ask businesses owners if they view current conditions as warranting expansion.



#### With limited labor force growth and capital spending not coming through, the U.S. is looking at lower growth for longer

EXHIBIT 6: DRIVERS OF GDP GROWTH, 1955-2014

Average year-over-year percentage change

### **GROSS INVESTMENT AND DEPRECIATION, 1990-2015**

Private nonresidential fixed investment, % of GDP

Source: BEA, BLS, Census Bureau, DOD, DOJ, FactSet, J.P. Morgan Asset Management. Data as of August 21, 2015. GDP drivers are calculated as the average annualized growth between 04 of the first and last years.

A combination of regulations, employment dynamics, access to financing and a lack of consumer spending has made it more difficult for small businesses to expand and survive. Dampened growth in small businesses is undoubtedly reducing U.S. capital spending, but investment spending is depressed across all firm sizes, indicating troubling trends ahead for the U.S. economy. Capital expenditures are key to productivity growth, which has been falling for several years. Without investment in the American worker, it will likely fall further, limiting the potential growth of the U.S. economy (Exhibit 6).

# THE IMPACT OF REGULATION ON FINANCIAL MARKETS

In the aftermath of the financial crisis, bank balance sheet leverage and the broader role of financial intermediaries came under particular scrutiny. The capstone of new regulation aimed at strengthening the financial markets, the 2010 Dodd-Frank Act, looked to achieve a "transformation on a scale not seen since the reforms that followed the Great Depression"<sup>4</sup> for the financial markets.

President Barack Obama, "Remarks by the President on 21st Century Financial Regulatory Reform," delivered at the White House on June 17, 2009.



The 2008 financial crisis saw substantial balance sheet deleveraging in the financial sector. Post-crisis, there was a lack of re-leveraging EXHIBIT 7: FINANCIAL SECTOR LEVERAGE OVER THE LAST FEW BUSINESS CYCLES

Source: Federal Reserve, Haver, J.P. Morgan Asset Management: data as of August 21, 2015.

Few would disagree with the notion that the relatively slack regulatory environment of the early 2000s helped to sow the seeds of the 2008 financial crisis. Yet for all the benefits of the post-crisis regulatory overhaul, it has also raised questions about the impact of regulation on market depth and liquidity.

The 2008 crisis was unusual in two regards: First, the substantial balance sheet deleveraging in the financial sector, and second, the lack of re-leveraging that followed (**Exhibit 7, prior page).** Since the crisis, the recovery in balance sheets has remained well below its long-run trend. Furthermore, despite the continued economic recovery, broker-dealer balance sheets began to shrink again in 2011–not long after Dodd-Frank was enacted (**Exhibit 8**).

The primary concern this raises is whether financial intermediaries are as well equipped to absorb short-term market gyrations as they were pre-crisis. In our view, during a severe crisis, the functioning of the market will remain supported, including, if necessary, central bank intervention. In previous downturns, broker-dealers typically reduced balance sheet assets at the start of the recession, necessitating central bank intervention as a lender—or balance sheet—of last resort (**Exhibit 9**). This scenario is likely to reoccur in a future recession. However, what may be of greater concern is the degree to which the financial system can withstand temporary shocks during normal markets (for example, the Bund market sell-off of April 2015 or the Treasury flash crash of October 2014). The shrinkage of financial sector balance sheets, in part a consequence of regulation, may leave markets less able to absorb bouts of volatility outside of recession periods.

Broker-dealers have typically reduced balance sheet assets at the start of a recession



EXHIBIT 9: SECURITY BROKER-DEALER BALANCE SHEETS-TOTAL FINANCIAL ASSETS Y/Y  $\%,\,1971\text{-}2014$ 

Source: Federal Reserve, Haver, J.P. Morgan Asset Management; data as of August 21, 2015.

Broker-dealer financial assets have not increased since the financial crisis





Source: Federal Reserve, Haver, J.P. Morgan Asset Management; data as of August 21, 2015.

We see two consequences of shrunken financial sector balance sheets: higher aggregate volatility during bull markets and, at the margin, an increased demand for riskless assets. In this context, we note that, even accounting for the distortion from quantitative easing (QE), longer-dated interest rates are some way below our fair-value model (**Exhibit 10**). The dislocation became most severe from late 2011 onward. We cannot say with certainty that increased regulation is a drag on longer-dated interest rates, but it is one possible explanation for the deviation we observe in our interest rate models.

Increased regulation may explain some of the deviation between modeled and actual U.S. interest rates





Source: Bloomberg, MacData, J.P. Morgan Asset Management; data as of August 21, 2015. Gray bands denote +/- standard deviation band.

# REGULATION MISMATCH: AN EXAMPLE FROM EUROPEAN PENSIONS

Among the regulatory matters that are currently being discussed in the European institutions, two appear to cause a conflict in outcomes: the European pensions legislation, and prospective Capital Markets Union.

#### EUROPEAN PENSION REGULATION

The controversial draft European pensions directive, known as IORP II or Solvency II for Pensions, aims to provide a framework to promote and facilitate the transfer of pension schemes across the European Union. It is currently being debated in the European Parliament.

The stakes are high for European pensions, particularly large funds and those with cross-border ambitions. At the heart of the controversy surrounding the proposal is the European Commission's belief that pension schemes and insurance companies perform roughly equivalent functions and should thus be subject to similar regulatory requirements. As we have explained in a separate publication,<sup>5</sup> we believe this premise to be flawed, since it does not take into account the fact that pension schemes and insurance companies have different objectives, time horizons and levels of recourse to additional capital.

In particular, there is concern that the solvency requirements that currently apply to insurance companies could be applied to pension funds, leading to higher levels of funding than should be necessary. Following challenges from some of the EU's member states, the inclusion of stringent solvency requirements has been postponed for the time being.

#### CAPITAL MARKETS UNION

The Capital Markets Union constitutes a regulatory and legal framework that exists to promote more integrated capital markets across the EU's 28 member states. It also aims to promote investment in long-term and illiquid assets, furthering the objectives of governments to promote private sector investment in infrastructure. This framework is currently undergoing a consultation, offering stakeholders in the public and private sectors an opportunity to express their views.

#### REGULATORY MISMATCH

There appears to be a mismatch between the stated ambition of the Capital Markets Union and the European pensions directive. The Capital Markets Union is meant to help direct private investment to long-term projects, infrastructure assets, smalland medium-sized enterprises (SMEs) and start-ups. Although the pensions directive is presented as promoting long-term investment,<sup>6</sup> it is largely modeled after insurance regulations, which, on balance, penalize investment in such assets. As matters currently stand, the draft pensions directive mentions only in passing that member states will be required to allow pension schemes to invest in long-term illiquid assets. An amendment that could go some way toward mitigating the impact of excess regulation would include regulatory incentives for pension schemes to invest in illiquid assets, for example, by allowing an illiquidity premium on discount rates.

The proposed Capital Markets Union and pensions directive are often presented as separate issues. Yet if the ambition is to encourage institutional investors such as pension schemes to invest in long-term and illiquid assets, then the link between the two must be highlighted.

<sup>&</sup>lt;sup>5</sup> Alex Christie, Paul Sweeting "IORP II Lite" (J.P. Morgan Asset Management, July 2013).

<sup>&</sup>lt;sup>6</sup> An analysis of this point, including a numerical example of the impact it may have on a typical occupational pension scheme, is provided by Alex Christie, Paul Sweeting, Edward Gladwyn in "Solvency II for Pensions", J.P. Morgan Asset Management.

# CONCLUSION: THE IMPACT OF REGULATION ON LONG-RUN ASSET RETURNS

Two important themes emerge from our analysis. First, financial markets need regulation for their proper and safe function, but the complexity of global markets means that no policy can be introduced without some risk of unintended consequences. Second, the impact of regulation will, at some level, limit financial activity. For an economy underpinned by credit formation, this naturally creates a drag on growth.

It is difficult to exactly quantify the potential impact of increased regulations on growth. But our analysis demonstrates that there is a large residual component in both real economy and interest rate models that is likely to be at least partly attributable to the increase in regulation. To the extent that economic drag can reasonably be attributed to regulation, this could manifest itself through modestly lower equilibrium interest rates. Real GDP growth has trended lower over the past 30-odd years, and so have interest rates (**Exhibit 11**).

Slower growth and lower interest rates have moved in tandem EXHIBIT 11: U.S. REAL GDP YEAR-OVER-YEAR % CHANGE, NOMINAL 10-YEAR U.S. TREASURY YIELD



Source: BEA, FactSet, Federal Reserve, J.P. Morgan Asset Management; data as of August 20, 2015.

This is consistent with two themes presented in our 2016 Long-Term Capital Market Assumptions: the "lower for longer" themes and the shallower path of interest rates that our 2016 Long-Term Capital Market Assumptions lay out.

With financial intermediaries less able to deploy their balance sheets under normal market conditions, bull market corrections may become more violent, leading to modestly higher average volatility during a bull market phase. This creates the scope for new players with large balance sheets and fewer mark-to-market restrictions, such as pension and sovereign wealth funds, to take an increasing role as providers of liquidity.

In bear markets, the presence of the central banks, plus countercyclical measures now in place, may dampen extreme volatility. Thus, over the cycle, average volatility might be modestly lower, but during bull markets, traditional financial intermediaries will have less scope to absorb market volatility. In turn, Sharpe ratios for risky assets could well be lower in bull market phases, which may inhibit the ability to optimally allocate to them. As a result, portfolio returns may suffer slightly at the margin.

What is the outlook for the coming regulatory cycle? These cycles are slow moving and appear to swing from periods of apparent under-regulation (as in the early 2000s) to more highly regulated periods. It is reasonable to assume that for this cycle, and probably the next, the pendulum will stay on the "tight" side of regulation. As a result, some unintended limitations on lending, growth and ultimately the terminal interest rate may occur. As our analysis has underscored, when new rules are introduced to any complex system, they will almost certainly cause unintended consequences that cannot be predicted.

# EMERGING MARKET EQUITIES

# Emerging market equities: Then, now and tomorrow

Patrik Schöwitz, Global Strategist, Multi-Asset Solutions Michael Albrecht, Global Strategist, Multi-Asset Solutions

#### IN BRIEF

- Emerging markets have been steadily gaining importance in the global economy and as places to invest since the concept began to gain traction in the late 1980s.
- However, many investors still see "emerging markets" as a monolithic concept, with limited appreciation for the underlying differences among countries and regions.
- With many changes underway across emerging markets, investors will increasingly need to differentiate more carefully.
- This article aims therefore to provide an easy-to-digest "map" of the emerging market (EM) equity landscape, discusses the investment experience so far and provides a few thoughts on important drivers for EM equity returns going forward.

The authors are conscious that they are writing this piece in the middle of a difficult time for EM equities, which is already being compared to the Asia/EM crisis of the late 1990s. As such, EM performance and growth numbers throughout this piece now look much worse than even two months ago and could be interpreted as signifying either cyclical lows or a structural return to more normal levels. The data presented below supports aspects of both positions.

# TAXONOMY OF EM EQUITIES

Since its inception in 1988, the widely used MSCI Emerging Markets Index has grown roughly 100-fold, from a market capitalization of USD 38 billion to around USD 4 trillion. But as of August 2015, EM equities still represent only a modest 10% share of the USD 35 trillion capitalization of the MSCI All Country World Index (ACWI) (**Exhibit 1**). The EM equity weighting is held back by a low free-float factor, but even at a full-float weight of around 15.5% it is small compared with the share of global GDP represented by emerging economies. Much catch-up potential should therefore remain–although, as our work on dilution suggests (see explanation below), only a fraction of this growth will likely accrue to today's investors.

Emerging markets still only represent a small portion of investible global equity





Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.

### REGIONAL, COUNTRY, SECTOR BREAKDOWN

Tracking changes to the regional composition of the MSCI Emerging Markets Index universe<sup>1</sup> shows that the dominance of Asia has grown further (**Exhibit 2**). Asia now accounts for over 69%, up from 63% in 1995, mostly at the expense of Latin America, which is now less than 14% (down from 23% in 1995). Meanwhile, Europe, the Middle East and Africa (EMEA) has grown only moderately, from around 15% to 17% today. Changes at the country level are more interesting, with the most important being China's rise from less than 1% to nearly a quarter today. Today, the largest five markets—in order, China, Korea, Taiwan, India and Brazil—account for roughly 68% of the index. In 1995, the then-largest markets—Taiwan, Korea, Malaysia, Brazil and South Africa—accounted for 63%.

Comparing today's EM sector composition to that of 1997<sup>2</sup> reveals the ongoing dominance of financials, which still account for close to 30% of the market (**Exhibit 3**). In contrast, technology has grown from the second-smallest sector to the second-largest, mainly at the expense of materials and industrials, reflecting the unwinding of the commodity super cycle and the gradual shift toward service-led economies, most notably in China. Health care is still very small at less than 3%, compared with 14% in developed markets.

## EM EQUITY PERFORMANCE: THE STORY SO FAR

In this section, we examine the EM equity earnings and valuation story, including the impact of currency and dilution. Analysis of the historical performance of EM equities shows that outperformance over developed market (DM) equities has been concentrated in two specific periods (**Exhibits 4A and 4B**), each of which saw EM equities outperform by roughly 300%. The first period lasted roughly from the end of the communist era in the late 1980s until the mid-1990s; the second, from the early 2000s until about 2010, encompassed the rise of China and the associated commodity boom. Sandwiched between these two eras of outperformance are the Asian crisis and the tech bubble, during which EM equities gave up all of their previous outperformance. The current period of underperformance, which began in 2010, has now reduced total outperformance since the inception of the MSCI EM Index to around 120%.

Looking at performance *within* emerging markets, since 1997<sup>3</sup> Latin America has been the clear performance leader, with an annualized total return of 7.8% in U.S. dollars, followed by EMEA at 6.7% and EM Asia at 3.2%. However, much of the recent weakness of EM equities has also been driven by Latin America. From its 2011 peak, Latin America's return has been -14.1% and EMEA's -8.7%, while Asia's has been -2.1%.

<sup>3</sup> All regional performance comparisons refer to changes from 1997, when MSCI EM regional total return data begins, to the end of August 2015.

<sup>&</sup>lt;sup>1</sup> All regional size comparisons refer to changes from 1995, when MSCI EM region and country index free-float market capitalization data begins, to the end of August 2015.

<sup>&</sup>lt;sup>2</sup> All sector size comparisons refer to changes from 1995, when MSCI EM sector index free-float market capitalization data begins, to the end of August 2015.

# Dominance of Asia-especially China-has grown at the expense of Latin America EXHIBIT 2: EM EQUITY REGIONAL COMPOSITION (PERCENTAGE SHARE OF INDEX, BY MARKET CAPITALIZATION)



EM country breakdown, today

Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015. Note: Countries that account for less than 2% of the EM index are grouped as "other" by region.

#### Still dominated by financials, but technology share is growing EXHIBIT 3: EM EQUITY SECTOR COMPOSITION (PERCENTAGE SHARE OF INDEX, BY MARKET CAPITALIZATION) EM sector breakdown, today

EM sector breakdown, 1997

EM country breakdown, 1995



#### Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.



EM equities have outperformed DM equities since 1987, but only in two isolated periods

Source: MSCI, Thomson Reuters Datastream, J.P. Morgan Asset Management; data as of August 31, 2015.



# Currency has been a significant driver of local currency EM performance

Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.

## Currency translation effect<sup>4</sup>

Looking at the long-run performance of the EM equity universe drives home just how important the impact of currency is for EM investors. In nominal local currency terms, the MSCI EM Index appears to have performed spectacularly since its 1987 inception, with a total return of 28% per year, or nearly 1,000-fold growth **(Exhibit 5A)**. Measured in U.S. dollars, however, the index has delivered a total return of just 10.7% per annum, compared with 7.6% for developed markets **(Exhibit 5B)**. In particular, much of the recent underperformance of EM equities in U.S. dollar terms has been driven by currency weakness, especially in Latin America.

### Earnings growth and dilution

Investing in emerging markets has often been based on the premise that faster economic growth leads to higher equity market returns. But from an investor's perspective, it is crucial to consider the impact of dilution and growing share count—as our work last year showed.<sup>5</sup> While EM market capitalization and aggregate earnings have indeed grown at substantially faster rates than in developed markets over the last two decades, much of this growth was not sustained internally through reinvestment of retained earnings. Instead, the rapid growth in aggregate earnings relied on raising new equity capital, diluting existing shareholders. Both the listing of new companies and share

<sup>4</sup> Aggregate return comparisons refer to changes from 1987, when MSCI EM Index aggregate total return data begins, to the end of August 2015. issuance by existing companies mean the share of total index earnings that actually accrues to shareholders is reduced. Moreover, market caps of aggregate EM indices have also substantially expanded due to the simple inclusion of new countries; for example, MSCI's June 2014 reclassification of Qatar and the United Arab Emirates increased the market cap of the EM index by over 7%. This trend can be expected to continue with the pending inclusion of Saudi Arabia and Chinese A-shares.

Dilution in emerging markets has run ahead of that in developed markets

#### EXHIBIT 6: NET DILUTION (1995=100)



Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.

<sup>&</sup>lt;sup>5</sup> Last year's Long-term Capital Market Assumptions introduced an updated framework that more explicitly accounts for net dilution, and featured a thematic article, "How Dilution and Share Buybacks Impact Equity Returns."



### The impact of dilution: Overall EM earnings growth has vastly outpaced EPS growth

Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.

Since 1995 (when MSCI EM earnings data starts), total profits for the overall EM equity index have risen by 600% (in U.S. dollar terms), significantly outpacing those of the DM index, which have risen only 300% (**Exhibit 7A**). But in per share terms, earnings growth has been nearly identical for emerging and developed markets (**Exhibit 7B**).

Furthermore, comparing earnings growth in emerging and developed markets over time shows that, even in total profit terms, superior EM growth only really began with the EM boom of the mid-2000s. In per share terms, most of this outperformance shrinks down to just the financial crisis years. The protracted earnings recession and nearly 30% decline in EM earnings per



EXHIBIT 7B: EM AND DM EPS IN U.S. DOLLARS (1996=100)

share that began in 2011 has now wiped out even that earlier outperformance. This finding challenges the widely held belief that EM equities generate superior long-term earnings growth, even if a near-term earnings recovery from current cyclical lows is likely.

# Decomposing performance: Earnings, valuations and dividends

Having looked at performance and earnings separately so far, we now decompose equity returns to see what has driven the performance of EM equities. Looking at the entire sweep of priceto-earnings (P/E) history for MSCI EM and its sub-regions, valuations have not been a key driver of performance for either

#### Valuations have not been a key performance driver, with the possible exception of Latin America EXHIBIT 8: P/E RATIOS



Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.



Performance drivers show more similarities than differences at the broad asset class level, with greater variation among EM regions EXHIBIT 9: DECOMPOSITION OF PERFORMANCE FOR MSCI EM, DM AND EM REGIONS INTO PRICE RETURNS, DIVIDENDS, VALUATIONS AND EPS GROWTH SINCE 1997, U.S. DOLLARS

	MSCI EM	MSCI World	MSCI EM Asia	MSCI EM Latin America	MSCI EM EMEA
Total return since 1997	5.6%	6.1%	3.2%	7.8%	6.7%
Price return since 1997	2.9%	3.8%	1.0%	4.5%	3.8%
Dividend impact	2.7%	2.3%	2.3%	3.3%	2.9%
P/E appreciation since 1997	-1.3%	-1.1%	-2.6%	1.6%	-0.5%
EPS growth since 1997	4.3%	4.9%	3.6%	2.8%	4.3%

Source: MSCI, Thomson Reuters Datastream; data as of August 31, 2015.

emerging or developed equities, with the possible exception of Latin America. EM valuations have not only failed to close the gap with developed markets but even slightly de-rated, taking into account recent EM market weakness (**Exhibit 8**, prior page). The current P/E of 12.6x for emerging markets is some 17% below the average (since 1997) of 15.1x, putting EM equities at a discount of 31% to the current developed market P/E of 18.3x-but this is only slightly more than the 26% average discount since 1997. Comparing P/Es across the three main EM regions over the whole data period is difficult, as Asian P/Es rocketed in the late 1990s when earnings collapsed during the Asian crisis. However, we can tentatively say that EMEA has tended to trade at a discount to the other two regions, with an average P/E since 2000 of 14.5x for Latin America, 15.2x for Asia and 12.8x for EMEA.

In **Exhibit 9**, we take the analysis a step further and decompose performance into price returns, dividends, earnings growth and valuation change, again starting in 1997 and using U.S. dollar data.

The recent downdraft in emerging EM equities has been so severe over this period that the asset class has now more than given up all of its previous outperformance, with the total return for the period now 5.6% per annum vs. 6.1% for DM equities. The breakdown of performance drivers shows more similarities than differences at the broad asset class level, with a slightly higher share of returns coming from dividends in emerging markets than in developed markets. And while EM EPS growth has mildly lagged that of DM growth—to the tune of half a percent per annum—the negative contribution from valuation has been nearly identical for both.

There is unsurprisingly more variation within the EM regions, with Latin America (still) the strongest performer, followed closely by EMEA, with EM Asia trailing somewhat further behind. The impact of valuations has also differed somewhat among regions. While they have added 1.6% of performance per annum in Latin America, their impact has been mildly negative for EMEA and strongly negative for EM Asia.



#### **EXHIBIT 10: DUPONT SYSTEM BREAKS DOWN ROE INTO COMPONENTS**

All other things being the same, increasing asset turnover (sales per asset), profit margins or financial leverage will push return on ROE higher. In the past, as well as now, differences across market sectors are greater than differences across regions (and different sector weightings often help explain country-by-country differences).

Source: J.P. Morgan Asset Management.

#### EM and DM net margins have converged EXHIBIT 11: EM VS. DM NET PROFIT MARGINS (EX-FINANCIALS)



Source: Thomson Reuters Datastream; data as of August 31, 2015.

### DuPont breakdown of earnings

To examine the underlying drivers of earnings, we apply a high-level version of the DuPont system, which dissects return on equity (ROE) into a number of explanatory factors (**Exhibit 10**).<sup>6</sup> Over time, perhaps unsurprisingly, the story behind the changes in these drivers has largely been one of convergence toward developed market norms—although there is still some way to go in many areas.

#### EM margins have broadly declined

Having peaked in the mid-2000s, EM profit margins have generally declined over the past decade (**Exhibit 11**). In our view, while

<sup>6</sup> Based on U.S. dollar-denominated data from Thomson Reuters Worldscope indices.

EM margins are converging to DM levels

#### **EXHIBIT 13: NET MARGINS**



Source: Thomson Reuters Datastream; data as of August 31, 2015.

EM margins have weakened most in Latin America EXHIBIT 12: NET PROFIT MARGINS BY EM REGION (EX-FINANCIALS)



cyclical drivers explain some of the recent declines, the bigger explanation is likely structural: much of the growth of EM equities came on the back of globalization—as these markets gobbled up global market share—but this one-time boost is likely completed for the current set of "emerging" markets. This process may have left many EM firms, which previously faced little competition, with lackluster management and poor capital discipline. Further, now that many of these markets have reached a later stage of their development, they are simply growing more slowly and margins may be permanently shrinking toward DM levels. Finally, EM labor markets have remained generally tight through and since the global financial crisis, which has helped to accelerate upward pressure on wages.

September 2015

Telecoms

Developed markets (%)

Consumer goods

Utilities

Consumer services

5

Materials

Oil & gas



10

Financials

Tech

15

Health care





#### Source: Thomson Reuters Datastream; data as of August 31, 2015.

By region, the declining trend of the past decade is present everywhere, but EM Asia has seen a much smaller decline than Latin America and EMEA, having started from a much less elevated level (**Exhibit 12**, prior page).

Since 1995,<sup>7</sup> a few sectoral trends have mirrored those in developed economies, with profit margins weakening in the materials and oil/gas sectors as commodity prices have come down, as well as in utilities, while broadly expanding for financials. For all other sectors, we see a story of convergence (**Exhibit 13**, prior page), with EM margins at best remaining stable (for example, in consumer services) and at worst halving (telecommunications), while margins for the equivalent DM sectors have generally expanded.

<sup>7</sup> Thomson Reuters Datastream emerging markets index data begins in 1995.

Commodity-linked sector weightings vary considerably by market EXHIBIT 16: MSCI FREE-FLOAT MARKET CAP BY SECTOR, PERCENTAGE OF TOTAL



#### EM financial leverage still has room to grow EXHIBIT 15: FINANCIAL LEVERAGE (EX-FINANCIALS)



Source: Thomson Reuters Datastream; data as of August 31, 2015.

#### Asset turnover has generally increased

Asset turnover–sales relative to the level of balance sheet assets– has tended to increase across emerging markets. Many EM sectors are converging toward their developed counterparts as capital is deployed more efficiently, with industrials, telecommunications, utilities and (especially) technology leading the way (**Exhibit 14**). In contrast, asset turnover remained stable for consumer goods/ services and health care, and fell considerably for oil/gas and materials following the global financial crisis (as it did in developed markets).

Source: Bloomberg, MSCI; data as of September 14, 2015.

# Financial leverage is increasing in emerging markets (and decreasing in developed markets)

Over the past two decades, financial leverage in EM equities has broadly increased outside the financial sector (**Exhibit 15**), from 1.7x in 1995 to 2.4x today, while leverage in the financial sector itself has remained steady, and immune to the sharp contraction seen in developed markets following the global financial crisis. Still, among the major DuPont factors, leverage remains the most consistently far from converged to developed market levels.

Since the late 1990s, leverage has been particularly low in emerging Europe (and EMEA more broadly). Meanwhile, patterns in individual markets and sectors often reflect idiosyncratic events rather than secular trends: the leverage of Greek financials, for instance, temporarily increased amid write-downs during the European debt crisis, and that of Chinese financials saw a rapid expansion in the late 2000s.

# EM EQUITIES IN THE FUTURE

It is hard to ignore the cyclical headwinds that emerging economies are currently facing, but, as ever, some are better prepared than others. Rising interest rates in developed markets, led by the U.S., should penalize those with large accumulated debt loads and weak external positions, notably the so-called "fragile five" markets of Brazil, India, South Africa, Turkey and Indonesia (although India's external debt has improved enough that some now question its membership of this group). Bloated government debt loads will require tighter fiscal policies, particularly in Brazil, Turkey and South Africa, while private sector deleveraging may weigh on domestic demand, increase debt servicing ratios and decrease margins.

At the same time, less commodity-intensive growth in China, compounded by global oversupply for some products (such as oil) will weigh on commodity exporters (**Exhibit 16**).

Income levels of certain "emerging markets," including South Korea and Taiwan, have cleared MSCI's DM threshold\* EXHIBIT 17: INCOME LEVELS

	Economy	Per capita GDP in 2014	% of high income threshold*	
Asia ex-Japan	China	7,380	58	
	India	1,610	13	
	Indonesia	3,650	29	
	South Korea	27,090	213	$\checkmark$
	Malaysia	10,660	84	
	Philippines	3,440	27	
	Taiwan**	n/a	n/a	$\checkmark$
	Thailand	5,410	42	
Br Ch Co Me Pe	Brazil	11,760	92	
	Chile	14,900	117	
	Colombia	7,780	61	
	Mexico	9,980	78	
	Peru	6,410	50	
C E H F F F F C C C T	Czech Republic***	18,970	149	$\checkmark$
	Egypt	3,280	26	
	Greece	22,090	173	$\checkmark$
	Hungary	13,470	106	
	Poland	13,730	108	
	Russia	13,210	104	
	Qatar	90,420	710	$\checkmark$
	South Africa	6,800	53	
	Turkey	10,850	85	
	U.A.E.	43,480	341	$\checkmark$

\*USD 12,736 in 2014. \*\* Data unavailable, but the World Bank classifies Taiwan as "high income." \*\*\* Data as of 2013. Source: MSCI Market Classification Framework, J.P. Morgan Asset Management; data as of June 2014.

EM economies in general have benefited from rapidly growing populations, but some are facing an inflection point at which productivity will have to compensate for less favorable demographics. Here, Brazil, China and Mexico are challenged, while India and South Africa seem more promising.

Many emerging economies will struggle to join the likes of South Korea and Taiwan in breaking out of the middle-income trap by reforming and rebalancing their economies, as rising incomes drive up labor costs, putting pressure on profit margins and reducing competitiveness in industries lower on the value chain. Given the size and scale of the challenges that major emerging economies face, we believe the jury on their eventual success is still out. Still, many of those markets currently classified as "emerging" by MSCI should eventually meet "developed" criteria as their markets grow, becoming more liquid and accessible, and as their economies expand (**Exhibit 17**, prior page).<sup>8</sup> As this secular process plays out, index weighting will likely shift away from Asia toward the Middle East and Africa.

However, in this context it is worth remembering that even South Korea and Taiwan remain part of the EM universe to this day– chiefly due to the lagging accessibility of their equity markets.

Finally, as our earlier discussion of dilution highlights, EM investors will have to continue to be mindful of differences between equity markets and economies, and should remember that rapid growth of emerging market economies has not and may not automatically translate to shareholder returns.

<sup>&</sup>lt;sup>8</sup> MSCI's "economic development" requirement for developed markets is gross national income (GNI) per capita 25% above the World Bank high-income threshold, which is USD 12,736 as of July 2015, for three consecutive years. The GNI of MSCI EM countries currently ranges from USD 1,610 in India to USD 90,420 in Qatar.

# PRIVATE EQUITY

# The private equity illiquidity premium is mostly earned, not guaranteed

Anthony Werley, Chief Portfolio Strategist, Endowment and Foundations Group

#### IN BRIEF

For traditional asset classes, our Long-Term Capital Market Assumptions (LTCMAs) are projections of market beta (index) returns. For private equity (PE), where no such index exists, we present a representative industry pooled internal rate of return (IRR), that is, a composite return for a well-diversified pool of private equity investments.<sup>1</sup> Assumptions are developed using a rigorous quantitative building-block approach informed by qualitative judgment.

#### PRIVATE EQUITY RETURN ASSUMPTION =

Core beta return (based on our estimated beta coefficients and LTCMA projections for U.S. mid cap and European equity returns)

- + Alpha (based on historical analysis of the difference between estimated core beta returns and actual PE composite returns)
- +/- Adjustments (to account for cyclical and secular trends in alpha)

### OUR LATEST RESULTS POINT TO THREE KEY INSIGHTS:

- Our private equity assumption, which projects an industry composite return across deals and managers, suggests a modest premium over public equity at the average manager level—one that may not fully compensate investors for the incremental risk they assume.
- The alpha component of composite PE returns has declined over time-raising the question of whether PE performance is scalable, given its broader adoption as a return driver.
- PE manager returns are skill-based; both investing skill and portfolio returns vary widely across the industry. Selection of top-tier managers is essential to earning a premium over public equity commensurate with the incremental risk.

<sup>&</sup>lt;sup>1</sup> An industry pooled internal rate of return is calculated by considering all individual cash flows of an industry as the cash flows of a single entity and calculating an IRR from these flows. In our particular case, the industry is defined as all private equity buyout and growth deals. Hence, our assumption represents a pooled, or composite, return across deals and managers.

Investors may hope for a market "guiding hand" to capture an appropriate private equity illiquidity premium. However, returns in excess of public equity are not intrinsic; they are mainly provided by the selection of highly skilled managers with the ability to source unique opportunities, create value across investments and take advantage of cyclical market trends. In essence, private equity is more of a strategy class than an asset class. Unlike equity or fixed income, private equity does not have a passive benchmark that can be used to identify inherent and repeatable asset class characteristics. What's more, the wide dispersion of private equity returns indicates that financial sponsors have access to a powerful toolbox that can bolster their investments in companies through operational changes, capital structure, capitalization tilt, geographic expansion, exit strategies and more-tools unlikely to be employed with equal and repeatable skill across managers and opportunities.

# DEFINITION OF THE PRIVATE EQUITY ASSUMPTION AND DATA SOURCE

Our long-term private equity assumption is our return projection for a well-diversified pool of corporate finance strategies, including buyouts and growth equity but excluding venture capital. These investments span all fund sizes and geographic regions. Private equity data is sourced from the Burgiss Manager Universe, which tracks the transactional history for funds invested across a wide range of private capital strategies. For the purpose of our research, we focus on the corporate finance portion of the data set, comprised of buyout, distressed, mezzanine and special situations funds. We use results as of December 31, 2014.We assume a continuous, fully invested private equity allocation through the entire term of the evaluation (10 to 15 years) such that a theoretical private equity investor would experience the full impact of each cycle's excesses and opportunities. Even for this well-diversified portfolio, we estimate the volatility of the log-transformed pooled IRR composite data (unsmoothed to remove survivorship and reporting biases that can lead to an understatement of volatility), at 20.45% vs. the volatility of the original, unadjusted data set, at 11.02%.

### THE BUILDING BLOCKS OF PRIVATE EQUITY RETURN

Data from the available PE manager composites includes permutations of manager styles, abbreviated manager track records and differing fund-raising cycles. As a result, it is difficult to rely exclusively on this data to make a precise, systematic industry analysis of the components of manager returns. Even so, private equity composite IRR data provides useful insight into the drivers of those returns.

In developing our long-term private equity return assumptions, we estimate three key components of manager returns, identified in the following equation and described in detail below:

# Private equity returns = beta return + alpha return +/adjustment for cyclical and secular factors

# Estimating beta return-core financial sponsor risk exposure

To anchor average manager private equity (ex-venture capital) return and risk expectations, we look through to the raw material of sponsor returns. Historically, U.S. mid cap equities and, to a lesser extent, U.S. small cap equities have been the core of sponsor risk taking, while increasingly, European exposures are taking on a greater role in generating returns.

Using key betas and return assumptions, we derive a core beta return estimation of 6.0% EXHIBIT 1: PROPRIETARY MODEL BETAS AND SUPPORTING STATISTICS



Source: J.P. Morgan Asset Management proprietary model estimation, based on data from Bloomberg, Burgiss; data for January 2005 through December 2014.

When working with non-transparent pooled data, a systematic, multi-factor approach can be used to discern core risk taking. Our specific approach uses a best subset regression analysis to determine the market-sourced risk, or beta exposures, that drive PE manager returns. The factor methodology seeks to find the best fit of a composite's return, drawing from a representative sample of traditional market returns.<sup>1,2</sup>

Not surprisingly, U.S. mid cap and European equity returns are identified as the key sources of market risk taking; beta and validation statistics are summarized in **Exhibit 1** on the previous page. Using this model and our LTCMAs for these two public markets, we derive a log-based core beta return estimation of 6.0%.<sup>3</sup>

Next we conduct an integrity test of our estimation procedure to determine how well our model betas, combined with our 2005 LTCMAs for U.S. mid cap and European equity, would have done in predicting the growth rate in aggregate pooled private equity over the subsequent 10 years. Using our model coefficients and public equity return assumptions, we arrive at an estimated annualized growth rate for the period from January 2005 through December 2014 of 12.41% vs. an actual rate of 12.90%. The actual and estimated returns over this 10-year cycle are seen in **Exhibit 2**.

J.P. Morgan's estimated growth rate for PE has tracked closely with actual PE returns

#### EXHIBIT 2: ACTUAL PE RETURNS VS. ESTIMATED RETURNS USING MULTI-FACTOR REGRESSION (2005-14)



Source: J.P. Morgan Asset Management proprietary model and 2005 Long-Term Capital Market Assumptions for estimated PE returns; Burgiss for actual PE returns; estimates as of 2005; actual data as of December 2014.

- <sup>1</sup> This same approach, with modifications to account for the quarterly and serial correlation effects of the data, has also been employed as the core LTCMA hedge fund return estimation methodology for the past 13 years and has generated projections meaningfully closer to actual results than a simple forward extrapolation of historical composite data.
- <sup>2</sup> Other statistical methodologies for extracting key beta exposures can be found in the professional and academic literature, of which a few fairly recent examples are listed in References, at the end of this article.
- <sup>3</sup> The estimated 6.0% is a log return and must be converted back to a geometric return after including the alpha return component.

# Estimating alpha-the residual risk not explained by market risk exposures

The public market, or beta, estimations provide the core but not the only estimation in our statistical process. The residual, or spread between actual returns and those derived from our regression betas may be seen as representing the "alpha," or nonsystematic, risk component within composite sponsor returns. Isolating the alpha from the core beta component of the data, we observe the non-systematic returns to be on a constant downward path during the entire 10-year period of our analysis, culminating in negative alpha during 2012 to 2014 (**Exhibit 3**). Public market performance; the evaluation, accounting and regulatory framework; and the time lag within which sponsors price their portfolios can explain some of the erratic nature of the alpha path, but the downward slope of the trend is clear.

#### Private equity alpha has been declining over time EXHIBIT 3: ROLLING FOUR-QUARTER PRIVATE EQUITY ALPHA



Source: J.P. Morgan Asset Management proprietary model and 2005 Long-Term Capital Market Assumptions for estimated PE returns and alpha (actual minus estimated returns); Bloomberg and Burgiss for actual returns. Estimates as of 2005; actual data as of December 2014.

Using the entire 10-year sample, we estimate an average alpha of 1.6% quarterly, or 6.41% annually. In the latter five years of our sample, however, the quarterly estimate is reduced to 0.32%, or 1.29% annually. We believe the post-2008-09 time frame is more representative of future alpha potential than the pre-2008-09 period. To incorporate this view, we have adopted an exponentially weighted approach for deriving the expected alpha component. Using the industry standard decay parameter of 0.94,<sup>4</sup> we estimate a quarterly alpha of 0.67%, or an annual alpha of approximately 2.7%. Incorporating this 2.7% log-based alpha return estimate with our log-based 6.0% beta return estimate produces a 8.7% log return or, equivalently, an annual geometric return of 9.1%, prior to qualitative adjustments.

<sup>&</sup>lt;sup>4</sup> The exponential decay parameter describes the degree to which historical data is utilized in calculating a weighted historical average. An exponential decay parameter of 0.94 is typically used for financial time series.

# Adjusting for the impact of cyclical and secular forces

The environment of the last five years has been one of falling risk premiums across most of the public capital markets. The illiquid strategies of private equity, real estate and infrastructure are likewise experiencing a reduction in the historical liquidity premium. Central banks globally, including the Federal Reserve, are supplying the economy with liquidity as a means of suppressing low risk asset returns, thereby funneling money into riskier assets. Under these policies, both the absolute beta on which financial sponsor returns are based and the liquidity or, more aptly, the average skill premium have become compressed. There are both cyclical and secular factors contributing to the return premium reduction, of which the purchase price multiple, the leverage inherent in the private equity strategy and the asset size of the industry overall are likely candidates for consideration. We estimate, however, that most of the cyclical factors have little impact on returns over two economic cycles or the 10- to 15-year evaluation period for the LTCMAs. The up and down movements of these factors over a long time frame tend to cancel each other out. The one-cycle impact, however, may be considerable.

Purchase price multiples (PPMs), or the multiple of operating cash flow paid by sponsors to initiate a change of corporate control, are a recurring multi-cycle cyclical factor not limited to the current environment. Keeping in mind our continuous allocation/ continuous re-investment assumption over the course of two economic cycles, PPMs will also rise and fall, mostly negating the extremes at either end. PPMs over the most recent investment period of the last five years are approximately 7% above longterm averages but are still below the peak achieved prior to the 2008 financial crisis (**Exhibit 4**).

PPMs are approximately 7% above long-term averages but still below 2007 levels EXHIBIT 4: HISTORICAL AND AVERAGE PURCHASE PRICE MULTIPLES



Source: Standard and Poor's Capital IQ; data as of December 31, 2014.

Financial sponsors' leverage appears to be consistent with normal cyclical patterns and not a threat to PE returns





Source: Standard and Poor's Capital IQ; data as of March 31, 2015.

Sponsors' leverage also has a regular cyclical pattern that conforms to the economic and financial cycle with reasonable proximity and does not appear to be a concern for future returns (**Exhibit 5**).

We have argued in past private equity LTCMA projection discussions that the financial sponsor investment opportunity set has increased as more investment funds are being deployed outside of the U.S. We expect this partial non-U.S. deployment of assets to be an incremental positive, since the LTCMA public equity projections for most regional markets include a premium vs. the U.S. return assumption. Over the past three years, approximately 37% of private equity funds have been earmarked for non-U.S. investment purposes (**Exhibit 6**).

But a swell of money dedicated to private/illiquid allocations, particularly private equity (**Exhibit 7**), acts as an overpowering offset to that investment expansion. As investors anticipate lower public market returns with no diminution of their investment objectives, actuarial assumptions or distribution needs, the private equity allocation potentially fills a widening void. We find this growing allocation to private equity to be the most problematic industry trend, since it is by no means clear that the private equity performance record is scalable to asset sizes well in excess of past peaks. Additionally, as corporate managements continue to refine their operating and cost structures, often at the prodding of activist investors, there may be fewer opportunities for private equity value creation. The rise of the strategy class over the past 10 years may be a key contributor to the declining alpha observed in **Exhibit 3**. Measures such as the ratio of dry powder to overall

# Investments in private equity opportunities outside the U.S. are increasing

#### EXHIBIT 6: DRY POWDER-ALL PRIVATE EQUITY FUNDS BY REGION FOCUS (%)



# Source: 2015 Preqin Global Private Equity & Venture Capital Report; data as of March 31, 2015. Dry powder is defined as private equity funds that are committed and available for use during the respective investment period.

public market capitalization have not risen to troublesome levels at this point. Such measures can, however, be misleading. Increases in the denominator (public market capitalization) are partially driven by elevated valuations or reduced risk premiums—which detract from PE buyout and growth equity returns. The secular rise of private equity as an asset class portends a reduction in the potential liquidity premium and the subsequent lower absolute and relative returns received by investors.



Is the growing allocation to private equity contributing to a decline in alpha? EXHIBIT 7: ESTIMATED PRIVATE EQUITY DRY POWDER BY FUND TYPE, U.S. DOLLARS

Source: Q2 2015 Preqin Quarterly Update; data as of June 30, 2015. Dry powder is defined as private equity funds that are committed and available for use during the respective investment period.

# ASSEMBLING THE PRIVATE EQUITY RETURN BUILDING BLOCKS

The summation of the beta derivation and public market assumptions, alpha trend, cyclical and secular factors is illustrated in **Exhibit 8**. We initially convert the 2016 geometric return assumptions for U.S. mid cap and European equities to log returns. This allows us to scale these assumptions directly by our estimated betas in generating the beta return component (6.0%). To this, we add our exponentially weighted alpha estimate (2.7%). Finally, we convert this 8.7% log return number back to a geometric return of 9.1% and deduct for the impact of cyclical and secular factors (-0.6%) to arrive at the final geometric private equity return assumption (8.5%).

Combining private equity return components produces our 8.5% long-term return assumption





Source: J.P. Morgan Asset Management estimates, based on proprietary model and LTCMA projections for U.S. mid cap and European equity; estimates as of September 30, 2015.

# DISPERSION OF RETURNS IS THE KEY CONSIDERATION OF THE PRIVATE EQUITY STRATEGY CLASS

Our construction of a private equity projected return via a building-block approach is consistent with our long-held message that core PE composite returns, which reflect the average manager skill level, are primarily attributable to the beta of the public equity markets. U.S. mid cap equities and, increasingly, a non-U.S. equity opportunity set are the key sources of return. At this composite level, the alpha return component is less pronounced and, as we have seen, has been trending downward. By our analysis, fair compensation for the illiquidity and additional risk of the private equity strategy class is not inherent at the average manager level. Cyclical factors, such as portfolio leverage and purchase price multiples, are less likely to be the culprits of a reduced illiquidity premium because the extended time frame of our projection period will tend to average out the extremes of high and low portfolio metrics. A more durable, yet still partial, explanation may lie in the growing adoption of private equity as a key portfolio return driver and the resulting expansion of assets beyond the total sponsor industry's ability to generate returns at the same historical premium to the public markets.

Why might private equity returns at the average manager level not fully compensate investors for their incremental risk taking? The most likely explanation is a simple one: private equity investing skill varies widely across the industry. The multiple levers of return enhancement available to financial sponsors produce significant dispersion of results over time (**Exhibit 9**). To the average investor, the private equity asset class will provide a modest return above the public markets and may not justify the additional risks inherent in the investment. To investors in the upper tiers of financial sponsor performance, private equity is an invaluable skill-based strategy and portfolio return enhancer.

#### Private equity returns vary widely, an indication of the importance of manager selection



#### EXHIBIT 9: 10-YEAR DISPERSION OF ASSET CLASS RETURNS

Source: Thomson Reuters Lipper; Burgiss; J.P. Morgan. Equity is defined as all U.S. large cap, U.S. mid cap, and European mutual funds with at least 10 years of performance. Fixed income is defined as all U.S. core fixed income managers with at least 10 years of performance. Private equity is defined as all private equity returns over the last 10 years, represented by the asset-weighted Burgiss Corporate Finance Fund Composite. All data shown through December 31, 2014. Return figures are derived from an equal weighted average of quartiles and therefore may exhibit size bias.

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# SYSTEMIC INFLUENCES ACROSS ASSET CLASSES

# Modelling and managing fat-tailed market risks

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#### IN BRIEF

- Investors need a framework for how to engage with extreme return distributions. This is because global markets tend to rise in a gradual manner but to fall more dramatically and in concert. Certain strategies—especially carry trades—are particularly prone to asymmetric risks.
- The sudden market correction in August 2015 has also served to reawaken the broader systemic concerns that dominated the era of the global financial crisis of 2008-09.
- We illustrate that these extreme market events have had a disproportionate impact on certain asset classes, and show how the "fat tail" return distributions caused by systemic risk factors can be modeled objectively.
- We also distinguish between diversifiable asymmetries in returns, which are largely harmless, and systemic asymmetries, which require attention.
- Leveraged investors in particular need to build portfolios with a focus on tail efficiency. However, we believe that all investors will benefit from risk budgeting and portfolio construction techniques that consider the excess return per unit of systemic risk rather than simply looking at asset class return relationships under routine market conditions.
## MEETING THE SYSTEMIC CHALLENGE

Investors are familiar with assessing non-normal return opportunities. For example, some investment strategies—such as exotic FX carry and certain structured credit strategies—cannot be adequately addressed in a simple return and volatility context. These strategies, which seek to pick up the proverbial nickels in front of steamrollers, may show periods when they offer extremely strong compensation for their level of ex-post measured risk. Other strategies may be explicitly options-based, such as underwriting or covered call option sales.

In all of these cases, the investor's payoff formula is designed to be non-linear and to either reinforce or limit tail risk (the extent of the loss in the value of an investment experienced as a result of an extreme market movement).

However, a more interesting problem for the typical institutional investor is whether the return distributions of all risk assets are equally fat-tailed and how this insight might affect portfolio construction.

Investment theory tells us that idiosyncratic asymmetry doesn't matter in a well-diversified portfolio because of the statistical blurring effect called the central limit theorem, which suggests that lots of independent strategies will produce a normal-like portfolio distribution, irrespective of how asymmetric their individual distributions may be.

Yet if a portfolio is systematically exposed to asymmetric effects across multiple markets, these can constitute a much greater challenge for investors.

## INVESTMENT FROM A RISK FACTOR PERSPECTIVE

Portfolio design entails achieving an efficient trade-off between return and risk. Achieving this trade-off presumes that we are able to describe the anticipated investment world through a series of scenarios, or risk factors. It also presumes that we have a rational approach to assessing how much attention to devote to unlikely but highly damaging outcomes.

Simple portfolio construction mechanisms that only consider return and volatility sidestep this problem by assuming that the world is linear. This means that the risk driver structure that prevails in extreme outcomes is the same as that which applies in routine environments. Therefore, an investor should scale his positions to reflect his risk appetite, but he will not need to worry about adapting the portfolio design to handle distinct trade-offs emerging in the tail of the distribution. However, after the global financial crisis of 2008-09 we recognize that portfolio design based on a simple linear risk world is insufficient to capture systemic pan-market risks that may have self-reinforcing aspects. Hence, we explain why investors can consider a practical approach to building a more realistic set of risk factors. Finally, we also need to consider whether any statistical approach to modeling remote events can be truly robust.

## IN SEARCH OF "FAT FACTORS"

Our Long-Term Capital Market Assumptions are primarily communicated by means of expected returns, volatilities and correlations. However, it is widely recognized that market correlations tend to cluster more closely during hostile periods. This suggests that there may be systemic return drivers that become more dominant during extreme market movements and which may account for the fat-tailed nature of portfolio return distributions.

Our research finds strong evidence for systemic risk drivers that are able to account for the skewed behavior of individual markets and their increased correlations in more severe scenarios.

Over the past 10 years, we have identified two systemic factors:

- the "risk on/risk off" factor, which captures the sensitivity to global growth prospects; and
- the "taper tantrum" factor, which captures sensitivity to changes in u.s. monetary policy.

## METHODOLOGY

We use a stepwise factor analysis approach in which the first fat factor is selected to explain the skew and kurtosis of markets rather than volatility. The beta of each market to this factor is computed and the residual is the unexplained return. Additional fat factors are chosen until the residuals from this process are effectively normally distributed, after which orthodox factor analysis explains the risk behavior of markets under more routine conditions.

## FINDINGS

We applied our factor estimation approach to the data set for the U.S. dollar version of the 2015 Long-Term Capital Market Assumptions. **Exhibit 1** ranks markets according to their exposure to the first fat-tailed factor, the risk on/risk off factor, which is a broad reflection of their exposure to global growth. Based on the 2015 Long-Term Capital Market Assumptions, emerging market assets are particularly sensitive to changes in global growth EXHIBIT 1: SYSTEMIC GROWTH INFLUENCE



Source: Bloomberg, J.P. Morgan Asset Management; data as of June 30, 2014.

Based on the 2015 Long-Term Capital Market Assumptions, long-term fixed income assets are particularly sensitive to changes in U.S. interest rates

#### **EXHIBIT 2: SYSTEMIC RATE INFLUENCE**



Source: Bloomberg, J.P. Morgan Asset Management; data as of June 30, 2014.

This systemic factor is a fat-tail extension to a simple global equity beta. We observe that emerging market equities confer tail risk, by virtue of repatriation effects and because of the dependence of emerging markets on global export demand.

We also see that risk-free fixed income markets are negatively exposed to this driver by virtue of flight-to-quality effects.

The second systemic factor, the taper tantrum factor, captures the risk of a change in U.S. monetary policy (**Exhibit 2**). Long-term fixed income and carry markets are most adversely affected, while floating rate assets are largely immune. The period of the taper tantrum is most influential in identifying this factor.

We then inspected the probability distribution associated with the returns to the systemic growth factor (**Exhibit 3**). We found that this is a heavily skewed factor (skew of -2.1) with a pronounced mode in the region of small positive returns.

The negative skew of the distribution means that in adverse scenarios this systemic risk factor will become progressively more important compared with other risk sources, driving up tail correlations. The return distribution associated with the systemic growth factor is fat tailed

EXHIBIT 3: PROBABILITY DISTRIBUTION OF THE SYSTEMIC GROWTH FACTOR



Source: J.P. Morgan Asset Management. For illustrative purposes only.

It may therefore be helpful to think of a fat-tailed distribution as arising from non-linear exposure to a more conventional "normal" factor. **Exhibit 4** shows this transformation.

## Fat tails are akin to non-linear payoffs EXHIBIT 4: SKEW OF FAT-TAIL AND NORMAL DISTRIBUTIONS



Source: J.P. Morgan Asset Management. For illustrative purposes only.

A -3 standard deviation event in a "normal" world is amplified to a -6 standard deviation outcome in a fat-tailed world. Hence, extreme market outcomes will tend to be dominated by a common driver. The above relation shows that gaining exposure to a fat-tailed asset is analogous to writing puts on a normally distributed asset to amplify the tail exposure. This helps to explain why credit assets tend to show negative skew, since credit represents a sold put option on the health of the issuer.

## VISUALIZING INCREASED TAIL CORRELATIONS

**Exhibit 5** (following page) shows the monthly correlation matrix of market returns, which illustrates the scope that investors have to achieve diversification across asset classes.

**Exhibit 6** (following page) re-computes the correlation matrix, with double weighting applied to the systemic growth factor. This new correlation data demonstrates the reduction in diversification benefits that are feasible in hostile environments, and the increased benefit of holding flight-to-quality assets.

## ROBUSTNESS AND "UNKNOWN UNKNOWNS"

Historical quantitative work can only describe what has actually happened, but may nonetheless highlight how to improve portfolio robustness.

A broadly normal distribution will always arise whenever there are several minor sources of risk but no single dominant one. Therefore, if we consider a one-in-200-year event, for example, we must look for dominant pan-market effects. Since the global financial crisis investors have learned to consider two such sinister types of risk—the black swan and the self-reinforcing spiral.

The black swan refers to a previously unobserved or underestimated source of risk whose influence may become dramatic. Possible examples are numerous and by definition difficult to circumscribe. However, relevant risks might include global plague, meteor strikes, weaponized terrorism or widespread technological failure.

There is a limit to anyone's ability to hedge against certain fundamental global risks. Hence, it seems more relevant for an investor to focus on self-reinforcing financial spirals, such as risk premium escalation via adverse wealth effects, and global depression fueled by a collapse in demand. These events can lead to multiple equilibria, where confidence effects may become self-fulfilling.

The global financial crisis provided an excellent case study of a self-reinforcing spiral, so the framework that we described above should be suitable to address this type of risk.

### Under normal conditions, many asset classes are lowly correlated to one another

#### EXHIBIT 5: BASE CASE CORRELATIONS (NORMAL MARKET CONDITIONS)

	U.S. large cap	European large cap	Japanese equity	Em equity	u.S. REITS	Diversified hedge funds	Commodities	U.S. high yield bonds	U.S. leveraged loans	EMsovereign	U.S. inv grade corp bond	U.S. agg bonds	Long T-bonds
U.S. large cap	100%	89%	67%	79%	77%	68%	48%	72%	51%	57%	34%	2%	-33%
European large cap	89%	100%	72%	87%	69%	73%	60%	73%	50%	64%	42%	8%	-31%
Japanese equity	67%	72%	100%	69%	55%	64%	38%	56%	41%	50%	40%	11%	-16%
Em equity	79%	87%	69%	100%	61%	78%	63%	72%	52%	69%	43%	12%	-27%
U.S. REITs	77%	69%	55%	61%	100%	39%	33%	73%	46%	60%	40%	19%	-11%
Diversified hedge funds	68%	73%	64%	78%	39%	100%	61%	62%	59%	46%	32%	-7%	-39%
Commodities	48%	60%	38%	63%	33%	61%	100%	47%	37%	44%	30%	7%	-23%
U.S. high yield bonds	72%	73%	56%	72%	73%	62%	47%	100%	83%	75%	62%	23%	-27%
U.S. leveraged loans	51%	50%	41%	52%	46%	59%	37%	83%	100%	54%	41%	3%	-36%
EMsovereign	57%	64%	50%	69%	60%	46%	44%	75%	54%	100%	78%	61%	17%
U.S. inv grade corp bonds	34%	42%	40%	43%	40%	32%	30%	62%	41%	78%	100%	81%	41%
U.S. agg bonds	2%	8%	11%	12%	19%	-7%	7%	23%	3%	61%	81%	100%	76%
Long T-bonds	-33%	-31%	-16%	-27%	-11%	-39%	-23%	-27%	-36%	17%	41%	76%	100%

Source: Bloomberg, J.P. Morgan Asset Management; data as of September 2015.

### In more hostile conditions, it's harder to achieve effective portfolio diversification EXHIBIT 6: STRESSED CORRELATIONS (DISTRESSED MARKET CONDITIONS)

	U.S. large cap	European large cap	Japanese equity	Em equity	U.S. REITS	Diversified hedge funds	Commodities	U.S. high yield bonds	U.S. leveraged loans	EMsovereign	U.S. inv grade corp bonds	U.S. agg bonds	Long T-bonds
U.S. large cap	100%	96%	82%	91%	89%	85%	75%	89%	82%	83%	71%	31%	-54%
European large cap	96%	100%	85%	94%	85%	88%	81%	90%	82%	86%	75%	35%	-53%
Japanese equity	82%	85%	100%	83%	75%	80%	66%	77%	71%	74%	68%	33%	-41%
Em equity	91%	94%	83%	100%	81%	90%	82%	89%	81%	87%	74%	36%	-50%
U.S. REITs	89%	85%	75%	81%	100%	69%	64%	86%	76%	81%	70%	40%	-39%
Diversified hedge funds	85%	88%	80%	90%	69%	100%	80%	83%	82%	76%	67%	23%	-57%
Commodities	75%	81%	66%	82%	64%	80%	100%	76%	72%	74%	65%	32%	-47%
U.S. high yield bonds	89%	90%	77%	89%	86%	83%	76%	100%	95%	91%	85%	44%	-52%
U.S. leveraged loans	82%	82%	71%	81%	76%	82%	72%	95%	100%	84%	76%	34%	-56%
EMsovereign	83%	86%	74%	87%	81%	76%	74%	91%	84%	100%	90%	66%	-27%
U.S. inv grade corp bonds	71%	75%	68%	74%	70%	67%	65%	85%	76%	90%	100%	79%	-9%
U.S. agg bonds	31%	35%	33%	36%	40%	23%	32%	44%	34%	66%	79%	100%	44%
Long T-bonds	-54%	-53%	-41%	-50%	-39%	-57%	-47%	-52%	-56%	-27%	-9%	44%	100%

Source: Bloomberg, J.P. Morgan Asset Management calculations; data as of September 2015.

## IMPLICATIONS FOR PORTFOLIO EFFICIENCY

For some investors with very long investment horizons and no cash flow needs from their investments, it may suffice to build an orthodox diversified portfolio. However, most investors—and in particular leveraged investors—should build portfolios with a more explicit tail risk focus and hence boost allocations to assets that offer tail efficiency.

For investors that are especially focused on tail risks, the primary metric for evaluating a market opportunity is the excess return per unit exposure to the systemic factor. This represents the fattailed extension to an orthodox market beta under a traditional capital asset pricing model worldview.

**Exhibit 7** shows both the excess return forecast for major asset classes and their excess returns per unit of tail risk.

We can see that the following assets appear to offer a high level of excess return per unit of systemic risk:

- Diversified hedge funds
- EM hard currency debt
- U.S. corporate bonds

100

This is because these assets show idiosyncratic risks that attract a premium but that become more manageable as part of a well-diversified portfolio.

## Some asset classes offer greater tail efficiency than others EXHIBIT 7: EXCESS RETURNS AND TAIL EFFICIENCY

## CONCLUSION AND IMPLICATIONS FOR INVESTORS

- Our framework identifies severely fat tails arising in monthly returns. However, as holding periods increase, portfolio return distributions will tend to become more normal. Hence, shorter-term traders will be more focused on fat-tail risks than long-term, low-turnover investors.
- Nevertheless, our analysis suggests that investors should consider the impact of systemic risks in assessing their risk budgets. They should then seek out assets that offer a high level of compensation for idiosyncratic risks rather than reinforcing existing systemic risks.



Source: Bloomberg, J.P. Morgan Asset Management calculations; data as of September 2015. For illustrative purposes only.

## II. RATIONALE AND METHODOLOGY ARTICLES: THE THINKING BEHIND THE NUMBERS

## MACROECONOMIC ASSUMPTIONS

## Subdued but steady growth

Michael Hood, Global Strategist, Multi-Asset Solutions

### **IN BRIEF**

- The macroeconomic projections underlying our 2016 capital market assumptions call for overall modest growth accompanied by generally stable inflation.
- In developed markets, we have downgraded our growth assumptions for five of eight economies, due more to slower labor force growth and aging populations than to any broader weakening of the overall growth outlook.
- We have again reduced our growth estimates for emerging market (EM) economies. The likely beginning of a deleveraging cycle, along with expectations for slower developed market (DM) growth and more modest commodity price increases, underlie this reduction.
- Growth desynchronization, characterized by varying local conditions such as diverging central bank policies and housing cycles, will likely prevent a unified global business cycle from appearing.
- Our inflation expectations assume developed markets will stay close to their respective central bank targets. Risks for short-term deviations exist on both sides of this view. For emerging markets, we are projecting continued single-digit inflation, with further progress in high-inflation economies and modest change elsewhere.

The macroeconomic projections underpinning the 2016 Long-Term Capital Market Assumptions envision relatively modest growth and broadly stable inflation. For most developed market economies, growth expectations lie below 25-year historical averages, primarily reflecting slower population and labor force expansion. Still, we expect several DM economies to grow more strongly than during the past 10 years, a period marked by the Great Recession and a sluggish recovery. Indeed, this year's GDP growth forecast downgrades, which affect five of the eight DM countries covered, owe more to continued population aging and the successful absorption of cyclical slack than to any broader deterioration in the growth environment. By contrast, we continue to lower our sights on the emerging market economies, which are adjusting to a less friendly global environment while also confronting various homegrown challenges. Meanwhile, our inflation forecasts have changed only slightly from last year. Although inflation could plausibly run on either side of our projections, we generally expect that DM central banks will come close to their official targets. While we believe EM central banks will enjoy slightly less success in this respect, we expect continued single-digit inflation and do not forecast a return to the price instability that characterized much of the EM world before the 1990s.

## DM GROWTH: THE PRODUCTIVITY PUZZLE

We expect DM growth to run at roughly a 1.75% average annualized pace during the 10- to 15-year forecast horizon, with the U.S. at the top end of the scale and Japan bringing up the rear. Forecasts for those two economies, along with those for the UK, Canada and Sweden, have dropped compared with last year. In the bulk of these cases, each passing year results in a somewhat mechanical trimming of our expectations for labor force growth as populations steadily age. Indeed, most of the decline in our DM projections during the past several years has come from the labor supply channel. Among the DM countries we cover, only Australia and Switzerland-both of which benefit from significant immigration flows-are likely to experience labor force growth exceeding 0.5% per year during the coming decade. In other economies, rising participation rates among older workers will likely provide some offset to weaker expansion of the prime-age population, but labor forces will nonetheless expand quite slowly by historical standards.

Slow-moving demographic factors generally do not pose much forecast uncertainty. By contrast, considerably greater mystery surrounds productivity. Our forecasts attempt to strike a balance among the possible outcomes, assuming that productivity growth will accelerate in most DM economies relative to recent trends while remaining below long-term averages. Since the initial stage of the current expansion, productivity growth has run at an exceptionally slow clip in many DM economies. This sluggishness likely owes to many different factors, including a drop-off in technology investment by the corporate sector and the near completion of the globalization process. While some of these explanations appear structural, or at least persistent, other forces may prove more cyclical in nature. These more temporary forces include relatively inexpensive labor that has encouraged firms to hire additional workers to boost capacity instead of adding to their capital stock. With time, cyclical influences on productivity should fade. Productivity growth in DM economies has tended to revert to longer-term norms after fast or slow periods. Two-sided risk thus surrounds our expectations. Continuation of the current environment would imply significantly slower potential growth rates. On the other hand, the possibility exists of reacceleration in technological change after what appears to have been a fallow period over the past decade.

## EM GROWTH: GRADUALLY DEFLATING

Our EM forecasts, which we already cut significantly last year, have also taken a step down. For our sample of EM economies, we expect annual growth to run slightly below 5%, with India leading the way and Russia bringing up the rear. In rough terms, our country-by-country EM projections show a negative relationship between current per capita income and expected future growth, with poorer countries enjoying greater potential for catch-up. Most EM economies, though, are feeling pressure from various global factors. With the globalization process largely complete, EM economies seemingly coming to the end of an extensive credit cycle, commodity price increases expected to remain muted and DM growth itself below historical norms, the backdrop does not look particularly supportive for emerging markets. Moreover, policy orientations in some large EM economies, notably Brazil, appear to have dampened private investment, denting potential growth rates. Korea and Taiwan, for their part, have moved quite close to DM status, limiting further dividends from convergence.

Significant risk surrounds our China forecast, which we have trimmed to 6.0%. The country's enormous success in recent decades has moved it up the income ladder, to a point at which slower growth should be expected (and indeed has materialized). At the same time, the economy's growth has relied heavily on massive credit creation, as well as investment led by state-owned companies. As a share of GDP, private borrowing has jumped in the past several years, and historical cross-country experience suggests some possibility of a sharp growth slowdown in the near future. Our forecast assumes a smoother deceleration, toward growth in the 4%-5% range by the end of our horizon, but we acknowledge the possibility of a more volatile path.

We expect growth desynchronization to characterize the next several years. For one thing, with EM economies likely to enter a deleveraging cycle, while DM economies have mostly passed through that phase (at least at the private sector level), credit dynamics will differ sharply across our forecast universe. Within developed markets, we expect considerable policy divergence as the U.S. Federal Reserve begins to raise interest rates while other DM central banks are implementing or considering additional easing measures. The Bank of Japan, for example, is explicitly attempting to overheat the economy in order to boost inflation expectations, putting Japan on a different path from its DM peers. Meanwhile, although many DM economies, such as the U.S. and the euro area, are enjoying housing-cycle upswings, others, such as Canada and Australia, probably will experience housing downturns at some point during our forecast horizon. These varying local conditions will likely prevent a unified global business cycle from appearing, and overall global growth will likely remain relatively close to our multi-year forecast level rather than fluctuating widely around that figure.

## INFLATION: ON TARGET

DM central banks have enjoyed great success over the past 30 years in steering inflation close to their desired targets. Our projections assume that DM inflation stays close to these goals in coming years, despite the current prevalence of highly supportive monetary policy stances. Even with this stimulus, inflation expectations have remained well anchored, and elected governments have not significantly interfered with policymaking or attempted to gain control of central bank balance sheets (perhaps to loosen fiscal constraints or lower debt-service costs). While near-term inflation overshoots seem possible, the experience of recent decades suggests that such near-term deviations need not presage longer high-inflation episodes.

Risk exists on both sides of this benign view. On the one hand, political or societal pressure for higher inflation could mount. Many DM governments are carrying fairly heavy debt burdens, and faster nominal GDP growth—more easily achieved via higher inflation than stronger real growth—would help reduce indebtedness. Some analysts have suggested raising DM inflation targets as an indirect way of stimulating demand, although such calls do not appear to have picked up much mainstream support, and the broadly satisfactory performance over the past year of the U.S. economy, at least, appears to have diminished their appeal. Alternatively, policies designed to raise the share of national income that goes to households, at the expense of corporate profits, could gain favor. Such efforts would likely boost unit labor costs, raising inflation rates. On the other hand, although the Japanese descent into deflation remains poorly understood, DM economies in general will be following in Japan's footsteps in some ways, especially in terms of population growth and aging societies. If these phenomena played some role in lowering Japanese inflation, they may operate similarly elsewhere. Already, the slow-growth euro area is experiencing low inflation, although the hawkish nature of its central bank seems more obviously responsible. We take some comfort from the modest but convincing early success enjoyed by the Bank of Japan in raising inflation during the past two years, another piece of evidence suggesting that monetary policy generally works when central banks adopt clear targets and use the full range of tools at their disposal.

Our EM inflation projections also take central bank targets as a jumping-off point where applicable, but we generally expect some overshoot of the official goals in these economies. Still, we expect gradual further progress in the remaining relatively high-inflation EM economies (Brazil, India, Turkey and Russia), with broadly sideways movement in the remaining countries. Macroeconomic stabilization arrived more recently in emerging markets than in developing markets and remains incomplete in several countries. Inflation expectations thus appear less stable and more susceptible to influence from currency depreciation, commodity price fluctuations and other factors. Moreover, some EM central banks enjoy less independence, at least formally, than most of their DM counterparts. Still, we do not foresee a return to the very high-inflation past (which, in Latin America particularly, continued into at least the 1990s). Despite disappointing growth and occasional political stress in the past few years, very few EM governments have shown any sign of abandoning the commitment to broadly sustainable financial policies adopted in recent decades. For example, despite a deep recession, Brazil in mid-2015 finds itself engaged in simultaneous monetary and fiscal tightening in an effort to maintain stability and preserve creditworthiness. We therefore project single-digit inflation across our EM forecast universe.

Our 2016 assumptions call for moderate growth overall, with real growth expectations mostly flat to slightly down and inflation generally stable EXHIBIT 1: MACROECONOMIC ASSUMPTIONS

	2015 as	sumptions	2016 as	sumptions	Change (percentage points)		
	Real GDP (%)	Core inflation (%)	Real GDP (%)	Core inflation (%)	Real GDP	Core inflation	
Developed markets	2.00	2.00	1.75	2.00	-0.25	0.00	
U.S.	2.50	2.25	2.25	2.25	-0.25	0.00	
Eurozone	1.50	1.75	1.50	1.50	0.00	-0.25	
UK	2.00	2.25	1.50	2.25	-0.50	0.00	
Japan	1.00	1.25	0.50	1.50	-0.50	0.25	
Australia	2.00	2.50	2.00	2.50	0.00	0.00	
Canada	2.25	2.00	1.75	2.00	-0.50	0.00	
Switzerland	1.75	0.75	1.75	0.75	0.00	0.00	
Emerging markets	5.00	4.00	5.00	3.75	0.00	-0.25	
Brazil	3.25	4.75	3.00	5.25	-0.25	0.50	
China	6.25	3.00	6.00	3.00	-0.25	0.00	
India	7.00	7.00	7.25	5.00	0.25	-2.00	
Russia	3.00	5.50	2.75	5.50	-0.25	0.00	

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

## FIXED INCOME ASSUMPTIONS

## Normalization and policy divergence: A staggered liftoff

Michael Feser, CFA, Portfolio Manager, Multi-Asset Solutions Grace Koo, Ph.D, Quantitative Analyst and Portfolio Manager, Multi-Asset Solutions

### IN BRIEF

- Global policy rates will start to diverge as short-term rates rise in the U.S. and UK while easing continues in the eurozone and Japan.
- Easy global monetary conditions, lack of inflation and financial repression will exercise downward pressure on long-term equilibrium yields and returns globally.
- Corporate credit will be supported by ongoing demand for yield and limited leverage during a long but shallow economic cycle, although rising yields will subdue returns somewhat.
- In emerging markets, weaker fundamentals will drive spreads wider and risks up. As rebalancing progresses, value should slowly begin to emerge.

## AMERICA LEADS THE WAY

After the longest stretch of unchanged, ultra-low federal funds rates on record, the first increase is finally imminent. Although the Federal Reserve left the policy rate on hold in the September Federal Open Market Committee meeting, we believe, as we have for several years, that the U.S. hiking cycle will get under way in 2015 and that the UK will start normalizing toward more neutral short-term rates shortly thereafter (**Exhibit 1A**). We expect this process to be very gradual. As the two nations commence their rate normalization process in a tepid environment for global growth, inflation pressures are well contained and many regional economies remain fragile. While not our central case, the shallowness of this business cycle does carry the risk that it may even end before interest rates reach our long-term equilibrium target.

The sustained desynchronization of growth globally, as described in the macro assumptions section, suggests that central bank monetary policy in major developed markets may be more divergent than at any time in the last 20 years. Aided by a more expansive monetary policy than we had contemplated, eurozone economic activity has improved in line with our 2015 LTCMA expectations, and we continue to expect policy tightening to begin in 2019. Progress, however, has been more halting in Japan (**Exhibit 1B**). With the monetary arrow of Abenomics still asked to carry a disproportionate share of the responsibility for revitalizing the economy, monetary policy in Japan will have to remain expansive for even longer. We now project that Japan will not start tightening monetary policy until 2020. Continued accommodative central bank policy, combined with lower equilibrium real yields, should result in flat or slightly negative cash returns relative to headline inflation in most markets.

We believe that equilibrium yield curves will be flatter globally than in prior cycles, leveled by financial repression and benefiting, especially at the long end, from persistent demand by liabilitydriven investors and the income needs of an aging population. The need for income-producing assets and the reduced differential in credit quality between sovereign and corporate credit ratings should also lead to lower equilibrium spread levels for investment grade and high yield bonds going forward.

With no inflation concerns in sight, we also see no structural change in fixed income volatility on the horizon. In recent years, however, central bank policy has significantly subdued the level of volatility, particularly at the short end of the yield curve, and an increase from these subdued levels as the rate-hike cycle starts is very likely. Combined with the near-term challenge of mark-to-market losses as yields rise, risk-adjusted returns are likely to be modest both in absolute terms and relative to their own history. Against this dim outlook, extended credit, especially in the developed markets, should stand out as a comparatively bright spot.



Divergence in monetary policy among major developed markets may reach a 20-year high

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

## U.S.: IN THE SLOW LANE TO NORMALIZATION

U.S. domestic factors, such as labor market conditions and inflation, have developed in line with our assumptions in prior years. We expect the policy rate to rise over a three-year adjustment period, starting at the end of 2015, to an equilibrium rate of 2.5%, well below the Fed's current dot plot. We project the 10-year Treasury yield and 30-year Treasury yield to rise toward 4.00% and 4.25%, respectively. This is 25 basis points (bps) below last year's outlook and reflects both the reduction of our U.S. GDP growth assumption by 25bps and ongoing easy monetary policies elsewhere in the developed world.

With the equilibrium cash yield assumption only 25bps above the expected long-term level of headline inflation, and with several more years to pass until the Fed has normalized policy rates, real cash returns will remain very low by historical standards. Fixed income returns more broadly will be pressured by low starting yields and mark-to-market losses as yields rise.

Generally unchanged from prior years, our assumptions anticipate tighter spreads compared with their long-term history for both investment grade and high yield bonds. Although the credit cycle is showing some signs of maturation with a relaxation in issuance standards, excess credit build up seems limited to specific sectors, such as energy.

In a change from prior cycles, we believe that not only small and new enterprises but also more established and larger businesses will be comfortable operating on an ongoing basis with a belowinvestment grade rating. The number and size of these participants has notably improved the average credit quality, average issue size and liquidity of the high yield bond market, albeit at the expense of a higher issuer risk concentration. In contrast, structural changes in the high yield loan market have been less favorable for its credit quality. Among the many changes the Volcker rule brought about, it has reduced the ability of banks to warehouse lower-quality high yield bonds in preparation for their inclusion in collateralized loan obligations (CLOS). As this limitation does not apply in equal measure to loans, more companies have chosen to issue lower-rated loans to satisfy the thirst for yield by CLOS.

Our equilibrium investment grade corporate credit spread therefore remains unchanged at 125bps. The average net premium for high yield bonds is 275bps. Adding to that an expected credit loss of 200bps—based on an average default rate of 3.00% to 3.50% and loss rates of around 60%—leads to a high yield spread in equilibrium of 475bps.

## EUROZONE: STILL EASING VIGOROUSLY

After successfully containing the sovereign debt crisis, the European Central Bank (ECB) has started to focus on easing credit conditions throughout the eurozone.<sup>1</sup> With improving fundamentals and better containment of Greece's issues, the eurozone is slowly healing. We believe, however, the deflationary pressures in the near term to be larger and the ongoing inflation rate in the outer years to be lower than previously assumed. We are therefore reducing our equilibrium cash rate by 50bps while maintaining an equilibrium curve slope of 150bps.

Although more easing may be required before the region will be ready for higher rates, we believe enough progress has been made for yields to begin to rise in 2019 toward their equilibrium of 2.00% for cash and 3.50% for 10-year government bonds. Cash returns will consequently be lackluster in the eurozone overall– particularly in the first half of our assumptions period.

For European investment grade corporate bonds, we target a spread of 125bps. Through the inclusion of a significant number of fallen angels from the finance and auto sectors, the credit quality and issue size of the European high yield bond market have increased meaningfully. While it will take a number of years, many of these issuers will want to return to an investment grade credit rating, which should create a secular improvement in the upgrade-to-downgrade ratio. We reflected this improvement by tightening our expected high yield spread to 425bps from 500bps and lowering the expected credit loss to 175bps from 200bps.

## UK: IN THE SLOWER LANE TO NORMALIZATION

The UK economy expanded less than we had projected last year, which leads us to postpone rate normalization to 2016. Cash yields should then rise over three years to an equilibrium yield of 2.50%, 25bps below last year's assumption and 25bps above our current headline inflation expectation of 2.25%. We lower our outlook for the 10-year equilibrium Gilt yield further, to 4.00% from 4.50%, to reflect weaker long-run potential growth and lower inflation.

<sup>&</sup>lt;sup>1</sup> As in prior years, we assume the euro common currency area will remain intact, with Spain and Italy in particular continuing to be among its members.

	U.S.		ик		Euro		
	Equilibrium yield (%)	Return (%)	Equilibrium yield (%)	Return (%)	Equilibrium yield (%)	Return (%)	
Inflation	2.25	-	2.25	-	1.50	-	
Cash	2.50	2.25	2.50	2.25	2.00	1.25	
10-yr government bond	4.00	3.00	4.00	2.75	3.50	1.75	
Government bond market**	4.00	3.00	4.00	2.50	3.50	1.75	
Investment grade credit	5.25	4.25			4.25	2.75	
High yield	8.50	6.75			7.50	5.00	
Emerging market debt	7.25	6.50					

Long-term equilibrium yields and returns will be constrained by easy global monetary conditions, financial repression and lack of inflation EXHIBIT 2: FIXED INCOME SELECTED LONG-TERM EQUILIBRIUM YIELD AND RETURN ASSUMPTIONS (COMPOUND 10-15 YEAR RETURNS\*)

Source: J.P. Morgan Asset Management; estimates as of September 30, 2015. \*Results are in terms of base currency for the region (USD, GBP, EUR). \*\*U.S.: Intermediate Treasuries; UK: UK Gilts; euro: Euro Government Bond Index.

## JAPAN: EVEN MORE EASING REQUIRED

The uncertainty around Japan's longer-term prospects persists. In the face of demographic pressures and high public debt levels that curb our enthusiasm for the region, we foresee that more policy intervention and more time are needed to achieve a moderately successful Abenomics outcome. As a result, we have reduced our growth estimate while increasing our inflation estimate and assume that monetary tightening will not commence until 2020 vs. 2019. To aid debt sustainability, we anticipate the long-run yield curve will remain very flat, with cash yield at 1.50% and 10-year bond yields at 1.75%.

## EMERGING MARKETS: TAKING ANOTHER STEP BACKWARD

Adequate compensation for risk is a key concern for today's emerging market debt investors. While we noted last year that the secular credit upgrade trend of the last decade had peaked, we are concerned that in several emerging markets (EM) prior secular progress may partially unravel in the prevailing cyclical headwinds. Some of the markets will require further sustained deleveraging. However, sticky inflation will constrain the ability of some central banks to support their economies, and the political appetite for needed reform is growing only slowly. Commodity-driven economies in particular still have substantial work to do in order to rebalance their economies and arrest the downward trend in their credit fundamentals. For hard currency EM sovereign debt, we expect a long-run equilibrium spread of 325bps over U.S. Treasuries, partly offset by credit losses of 75bps, up from 300bps and 50bps, respectively, last year. This reflects either a 1.00% rate of very severe defaults or a 2.00% rate of defaults with typical recovery rates. Starting from a wider base and with a very different regional composition, we see a similar trend for the EM corporate sector, with an increase in the equilibrium spread from 350bps to 375bps. Accounting for less robust creditor protection and default procedures results in credit losses of 25bps for EM corporate investment grade debt, 300bps-based on an average default rate of 4.00% and loss rates of around 75%-for EM corporate high yield debt and 110bps for the EM corporate bond market index as a whole.<sup>2</sup> The FX mismatch in EM corporate borrowing seems limited, but we expect some fragility to emerge as the U.S. dollar strengthens.

For local currency EM debt, our equilibrium yield assumption remains broadly unchanged at 7.25%, reflecting reasonable credit and balance of payment dynamics that should contain the adjustment in most markets primarily to the currency exchange rate channel.

We assume the composition of the emerging market corporate debt index by credit quality is two-thirds investment grade and one-third high yield debt.

## EQUITY MARKET ASSUMPTIONS

## **Still subdued**

Michael Albrecht, Global Strategist, Multi-Asset Solutions Patrik Schöwitz, Global Strategist, Multi-Asset Solutions

### IN BRIEF

- Our equity return assumptions are based on a methodology that accounts explicitly for specific drivers, including the global composition of corporate revenues—how fast different regions are growing—as well as normalization of profit margins and valuations, and the impact of share buybacks and dilution.
- This year's equity return assumptions again paint a slightly disappointing picture relative to history for developed markets in particular, which remain constrained by relatively low earnings growth and elevated valuations.
- For developed markets, our total return assumption rises only modestly, mostly due to less stretched valuations than a year ago. Returns are likely to be held back by relatively modest economic growth, and hence also earnings growth, over the 10- to 15-year period of our assumptions.
- We continue to expect a relatively large share of developed market equity total returns to come from a high level of payouts to shareholders rather than from earnings growth.
- Our emerging market equity return assumption ticks up marginally in local currency terms compared with last year due to more attractive valuations, but rises more substantially in U.S. dollar terms, reflecting a substantial realignment in currency exchange rates over the last 12 months.

## DEVELOPED MARKET RETURNS REMAIN MUTED

The message from our equity assumptions this year remains one of subdued returns relative to history, in particular for developed markets. Here, we continue to see a large share of total returns being generated through a high level of payouts to shareholders rather than through earnings growth, which should remain low compared with history. Meanwhile, still-elevated valuation levels remain a drag on future returns.

Our assumptions for developed market (DM) equities compared with last year see only a modest upgrade. This mostly reflects valuation levels that are somewhat less stretched following the market turmoil of the third quarter of 2015, offset partly by further downgrades to our macroeconomic assumptions, and in the U.S. and the euro area especially, an extra year down the path to margin normalization. Japan receives a bigger upgrade, partly due to a further incorporation of the potential impact of structural and corporate governance reforms.

## EMERGING MARKET RETURNS LOOK RELATIVELY ATTRACTIVE

The outlook in emerging markets remains somewhat more positive, with our local currency assumption rising by 25 basis points (bps) to 9.75%, leaving the return gap with developed markets unchanged. However, due to the substantial currency moves over the past year, the emerging market (EM) return assumption in U.S. dollar terms rises significantly from 8.75% to 10.00%, as currency goes from being a drag on returns to a slight positive, widening the return advantage the emerging markets have over developed markets. While EM return assumptions and drivers vary among specific markets, the overall message is that despite the undoubted cyclical and structural challenges ahead, there is also recovery potential over our long-term horizon. 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.

Last year, we introduced a new equity assumptions methodology into our Long-Term Capital Market Assumptions process, which was described in detail in the 2015 Equity Market Assumptions article and is summarized in **Exhibit 1**. Similar to DuPont analysis, this methodology allows us to structurally decompose total returns into easy-to-forecast ratios as return drivers. 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. The latter driver is often overlooked in return forecasting frameworks and was the focus of last year's equity thematic article, "How Dilution and Share Buybacks Impact Equity Returns."

Finally, we tie together complex interrelationships among these factors by ensuring that they are consistent with average return on equity, based on an index-level adaptation of Robert Higgins' sustainable growth rate (SGR) concept—which we substantially refined this year. This framework ensures that total payouts to shareholders (dividends plus buybacks) and resulting net dilution are sustainable and consistent with earnings growth and ROE.

Our inputs into this framework continue to reflect normalization across return drivers—not only reversion toward historical averages but also cross-sectionally between regions, as financial markets and corporate practices continue gradually to become more globally-integrated and as emerging markets become increasingly developed over our assumptions time horizon.

## 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

## DEVELOPED MARKET RETURN ASSUMPTIONS

At the aggregate DM level, our total return assumption rises modestly to 6.75%<sup>1</sup> in local currency terms from 6.50% last year. Most markets see small downgrades in their top-line aggregate sales estimates, in line with downgrades to our economic growth expectations, which are in most cases, however, more than offset by less negative impact from valuations following disappointing equity performance over the past year. The composition of equity return assumptions across the major developed markets is illustrated in **Exhibit 2**.

The composition of equity return forecasts differs across developed markets



EXHIBIT 2: TOTAL RETURN IMPACTS FOR G4 LARGE CAP EQUITIES

Source: J.P. Morgan Asset Management; estimates are local currency returns as of September 2015.

For the **U.S.**, our return assumption rises modestly to 7.0%, mostly due to a smaller negative impact from currently elevated margin contraction going forward, as some of this expected normalization has taken place over the past year. This more than offsets a small downward revision to top lines, while the negative impact of elevated valuations is slightly lower than last year. This year we have also extended our updated equity methodology to U.S. small caps, whereas in previous years our assumption was mostly driven by valuation differentials.

Compared with large caps, small cap aggregate earnings should grow faster before dilution, in spite of lower exposure to fastgrowing emerging markets. However, lower ROE implies substantially lower internally sustainable earnings growth, which in turn implies that much of the extra growth is lost to higher dilution. The valuation impact this year, meanwhile, is roughly neutral between large and small caps. These effects net to a projected small cap return premium of only 0.25%, for a return assumption of 7.25%.

Our **eurozone** assumption stays unchanged at 7.0%, but two significant moves in return drivers are worth pointing out. On the one hand, the positive contribution from recovering margins is lower than last year, as some of the normalization we projected then has happened (**Exhibit 3**). On the other hand, the resulting recovery in earnings, in combination with lackluster price performance, has reduced the negative impact from valuations.

## Margins are expected to rise in the eurozone and UK, and contract in the U.S. and Japan

EXHIBIT 3: HISTORICAL AND PROJECTED MARGINS FOR G4 MARKETS



Source: Thomson Reuters Datastream, J.P. Morgan Asset Management; data as of September 2015.

Japan remains a special case, as future returns will depend significantly on the success of corporate governance reform as part of Abenomics. With Japanese equity fundamentals (notably profit margins and ROE) already at record levels (by local standards), we are reluctant to assume either reversion to the historically lower mean values or a wholesale surge to the much better levels that are normal in the rest of the developed world. We are left with a middle way, assuming fundamentals remain steady near current (record) levels, and will continue to re-assess. This shift to a higher level of profitability also manifests itself in our framework as higher shareholder payouts. The aggregate impact of a change to our growth sustainability calculation, modestly raised margin assumptions to account for actual developments, and a slightly larger valuation penalty, is to raise the Japanese local currency return assumption from 4.5% last year to 5.75%.

<sup>&</sup>lt;sup>1</sup> All return assumptions are in nominal total return terms.

## Domestic revenue share varies widely across markets EXHIBIT 4: INTERNATIONAL REVENUE BREAKDOWN FOR G4 MARKETS



Source: Thomson Reuters Datastream, J.P. Morgan Asset Management; data as of September 2015.

For developed markets, our total return assumption rises only modestly, mostly due to less-stretched valuations than a year ago

#### EXHIBIT 5: SELECTED EQUITY LONG-TERM RETURN ASSUMPTIONS AND BUILDING BLOCKS FOR DEVELOPED MARKETS

Equity assumptions	<b>U.S.</b>	Europe ex-UK	ик	Japan
Revenue growth	6.1	4.8	5.0	4.0
Margins impact	-0.5	1.6	2.0	-0.7
Earnings growth	5.5	6.5	7.2	3.3
Gross dilution	-2.0	-2.0	-2.0	-2.0
Buybacks	2.5	0.7	0.2	3.7
EPS growth	6.0	5.1	5.2	5.0
Valuation impact	-0.9	-1.1	-1.4	-0.8
Price return	5.0	4.0	3.7	4.2
Dividend yield (DY)	2.0	3.0	3.5	1.5
Total return, local currency	7.00%	7.00%	7.25%	5.75%

Source: J.P. Morgan Asset Management; estimates are as of September 2015.

In the **UK**, the modest rise in the return assumption to 7.25% hides some sizable shifts in the underlying components. Given the heavy weighting of commodity-related sectors in the UK index, the rout in commodity prices has hit UK earnings particularly hard. As a result, the contribution from future margin normalization swings sharply from a negative to a positive factor (**Exhibit 3**), even though we have cut our equilibrium margin assumption to recognize damaged business models in the commodity sector. Conversely, the drop in earnings has seen UK valuations rise despite poor equity performance, resulting in more of a drag from valuations going forward.

Of the other two developed markets with large commodity weightings, **Australia** and **Canada**, the former sees its return number downgraded by 25bps this year to 5.75%, mostly due to a larger valuation drag as falling earnings have driven up price-toearnings ratios. **Canada**, on the other hand, receives a slight upgrade to 6.25% despite meaningful cuts to its economic growth assumptions, due to improved valuations and a positive contribution from margins going forward.

## EMERGING MARKET RETURN ASSUMPTIONS

Our overall EM equity assumption is derived by applying the same methodology to nine large emerging markets and aggregating by market capitalization weight. These markets account for more than 85% of the total MSCI Emerging Markets Index universe market capitalization.

In deriving the inputs for EM equities, we try to account for the special factors we highlight in this year's equity thematic article, "Emerging Market Equities: Then, Now and Tomorrow." As a word of caution, the available data history is generally shorter for emerging economies and the data quality less robust, so the confidence in the resulting assumptions is by nature somewhat lower than in those for developed markets. Despite this reservation, and the variety of cyclical and structural cross-currents within the emerging market universe now, we can identify a few common themes.

The first obvious commonality is that top-line growth tends to be much higher than in developed markets, in almost all cases (Taiwan and to a lesser extent South Korea being the exceptions). In contrast with developed markets, however, the contribution to top-line growth from international sales is generally (a slight) negative for emerging markets as they have to export to slowergrowing developed markets and the period of rapid market share gains is likely behind us. The more important offset to faster aggregate earnings growth, however, is the generally much higher level of shareholder dilution, the importance of which is explained in our emerging market equities thematic article. When it comes to valuations, the picture is mixed across markets. China and Taiwan, at the cheap end of the spectrum, should see expanding price multiples contribute positively to returns. At the expensive end of the spectrum are Mexico and Brazil, where prices relative to earnings should be a strong negative contributor (albeit offset to some degree by margins in each case). However, this still leaves a much better valuation picture than for developed markets, where the impact is negative for all but one market. Overall, our EM equity return assumption ticks up to 9.75% in local currency terms from 9.50% last year, with the return gap to DM local currency returns unchanged. The U.S. dollar assumption, however, changes more significantly, rising to 10.0% from last year's 8.75%, given changes to our currency assumptions following sizable moves over the past year. At the regional level, our return assumptions look very similar for emerging Asia and for Europe, the Middle East and Africa (EMEA), at 10% and 10.25%, respectively, while Latin America trails at 8.50%.

Our emerging market equity return assumptions tick up marginally in local currency terms compared with last year, largely due to more attractive valuations

Equity assumptions	China	Korea	Taiwan	India	South Africa	Brazil
Revenue growth	10.0	7.9	6.6	12.5	9.4	9.9
Margins impact	-1.4	-1.6	-1.0	0.7	-2.1	3.5
Earnings growth	8.5	6.2	5.6	13.3	7.1	13.7
Gross dilution	-4.1	-0.3	-0.9	-2.8	-0.9	-5.0
Buybacks	0.5	0.5	0.5	0.3	1.0	0.5
EPS growth	4.6	6.4	5.1	10.4	7.1	8.5
Valuation impact	2.6	0.8	2.3	-1.4	-0.7	-2.6
Price return	7.3	7.3	7.5	8.9	6.3	5.8
Dividend yield (DY)	3.0	1.5	3.3	1.5	3.5	3.5
Total return, local currency	10.25%	8.75%	10.75%	10.50%	9.75%	9.25%

Source: J.P. Morgan Asset Management; estimates are as of September 2015.

## Beta drivers vary across alternative strategies; manager selection remains critical to success

Anthony Werley, Chief Portfolio Strategist, Endowment and Foundations Group

## IN BRIEF

Our 2016 Long-Term Capital Market Assumptions (LTCMAs) anticipate overall modest growth, an aging economic cycle and a moderate rise in public market returns. These assumptions flow through to our outlook for alternative strategy classes, but to different degrees and in different ways. Our assumptions represent composite returns across managers with widely divergent skill sets. As a result, manager selection remains a critical determinant of success in achieving risk and return objectives for all alternative strategy classes.

- Higher public equity market returns should have a positive impact on composite private equity (PE) returns. Combined with a continuing downward drift in alpha and an expected net negative impact from secular trends, we anticipate a modest premium for private over public equity.
- Public market betas, the dominant sources of risk for most hedge fund strategies, drive our composite return assumptions. The environment for alpha generation remains challenging but should improve throughout our forecast period.
- The real estate cycle is aging gracefully. Recent improvements in valuations lower our return estimates but, in the absence of excesses generally seen at this stage in a recovery, the strategy class should offer attractive returns relative to fixed income and equity markets as real estate valuations continue to rise.
- Demand for infrastructure investments remains strong among liability-driven investors and those seeking income-generating, relatively low-risk assets. Non-trophy, midmarket assets should provide attractive investment opportunities.
- Sluggish economic growth and a weakening demand for commodities, especially in China, are suppressing prices. While still in the early innings of the demand/supply adjustment process, prices will ultimately have to rise to provide incentive for suppliers to meet growing long-term demand.

### OVERVIEW

The equity-oriented alternative return assumptions for hedge funds and private equity are expected to rise in line with public market expectations. Our private equity alpha estimations are generally unchanged from last year's assumptions, although hedge fund alpha is revised slightly upward to reflect a more hospitable market environment for fundamental long/short strategies. Real asset returns, excluding commodities, while relatively attractive vs. stock/bond combinations, fall in line with the aging economic cycle and rising valuations. Investor demand for long-lived, cash-flowing assets remains robust.

Apart from the economic outlook, alternative strategy classes are driven by a mix of beta, idiosyncratic alpha and unique cyclical dynamics

#### EXHIBIT 1: ALTERNATIVE STRATEGIES-SELECTED LONG-TERM RETURN ASSUMPTIONS-U.S. DOLLAR-BASED COMPOUND 10- TO 15-YEAR RETURNS (IRR%)

	2015 LTCMAs	2016 LTCMAs
Private equity		
U.S. private equity	7.75	8.50
Hedge funds		
Equity long bias	5.25	5.50
Event driven	6.00	6.00
Macro	4.75	5.00
Relative value	5.00	5.25
Diversified	4.50	4.25
Real estate-direct		
U.S. direct real estate (unlevered)	6.00	5.50
U.S. value-added real estate (unlevered)	7.75	7.25
European direct real estate (unlevered)	5.75	5.50
REITS		
U.S. REITs	6.50	6.00
European REITs	6.50	8.25
Global REITs	6.50	7.25
Global ex-U.S. REITs	-	7.50
Global infrastructure	6.75	6.50
Commodities (spot)	3.50	3.00
Gold (spot)	4.00	3.50

Source: J.P. Morgan Asset Management; estimates as of September 30, 2015, and September 30, 2014.

## PRIVATE EQUITY

Our building-block approach to estimating private equity representative pooled IRR returns indicates that beta continues to be the most significant return driver (**Exhibit 2**), with U.S. mid cap and, increasingly, European betas the primary sources of market risks taken.<sup>1</sup> Accordingly, we apply the relevant LTCMAs to our estimated betas for these asset classes to arrive at the core building block of PE returns.

Estimations for alpha, the non-beta component of historical returns, clearly indicate a return series in decline. A standard decay function, or form of trend calculation is applied to the adjusted historical data to estimate the alpha return component.

Cyclical and secular factors—such as purchase price multiples, capital structure leverage and industry asset size—are assessed as a final adjustment to the quantitatively derived components of return.

Combining these components, we arrive at our 8.5% return (Exhibit 2), up from last year's 7.75% assumption, primarily due to rising U.S. mid cap and European equity return assumptions.

Combining private equity return components produces our long-term return assumption of 8.5%

## EXHIBIT 2: PRIVATE EQUITY LONG-TERM RETURN ASSUMPTION AND BUILDING BLOCKS



Source: J.P. Morgan Asset Management estimates, based on proprietary model and LTCMA projections for U.S. mid cap and European equity; estimates as of September 30, 2015. Beta and alpha return components are initially estimated in log-return form and then combined and converted back to a geometric return equivalent.

<sup>1</sup> For a detailed discussion of our methodology, see "The private equity illiquidity premium is mostly earned, not guaranteed," pages 28-34 in this 2016 Long-Term Capital Market Assumptions report.

## HEDGE FUNDS

Since the inception of our hedge fund assumptions in 2004 we have employed a statistical approach to understand the core beta (traditional asset class/market) drivers of hedge fund returns. We further assess the environment for hedge fund alpha (returns attributed to non-beta risk taken) through a qualitative top-down review of market and operating conditions. During the entirety of this period the top-down process has resulted in downward adjustments to alpha expectations, given our assessment of market and industry conditions. At the average manager level, our estimation of market risk taken would have, for the most part, correctly captured the bulk of the actual return, while non-beta risk taken-primarily through shorting-most likely contributed to risk reduction more than return enhancement during this time frame (**Exhibits 3A-3E**).

Over the next 10 to 15 years, our assumptions call for a moderate rise in the traditional asset class/market drivers of core beta returns even as we anticipate a less negative environment for

Our estimates of core beta returns have generally captured a major portion of actual hedge fund returns at the average manager level EXHIBIT 3A: ACTUAL COMPOSITE HEDGE FUND RETURNS VS. ESTIMATED RETURNS USING MULTI-FACTOR REGRESSION (2005-14) MODEL AND 2005 LONG-TERM CAPITAL MARKET ASSUMPTIONS\*

Hedge fund strategy	Actual return (IRR %)	Estimated return (IRR %)
Equity long bias	4.92	5.50
Event driven	5.74	6.00
Macro	4.37	5.00
Relative value	6.40	5.25
Diversified	3.28	4.25



**EXHIBIT 3B: EQUITY LONG BIAS RETURNS\*** 

**EXHIBIT 3C: EVENT DRIVEN RETURNS\*** 







#### EXHIBIT 3E: RELATIVE VALUE RETURNS



Source: Hedge Fund Research (HFR) for actual returns; J.P. Morgan Asset Management for estimated returns; data as of April 30, 2015.

\*Estimated values are calculated using J.P. Morgan Asset Management proprietary regression models along with 2005 Long-Term Capital Market Assumptions for the traditional asset class drivers of return (betas).

hedge fund alpha. This leads to a modest rise in composite hedge fund return assumptions, except in the case of the diversified and event driven categories. These observations are applicable at the average manager level but may be wide of the mark for those managers at the upper deciles of performance.

Investors in liquid alternatives can expect to experience directionally similar results, though with a modest decrement to returns vs. longer lock-up vehicles, depending on the strategy and the nature of public market conditions. Importantly, the positive private partnership characteristics of up-capture/down-capture and muted volatility vs. the public markets, as well as the modest alpha contributions of the average manager, should be realized in the main by liquid strategy counterparts. Enhanced benefits from liquid alternative strategies may be realized at the upper levels of peer group performance, as in the case of private market hedge funds.

## Deriving the beta component of return

The bottom-up, beta estimation methodology has produced reasonable accuracy vs. actual historical composite hedge fund strategy results, particularly in light of the fact that the analysis uses relatively abbreviated and flawed composite data vs. the merits of traditional asset class benchmarks.

The factor approach uses regression analysis to discern the overriding source of hedge fund returns, namely, market-sourced risk (or beta exposures). The factor regression seeks to find the best fit of a composite return vs. a representative set of traditional market returns, such as the S&P 500, U.S. high yield, global fixed income and other sub-asset-class benchmarks. These beta exposures are multiplied by our traditional asset class forward-looking return assumptions for the relevant betas to form one of the building blocks of the return outlook. While the beta exposures of each strategy class vary over shorter periods of time, beta exposures are relatively consistent over longer-term rolling periods. As in most statistical analysis, interpretation of the pure numerical output combined with some knowledge of the basic strategy analyzed is the best approach for dealing with the vagaries of the process.

In general, alpha has been trending slightly down to flat, leading to net negative adjustments to average historical alpha in our estimation of forward-looking hedge fund returns\*



#### EXHIBIT 4B: EVENT DRIVEN ALPHA

**EXHIBIT 4D: RELATIVE VALUE ALPHA** 



'13

'14

'15





Source: Hedge Fund Research (HFR) for actual returns, J.P. Morgan Asset Management for estimates; data as of April 30, 2015. \*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.

## Projecting alpha-return to the non-beta component of risk taken

Our top-down or alpha considerations assess market and hedge fund industry conditions as positive or negative increments to the beta projections described above. **Exhibits 4A-4D** show the starting point for our assessment—the paths of alpha (defined as the difference between actual composite returns and beta returns estimated by solving our regression models historically) from April 2008 through April 2015. As seen in the exhibits, this is a period during which all but relative value alpha shows a downward trend.

Growth in hedge fund assets and the questionable scalability of hedge fund alpha represent a potential headwind for returns





Source: Bloomberg, HFR, J.P. Morgan Asset Management; data as of June 30, 2015.

Among the conditions considered in the alpha estimation, the asset size of the hedge fund industry (**Exhibit 5**), the level of U.S. domestic interest rates, the overall volatility of markets (**Exhibit 6**) and the extent of inter-asset-class and intra-sector/industry relationships are the most important.

We have, since developing our 2005 estimates, interpreted the alpha conditions as being net negative vs. the average of the historical data. This year, our alpha estimates are, on balance, a small contribution to total return. Growth in hedge fund assets

The outlook for hedge fund alpha should improve as market volatility rises toward its mean





Source: Bloomberg, J.P. Morgan Asset Management; monthly data as of July 2015.

#### Our hedge fund return assumptions are applicable at the average manager level but can greatly understate top-ranked manager returns EXHIBIT 7: J.P. MORGAN 2016 ASSUMPTIONS VS. DISPERSION OF HISTORICAL RETURNS WITHIN CORE HEDGE FUND STRATEGY CLASSES (10-YEAR ANNUALIZED RETURNS, MAY 2005-APRIL 2015)



Source: Hedge Fund Research (HFR) for historical returns, J.P. Morgan Asset Management for estimates. Historical data for May 2005-April 2015; estimates as of September 30, 2015. \*Note that the median, 75th and 25th percentile figures represent the historical returns from the HFR universe of these respective hedge fund strategy classes. This data may reflect survivorship bias as only funds for which 10 years of returns were available were used in the analysis. remains a negative in our estimation, as hedge funds are another strategy class where skill and the scalability of alpha are key considerations in return projections. We assume, however, that rising rates, increased volatility and a broadening of inter-assetclass and intra-sector dispersions, along with a decrease in correlations, will provide a more positive environment for hedge fund alpha generation as these factors revert toward longer-term means.

As in other alternative strategy classes, the dispersion of manager returns is wide, since the availability of resources and skill is not evenly distributed across strategies that have broad investment latitude (**Exhibit 7**, prior page).

## REAL ESTATE-DIRECT

Seven years have elapsed since the bottom of the previous real estate cycle. At this stage in the current cycle, the appearance of excesses would be expected. But this is not a "normal" cycle. Our long-term estimate for core unlevered real estate returns of 5.5% (down 50bps from our 2015 estimate) is premised upon the fundamental assumption that the usual excesses are, for the most part, not present at this point. The surprising strength in net operating income (NOI) across the real estate sector and the lower returns required by real estate investors in a lower interest rate environment should generate an attractive relative return vs. expectations in the equity and fixed income markets.

Despite being five years past the private real estate price trough, there remains upside visibility as to the length and price gains left in this cycle. A lagged supply recovery–attributable to the unavailability of credit, lack of risk appetite and slow pace of employment gains, coupled with an extended underlying economic recovery in the U.S.–sets up a prolonged real estate cycle with

Most real estate subsectors have not yet regained past cycle peaks in supply additions







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





**EXHIBIT 8B: SUPPLY-OFFICE COMPLETIONS** 



further NOI and price gains in the immediate years ahead. **Exhibits 8A-8D** indicate that supply across most segments of the industry, with the exception of the multifamily sector, has not yet reached past cycle supply increments despite years of falling vacancy rates and rising rents—signaling cycle-extending avoidance of a supply overshoot. In particular, retail construction and office completions are significantly short of past supply peaks. In effect, without the usual excesses or the need for a valuation unwind to restore a sense of fundamental and return equilibrium—at least in terms of demand and supply—the markdown of forward returns normally attributable to the age of the cycle is less onerous at this juncture.

## U.S. core: 5.5%

Based on the assumptions of going-in yields<sup>2</sup> of 5.0%, NOI growth of 2.0%-2.5%, a 1% deduction for capital costs and a 0.5% increase in capitalization rate assumptions, our outlook is for a forward core unlevered return of 5.5%. This fundamentally driven assumption seems reasonable in the context of a 4.00% 10-year U.S. Treasury bond equilibrium yield.

## Value-added spread: 175bps

The value-added spread over core assets remains at 1.75%. As core property going-in yields have fallen, the profitability of adding value through lease up, redevelopment or ground up construction has improved. However, rising land costs and falling required risk premiums for value-added asset sales prevent the value-added spread from widening. Our 7.25% unlevered projection is reduced 50bps from last year to reflect a constant spread to core.

### European core: 5.5%

Expected returns for core real estate investments in Europe have been reduced by 25bps from our 2015 assumptions. European real estate returns are expected to be driven primarily by yield compression in the short to medium term rather than by NOI growth, contrary to U.S. real estate assets. European real estate prices are still, on average across Europe, 15% below their previous peak. Capital values should continue to increase at an above-average rate of growth over the next few years before adopting a more sustainable growth rate. NOI growth is expected to increase more gradually. Our long-term assumption for core real estate investments is 5.5% with a slightly higher capital growth component compared with long-term historical averages.

## REAL ESTATE INVESTMENT TRUSTS (REITS)

### U.S. REITs: 6.00%

We expect U.S. REITs to generate a return premium of 0.5% as their net asset values converge from the current discount of around 10% to the valuations of the underlying real assets.

## European REITs: 8.25%

European REITs are expected to outperform their U.S. counterparts despite the same starting core real asset return, since we expect higher European equity market performance to raise public market valuations and for FX gains to enhance USDbased returns.

## Global REITs: 7.25%

As in the case of European REITs, public equity market and FX dynamics should drive USD-based returns for global REITs to exceed those for U.S. REITs.

## INFRASTRUCTURE

Global demand remains robust for long-lived cash-flowing infrastructure assets, since conservative and liability-minded investors have few places to go to realize their investment objectives. Several countervailing factors, however, are likely to dampen returns somewhat:

- A continuing rise in asset prices during 2015, boosted by demand and an increase in leverage, reduces potential forward returns, particularly for super-core or trophy assets.
- An on going global regulatory cycle, extending over the next three to seven years and characterized by a prevailing proconsumer mind-set, suggests regulated rates are likely to be kept in check, constraining utility sector returns.
- Debt costs are expected to rise, though moderately, in line with our long-dated fixed income outlook, which calls for a gradual rise in rates to levels short of previous historical averages.

On balance, these factors suggest a modest .25% markdown vs. 2015 return estimates, to 6.50% (**Exhibit 9**, following page).

Opportunities exist within the broad core categorization despite very aggressive trophy asset pricing. Midmarket assets—those with less than \$3 billion enterprise value and \$1 billion equity contribution, a category not dominated by sovereign wealth funds and large pension sponsors—should offer investors returns above the average long-term projection. Renewable power also appears attractive, especially within the political framework of the most

<sup>&</sup>lt;sup>2</sup> Going-in yield is the initial current yield (cash flow for the period divided by the capital valuation at the beginning of the period).

recent G7 summit, which affirmed longer-term targets for CO2 emission reductions and, by logical extension, renewable power increases. Assuming current pricing and long-term contractual agreements with load-serving utilities, minimum 15-year terms and ongoing government subsidization, returns to investors may exceed the base case infrastructure return expectation on a project-byproject basis by as much as 2%, with approximately two-thirds of the return generated from yield.

A modest decline in infrastructure returns is expected, given continued strong demand tempered by constraints on further increases in valuations

## EXHIBIT 9: THE BUILDING BLOCKS OF OUR INFRASTRUCTURE RETURN ASSUMPTION

Valuation impact	1.5%
Average yield	3.0%
OECD inflation	2.0%
Infrastructure return	6.5%

Source: J.P. Morgan Asset Management; estimates as of September 30, 2015. For modeling purposes, global infrastructure is defined as core equity investments within OECD countries and reflects exposure to low-volatility sectors such as regulated utilities and pipelines (40%), and more cyclical assets, such as transportation (30%) and contracted power (20%), as well as social infrastructure (10%).

## COMMODITIES

Commodities have been racing down the back half of the supercycle, with prices declining at close to an 11% annualized rate from June 2008 to August 2015, as measured by the Bloomberg Commodity Index.<sup>3</sup> The core building blocks of commodity returns are not stacking up to attractive heightsglobal inflation projections continue to come down even as global demand and, more acutely, Chinese demand continue to weaken. The price-signal/supply-adjustment process is progressing rapidly within the metals sector, but energy remains a less compelling story. U.S. shale oil production, OPEC market share strategies, surprisingly strong production from unexpected sources like Iraq and the possibility of a huge new source of supply from Iran-if welcomed back into international energy commerce-have all created a potential tsunami of incremental supply. In the U.S., cost curves within the energy patch are rapidly declining, at least for now, portending little slowdown in supply in the near term even as prices continue to erode. That said, these considerations only address the correction phase of the cycle. Over the course of the next 10 to 15 years, we would expect the diminution of supply growth and the continuation of even modest demand growth to generate real returns in the back half of the evaluation period, producing, on average, a small real return above global inflation over the assumptions period as a whole.

<sup>3</sup> Our forecast of commodity returns is based on the Bloomberg Commodity Index. The composition by percentage of weight, as of September 30, 2015, is: oil 23.9%, gold 12.6%, soy 10.7%, natural gas 9.0%, corn 8.0%, copper 7.0%, aluminum 4.5%, silver 4.4%, wheat 4.3%, sugar 3.8%, cattle 3.1%, zinc 2.1%, hogs 1.8%, coffee 1.7%, cotton 1.7% and nickel 1.5%.

... and new CEOs may signal a change from the supercycle mind-set

EXHIBIT 10B: BASIC RESOURCE COMPANY CEO TENURE-NEW THINKING?

Company	CEO tenure (years)
BHP Billiton PLC	2.3
Rio Tinto PLC	2.6
Anglo American PLC	2.3
Vale SA	4.2
Newmont Mining Corp	2.4
Newcrest Mining Ltd	1.1
Turquoise Hill Resources Ltd	0.7
Turquoise Hill Resources Lta	0.7

Source: Bloomberg (MSCI All Country World Index companies); data as of July 31, 2015.

In mining, capital expenditures have declined ...

### EXHIBIT 10A: GROWTH IN CAPITAL EXPENDITURES-MINING



Source: Thomson Reuters Datastream, Citi Investment Research; data as of June 30, 2015.



### Prices cannot remain below producers' break-even point; ultimately, they have to rise for supply to meet demand EXHIBIT 11: 2015 GLOBAL CRUDE BREAKEVEN COST CURVE

Source: IMF, Reuters, Deloitte MarketPoint; data as of September 2014.

## Supply is slowing, but...

Across the broadly defined extraction industry, we are in the early innings of constraining the growth in supply, if not its absolute level. Within the narrower segment of metals, slightly faster progress in cutting capital expenditures (capex) vs. previous cycles has been made (**Exhibit 10A**). Importantly, mining's corporate strategy has shifted materially from maximizing the upturn in the cycle to a more defensive financial and capex posture. The fact that 65% of the basic resources companies in the MSCI All Country World Index have CEOs with less than five years' tenure can be seen as one indication of this shift away from the supercycle mind-set (**Exhibit 10B**).

While the energy sector has made some progress in curtailing capex, more restraint is called for. As shown in **Exhibit 11**, below \$65 per barrel there is not enough profitably supplied crude to meet demand. Prices, however, have fallen below this break-even level, indicating that many producers are operating at a loss. At some point, prices will have to rise to ensure demand is met. This adjustment could take up to a few years, and new production is not likely to be brought online unless it brings a positive return to the producer within a reasonable time frame.

## ...demand is slowing faster than supply

On the demand front, sluggish overall global growth and, in particular China's economic rebalancing away from basic industry leave demand for commodities slowing at an even faster rate than supply. Over our forecast period, global and Chinese economic growth will continue to decelerate and the resource intensity of developed countries will likely continue to taper off, but per capita consumption in fast-growing China, India and other emerging countries should continue to rise. Going forward, regardless of whether historical Asian per capita commodity consumption patterns hold true for China, it is a much larger economic entity in 2015 than it was at the beginning of the supercycle. As such, lower expected growth rates should still produce considerable absolute demand for commodities, particularly at the consumer level (**Exhibit 12**).

Even a modest GDP growth rate for China can mean significant incremental demand for commodities





Source: Bloomberg, J.P. Morgan Asset Management; data as of December 31, 2014.

Investment and speculative holdings of gold are declining...





Source: Bloomberg, J.P. Morgan Asset Management; data as of June 30, 2015.

## The next supercycle?

Our assumptions time frame—spanning two economic cycles, or 10 to 15 years—should be an ample window for the correction phase to run its course and lay the seeds for the next commodity up-cycle, albeit a less robust cycle than the last. Over the course of the next 10 to 15 years, we anticipate less negative real return for commodities, eventually improving to modest real returns in the latter half of our assumptions period, producing, on average, a small incremental return above global inflation or a nominal annual return of 3.0%. Consideration of external factors, such as societal attitudes toward carbon production, government regulation and tax issues that have the potential to slow the pace of future supply increments, may play a greater role going forward.

## GOLD-SPECULATION DOWN, OFFICIAL RESERVES UP

Investment and speculative positions are being unwound rapidly. The GOLD SPDR® exchange-traded fund (ETF) holdings of gold are down 49% through August 2015 from their peak in January 2013 (**Exhibit 13A**. The ETF of major gold miners (GDX) has this year reached its lowest level since inception. Meanwhile, central bank purchases have risen on a net basis for each of the last six years, as well as year-to-date in 2015 (**Exhibit 13B**). The most recent report by the People's Bank of China (PBOC), showing central bank gold holdings of 1,658 metric tons, was well below expectations. This is likely an understatement, since gold held within the banking system but outside the PBOC is generally not counted. Retail gold purchases in China and India have dipped year-overyear, but holdings continue to grow. As has been suggested, gold is in sturdier store-of-value hands among consumers in the east than among investors in the west (**Exhibit 13C**).







Source: World Gold Council; data as of June 2015.

... and retail demand remains strong in India and China

## EXHIBIT 13C: ANNUAL CONSUMPTION FOR FIVE LARGEST GOLD CONSUMERS-JEWELRY, TOTAL BAR AND COIN



Source: World Gold Council, J.P. Morgan Asset Management; data as of December 31, 2014.

## CURRENCY EXCHANGE RATE ASSUMPTIONS

# Further away from long-term equilibriums

Michael Feser, CFA, Portfolio Manager, Multi-Asset Solutions

### IN BRIEF

- Our currency assumptions are derived from a framework that uses purchasing power parity (PPP) as an anchor for long-term fair value, with the results of this analysis subject to a thorough qualitative review to incorporate more subjective and secular factors into the results.
- The aim of our currency forecasts is to help provide internal consistency to our overall assumptions data set rather than to act as an exact point-in-time predictor of the level of exchange rates in 10 to 15 years' time.
- In this year's analysis of currency markets, we find that emerging policy divergences and ongoing rebalancing have led to an increase in currency volatility and started to drive exchange rates significantly away from their long-term equilibriums.
- The move away from fair value in developed market currencies has been short and sharp, suggesting that the cyclical realignment may already be well advanced, although it is likely that it will take several years for the trend to reverse back toward long-term equilibrium levels.
- For emerging market and commodity-related currencies, the process of rebalancing from overvalued levels appears to have further to run, given that the cyclical slowdown in emerging markets and commodities is ongoing.

## THE ANALYTICAL FRAMEWORK

Similar to last year, for G10 currencies we use a relative purchasing power parity approach that is based on the long-term average of a currency's real exchange rate as a fair value anchor. Relative PPP asserts that prices and exchange rates change over time in a way that preserves the ratio of each currency's domestic and foreign purchasing power. To look beyond static PPP and reflect the expected change in a country's terms of trade over the assumptions horizon, we adjust the current nominal fair value exchange rate by the expected inflation rate differential between the relevant two countries.

For emerging market currencies, we use an absolute PPP-based approach that accounts for GDP per capita differences that are then normalized over time. We obtain the initial fair value exchange rate estimates on the basis of actual individual consumption data from analysis conducted by the World Bank and the Organisation for Economic Co-operation and Development for the international price comparison program. As this data is published with a considerable time lag, we adjust it to the present day on the basis of historical consumer price index data from national sources and historical GDP-per-capita data as published by the International Monetary Fund in its World Economic Outlook. We adjust the current fair value exchange rate for the expected differentials in the respective GDP-per-capita growth rates and inflation rates to arrive at the exchange rate projection over the assumption horizon. In the final step, these results undergo a qualitative review and selective adjustment process to ensure that they are internally consistent and to incorporate secular factors and trends that would otherwise not be captured. Numerically, the expected rate of appreciation/depreciation is then determined by comparing the current spot exchange rate level with the fair value exchange rate projection and expressed as an annual compounded rate of change.

## LONG-TERM CURRENCY EXCHANGE RATE ASSUMPTIONS

In last year's edition of the Long-Term Capital Market Assumptions (LTCMAs), we discussed how several years of concurrent zero interest rate policies and quantitative easing (QE) by the major central banks in the developed world had led to exchange rates trading close to their long-term fair value and with a low level of realized volatility. However, we identified that the build up of significant divergences in the cyclical positions of developed economies, together with the emergence of diverging monetary policy stances, was likely to trigger an increase in overall market volatility and a significant move in currencies away from their long-term fair value. As is typical in foreign exchange markets, much of this change unfolded over a very short space of time. We therefore believe that the cyclical realignment is by now very well advanced, even if it is likely that several years will pass before a reversal of the trend back toward the long-term equilibrium.

Currency		30 September 2015 levels	2015 assumptions*	2016 assumptions*	Per annum % change**
Euro	EUR/USD	1.12	1.30	1.34	+1.50%
Japanese yen	USD/JPY	120	100	110	-0.75%
Swiss franc	USD/CHF	0.98	0.93	0.92	-0.50%
Sterling	GBP/USD	1.51	1.57	1.60	+0.50%
Canadian dollar	USD/CAD	1.31	1.14	1.15	-1.25%
Australian dollar	AUD/USD	0.70	0.71	0.70	+0.00%
Brazilian real	USD/BRL	3.96	3.26	4.13	+0.25%
Mexican peso	USD/MXN	16.90	14.76	18.00	+0.50%

Expected changes in major foreign exchange rates are likely to become more pronounced compared with emerging market currencies EXHIBIT 1: ASSUMPTIONS FOR SELECTED CURRENCY EXCHANGE RATES-NEXT 10-15 YEARS

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

\*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.

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

For emerging economies, the overall outlook is somewhat less sanguine, as the cyclical slowdown in economic activity in a number of countries is ongoing and commodity-linked currencies in particular have only just begun the adjustment process from an overvalued position. With limited appetite for reform so far, a less positive global liquidity outlook as the Federal Reserve begins to tighten and sticky inflation constraining monetary policy options, there is room for the re-alignment process to run further.

Expected changes in major foreign exchange rates over the long run have therefore become larger in general, with a more mixed picture for commodity-linked and emerging market currencies (**Exhibit 1**, prior page).

## EURO

Even the drawn-out and nail-biting showdown between Greece and its eurozone creditors failed to re-ignite the angst that would have been expected just a few years ago. While a fair amount of the institution-building, as well as domestic reforms in various eurozone countries is still a work in progress, the cyclical recovery is gathering pace and is improving the fiscal position of the region's governments. Growth is broadening out from Germany, Ireland and Spain to Italy and France, supported by a European Central Bank that is pursuing policies that would have hitherto not only been unconventional but also clearly considered out of scope. It is therefore not surprising to see the euro trade well below fair value at EUR/USD 1.12 as of the end of September.

In the outer years 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 1.50% annually, to the equivalent of a EUR/USD 1.34 exchange rate.

## JAPANESE YEN

The monetary policy arrow of Abenomics remains key to stimulating the Japanese economy, successfully weakening the yen further to USD/JPY 120. The deregulation agenda, meanwhile, continues its slow progress through a complex institutional framework. Compared with our default fair value starting point the long-term average exchange rate—the current level appears to be significantly below fair value. While corporate profits have improved strongly from—by international standards—paltry levels, they still do not seem to have reached the point where the focus of corporate strategy shifts from targeting profitability to increasing headline growth. Despite further declines in the yen over the last year, market share gains, both realized and targeted, by Japanese companies have remained limited and have convinced us to raise our fair value estimate for the yen over the LTCMAs horizon to USD/JPY 110. Inflation levels closer to the 2% target, combined with financial repression through extensive QE over a sustained period, will be necessary to erode the burden of Japan's high level of sovereign debt, reducing the attractiveness of Japanese assets for international investors in the process. We therefore expect the yen to trade below fair value for an extended period of time.

### SWISS FRANC

After being pushed down in 2014 by an exchange rate peg relative to a weakening euro, the Swiss franc surged earlier in the year when the Swiss National Bank suddenly announced it would no longer maintain the cap. Following the initial turmoil, the Swiss franc has now settled fairly close to fair value. Over the LTCMAs horizon, the Swiss franc should benefit from a relatively more benign inflation outlook, suggesting a rise at a long-term annualized rate of 0.50% against the U.S. dollar to USD/CHF 0.92.

## STERLING

While foreign exchange markets are likely to experience some anxiety as the date of the European Union referendum approaches, we assume that in the end this referendum—like the Scottish independence vote in 2014—will not result in a change of the status quo. Combined, however, with the perception of a somewhat slower cyclical recovery in the UK relative to the U.S. and, with that, a less imminent need for higher interest rates, the pound has weakened over the last year to trade slightly cheaper at GBP/USD 1.51. Relatively inferior inflation and growth dynamics going forward suggest that there is little upside for the pound, given our longer-term exchange rate assumption of GBP/USD 1.60.

## COMMODITY CURRENCIES

Our doubtful outlook for the Australian and Canadian dollars over the last two years has been vindicated by their further decline of 19.8% and 14.5%, respectively, over the past year. While the fall in commodity prices and slowdown in China may be largely behind us, there is still a considerable need for domestic rebalancing in these economies. Large amounts of accumulated household credit, elevated house prices and the significant erosion of each country's industrial manufacturing capacities still need to be unwound. Similar to the euro, these currencies may have to trade at a reasonable discount relative to fair value until they are able to make a cyclical recovery. As stated before, having benefited so strongly from China's rise over the last 15 years, the Australian dollar is, in our view, considerably more exposed to a Chinese slowdown. Some of this valuation gap has closed, with the Aussie dollar now trading close to its 2003 levels and closely in line with our long-term assumption of AUD/USD 0.70. But a near-term overshoot to the downside similar to that of the Canadian dollar remains likely. The loonie is now trading well below our long-term fair value assumption of USD/CAD 1.15 and is therefore expected to appreciate by 1.25% per annum. In Brazil, the lack of a political mandate to make the policy changes that are necessary to contain the fallout from the drop in commodity prices is further aggravating and extending the cyclical downturn and poor inflationary trajectory. We therefore significantly lower our long-term Brazilian real fair value exchange rate assumption to USD/BRL 4.13, with the expectation that this is likely to be exceeded in the near term.

## Many developed market exchange rates have moved away from our long-term forecasts EXHIBIT 2: SELECT EXCHANGE RATE HISTORIES RELATIVE TO 2016 LTCMAS



Source: Bloomberg, J.P. Morgan Asset Management.
## III. LONG-TERM CAPITAL MARKET ASSUMPTIONS

## HOW TO USE THE NUMBERS

Our assumptions can be used by investors in several ways:

- Develop or review a strategic asset allocation
- Understand the available risk and return trade-offs across asset classes and within asset classes across regions
- Make new, and review existing, relative value allocation decisions
- Use the correlation and volatility data to the risk characteristics of a strategic asset allocation

For example, investors may want to explore what opportunities exist to diversify their fixed income allocation ahead of a change in central bank monetary policy. Investors may also want to explore opportunities in emerging markets following a recent period of disappointing relative performance. The assumptions can also be used as a key input into an asset allocation model or simulation, such as the MAPS model that is used extensively by the J.P. Morgan Private Bank.

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.

	Annua	lized V	olatility	y: Squa	re Roo	t of 12																
		А	nnuali	zed Vo	atility								edit									
	Arithme	etic Ret	urn 20	16 (%)			ы		ate	S			t/Cre	dit								
	Compound Ref	turn 20	16 (%)				flati	ash	nedi	surie			men	/Cre								
	Compound Return 20	)15 (%)					Ξ	с v	itern iries	Irea		spi	/ern	nent								
	Inflation	2.25	2.25	2.26	1.5	1.5	1.00	Ŀ	S. In east	Buc		Bor	1 60	ernr	spuc							
	U.S. Cash	2.00	2.25	2.25	0.5	0.5	0.12	1.00	34	.S. L(		gate	atior	Gov	te B(							
	U.S. Intermediate Treasuries	4.00	3.00	3.20	6.5	6.3	-0.26	0.03	1.00	5	PS	ggre	Dur	ttion	orai	spue						
	U.S. Long Treasuries	2.75	2.50	3.40	13.8	13.0	-0.31	-0.01	0.91	1.00	F	S. A	hort	Dura	Corl	e Bo			ed		p	
	TIPS	4.25	2.75	2.92	6.0	5.8	0.00	0.01	0.68	0.52	1.00	5	5.5	Sug	ade	orat	spi		ledg		edge	
	U.S. Aggregate Bonds	4.00	3.75	3.83	4.0	3.8	-0.23	0.01	0.87	0.77	0.79	1.00	5	S. L	IV GI	Corp	Bor	ans	lds F		ds H	
	U.S. Short Duration Government/Credit	2.75	3.75	3.//	2.0	2.0	-0.18	0.33	0.63	0.40	0.66	0.74	1.00	<b>D</b>	ъ.	ong	vield	d Loa	Bor	spi	Bon	ds
ш	U.S. Long Duration Government/Credit	4.00	4.25	4.68	9.5	9.0	-0.27	-0.06	0.83	0.89	0.66	0.91	0.50	1.00		S.L	ligh '	ageo	nent	Bor	lent	Bon
ΜO	U.S. Inv Grade Corporate Bonds	4./5	4.25	4.45	6.5	6.3	-0.21	-0.11	0.51	0.46	0.65	0.83	0.60	0.79	1.00	<b>D</b>	.S. Н	ever	ernr	nent	ernm	ient
N	U.S. Long Corporate Bonds	4.50	4.75	5.22	10.0	9.3	-0.26	-0.12	0.55	0.60	0.58	0.82	0.47	0.89	0.96	1.00	5	.S.	Gov	ernr	Gove	ernm
	U.S. High Yield Bonds	6.00	6.75	7.15	9.3	8.5	0.06	-0.13	-0.21	-0.28	0.30	0.19	0.13	0.10	0.56	0.45	1.00	<b>D</b>	orld	Gov	J.S.	Gove
ХE	u.s. Leveraged Loans full index	N/A	5.25	5.43	6.3	6.0	0.29	-0.13	-0.46	-0.46	0.04	-0.08	-0.13	-0.12	0.31	0.22	0.80	1.00	5	/orld	ex-l	u.s.
ш	world Government Bonds Hedged	2.75	2.75	2.79	3.0	3.0	-0.35	0.03	0.88	0.85	0.54	0.81	0.57	0.80	0.53	0.58	-0.20	-0.44	1.00	5	orld	ex-l
	World Government Bonds	2.50	2.75	2.95	6.5	6.5	-0.05	0.11	0.60	0.44	0.65	0.67	0.68	0.55	0.55	0.50	0.17	-0.15	0.54	1.00	3	/orld
	World ex-U.S. Government Bonds Hedged	2.50	2.50	2.54	3.0	2.8	-0.36	0.01	0.76	0.75	0.44	0.72	0.49	0.73	0.51	0.56	-0.15	-0.38	0.97	0.48	1.00	2
	world ex-u.s. Government Bonds	2.25	2.50	2.81	8.0	7.8	0.00	0.10	0.47	0.31	0.60	0.58	0.63	0.45	0.51	0.45	0.24	-0.08	0.43	0.99	0.38	1.00
	Emerging Markets Sovereign Debt	7.00	6.50	7.01	10.5	9.8	-0.06	-0.05	0.26	0.13	0.57	0.58	0.45	0.47	0.74	0.65	0./1	0.39	0.26	0.50	0.27	0.52
	Emerging Markets Local Currency Debt	6.75	7.00	7.75	12.8	12.0	0.07	0.10	0.12	-0.03	0.43	0.37	0.38	0.26	0.52	0.44	0.60	0.29	0.09	0.56	0.09	0.61
	Emerging Markets Corporate Bonds	6.00	6.50	6.88	9.0	8.5	-0.03	-0.11	0.15	0.02	0.51	0.52	0.45	0.40	0.78	0.66	0.73	0.53	0.14	0.42	0.15	0.44
	U.S. Muni 1-15 YI Blend	5.25	3.25	5.30	3.3	3.3	-0.13	-0.03	0.51	0.46	0.54	0.05	0.44	0.57	0.59	0.55	0.28	0.11	0.52	0.40	0.51	0.35
		5.00	5.50	s./5	15.5	14.0	0.10	-0.09	0.02	0.00	0.29	0.25	0.03	0.21	0.37	0.31	0.40	0.56	0.04	0.02	0.07	0.02
		6.75	7.00	0.09	19.5	14.0	0.05	-0.00	-0.20	-0.30	0.04	-0.01	-0.04	-0.05	0.20	0.20	0.09	0.55	-0.20	0.15	-0.21	0.25
		6.75	7.25	0.04	21.3	10.5	0.05	-0.07	-0.30	-0.30	-0.03	-0.01	-0.05	-0.05	0.20	0.21	0.74	0.59	-0.20	0.11	-0.25	0.10
	IIS Large Can Value	6.75	7.25	9.20 8.45	16.3	14.8	0.04	-0.05	-0.28	-0.35	0.05	-0.01	-0.04	-0.05	0.17	0.15	0.00	0.51	-0.24	0.00	-0.19	0.14
	IIS Large Cap Growth	6.25	6.75	7.88	15.8	14.3	0.04	-0.08	-0.30	-0.38	0.01	-0.02	-0.05	-0.07	0.25	0.20	0.07	0.55	-0.29	0.10	-0.24	0.24
ES		7 25	8 50	10.10	19.0	17.3	0.06	0.06	-0.21	-0.31	0.13	0.02	0.03	0.01	0.25	0.27	0.69	0.50	-0.20	0.34	-0.16	0.42
Ε		5.25	6.50	7 71	16.3	15.3	0.00	-0.02	-0.17	-0.20	0.12	0.08	0.07	0.06	0.34	0.28	0.54	0.30	-0.15	0.17	-0.11	0.72
ηò	IIK Large Can	6.75	7 75	9.32	18.8	17.5	0.05	0.02	-0.29	-0.38	0.12	0.00	0.06	-0.03	0.34	0.20	0.71	0.45	-0.29	0.28	-0.24	0.22
ш	FAFF Fquity Hedged	7.00	7 75	8 77	15.0	13.8	0.00	0.00	-0.34	-0.36	-0.04	-0.03	-0.07	-0.04	0.30	0.24	0.68	0.60	-0.26	-0.01	-0.19	0.06
	EAFE Equity	6.75	7.75	9.20	18.0	16.5	0.06	0.04	-0.23	-0.31	0.15	0.09	0.11	0.02	0.38	0.30	0.72	0.55	-0.21	0.33	-0.17	0.41
	Emerging Markets Equity	8,75	10.00	12.53	25.5	22.5	0.06	0.09	-0,20	-0.29	0,21	0,10	0.13	0.03	0.37	0.29	0.69	0.52	-0.20	0.28	-0,16	0.35
	Asia ex-Japan Equity	9.75	10.25	12.62	24.8	21.8	-0.01	0.07	-0.17	-0.25	0.20	0.13	0.14	0.07	0.41	0.34	0.70	0.51	-0.15	0.26	-0.11	0.33
	AC World Equity	6.75	7.50	8.84	17.3	15.8	0.05	0.01	-0.27	-0.35	0.12	0.05	0.06	-0.01	0.34	0.27	0.74	0.58	-0.25	0.26	-0.20	0.34
	Private Equity	7.75	8.50	10.58	21.8	19.5	0.10	-0.10	-0.37	-0.42	-0.02	-0.11	-0.10	-0.14	0.19	0.13	0.69	0.61	-0.34	0.04	-0.29	0.12
	U.S. Direct Real Estate	6.00	5.50	6.12	11.5	10.8	-0.01	-0.01	-0.03	-0.05	0.04	0.05	-0.01	0.04	0.11	0.10	0.24	0.15	-0.02	0.08	-0.01	0.09
	U.S. Value Added Real Estate	7.75	7.25	8.34	15.5	14.3	-0.01	-0.01	-0.03	-0.05	0.04	0.05	-0.01	0.04	0.11	0.10	0.24	0.15	-0.02	0.08	-0.01	0.09
	European Direct Real Estate	5.75	5.50	6.64	15.8	14.8	-0.04	-0.01	-0.03	-0.04	0.03	0.07	0.02	0.06	0.15	0.14	0.20	0.15	0.03	0.04	0.06	0.06
/ES	U.S. REITS	6.50	6.00	7.48	18.0	16.8	-0.05	-0.04	-0.01	-0.05	0.16	0.21	0.03	0.19	0.38	0.35	0.63	0.38	0.02	0.24	0.05	0.27
T	Global Infrastructure	6.75	6.50	7.22	12.5	11.8	0.10	-0.01	-0.11	-0.13	0.01	-0.02	-0.03	-0.04	0.06	0.04	0.21	0.19	-0.11	0.04	-0.10	0.07
ΝA	Diversified Hedge Funds	4.50	4.25	4.42	6.0	5.8	0.19	0.10	-0.37	-0.40	0.04	-0.10	-0.07	-0.12	0.20	0.13	0.58	0.62	-0.35	-0.01	-0.30	0.06
ER	Event Driven Hedge Funds	6.00	6.00	6.30	8.0	7.5	0.21	0.02	-0.44	-0.50	0.03	-0.11	-0.06	-0.17	0.24	0.15	0.74	0.74	-0.41	0.06	-0.35	0.15
LT	Long Bias Hedge Funds	5.25	5.50	5.97	10.0	9.5	0.14	0.03	-0.40	-0.48	0.06	-0.08	-0.01	-0.15	0.26	0.16	0.73	0.65	-0.39	0.12	-0.34	0.21
A	Relative Value Hedge Funds	5.00	5.25	5.43	6.3	6.0	0.23	0.01	-0.38	-0.44	0.14	0.00	0.00	-0.07	0.37	0.26	0.82	0.84	-0.35	0.03	-0.29	0.11
	Macro Hedge Funds	4.75	5.00	5.27	7.5	7.3	-0.06	0.20	0.01	0.01	0.20	0.11	0.22	0.10	0.21	0.18	0.17	0.07	0.06	0.29	0.07	0.31
	Commodities	3.50	3.00	4.68	19.0	17.5	0.24	0.12	-0.14	-0.26	0.28	0.07	0.19	-0.01	0.25	0.17	0.45	0.36	-0.23	0.38	-0.24	0.44
	Gold	4.00	3.50	5.58	21.3	19.0	0.06	0.13	0.25	0.14	0.43	0.32	0.36	0.22	0.30	0.22	0.10	-0.06	0.15	0.45	0.10	0.45

Source: J.P. Morgan Asset Management. Data as of September 30, 2015, except hedge funds (diversified, event driven, long bias, and relative value) as of June 30, 2015 and hedge investible index. Hedge fund returns are shown net of manager fees. The return estimates shown for these alternative asset classes and strategies are our estimates of industry

## J.P. MORGAN LONG-TERM CAPITAL MARKET ASSUMPTIONS - U.S. DOLLAR

2016 Estimates - Correlation Matrix

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 the above asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on the above 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.

0.62         0.74         0.64 <th< th=""><th>Emerging Markets Sovereign Dept 1000 1000 1000 1000 1000 1000 1000 10</th><th>Emerging Markets Local Currency Debt 1000 0 1010 0 1000 00000000</th><th>Emerging Markets Corporate Bonds 0.44 0.55 0.54 0.55 0.54 0.55 0.54 0.55 0.54 0.55 0.55</th><th>Provide the second seco</th><th><b>play</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b></th><th>000.1 11.2. Large Cap 11.0.0 2.6.0 2.6.0</th><th>0001 001 002 002 002 002 002 002 002 002</th><th>0.00 0.00 0.00</th><th>0.01 U.S. Large Cap Value</th><th>0.1 U.S. Large Cap Growth</th><th>Euro Large Cap</th><th>nese Equity</th><th>e Cap</th><th>Hedged</th><th></th><th>uity</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>	Emerging Markets Sovereign Dept 1000 1000 1000 1000 1000 1000 1000 10	Emerging Markets Local Currency Debt 1000 0 1010 0 1000 00000000	Emerging Markets Corporate Bonds 0.44 0.55 0.54 0.55 0.54 0.55 0.54 0.55 0.54 0.55 0.55	Provide the second seco	<b>play</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b> <b>i</b>	000.1 11.2. Large Cap 11.0.0 2.6.0 2.6.0	0001 001 002 002 002 002 002 002 002 002	0.00 0.00 0.00	0.01 U.S. Large Cap Value	0.1 U.S. Large Cap Growth	Euro Large Cap	nese Equity	e Cap	Hedged		uity															
0.48         0.56         0.49         0.00         0.41         0.40 <th< th=""><th>0.62</th><th>0.74</th><th>0.60</th><th>0.03</th><th>0.19</th><th>0.87</th><th>0.85</th><th>0.77</th><th>0.85</th><th>0.85</th><th>1.00</th><th>Japa</th><th>Large</th><th>luity</th><th></th><th>ts Eq</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>	0.62	0.74	0.60	0.03	0.19	0.87	0.85	0.77	0.85	0.85	1.00	Japa	Large	luity		ts Eq															
0.69         0.61         0.30 <th< th=""><th>0.48</th><th>0.56</th><th>0.49</th><th>0.00</th><th>0.14</th><th>0.64</th><th>0.64</th><th>0.58</th><th>0.63</th><th>0.62</th><th>0.69</th><th>1.00</th><th>Ν</th><th>Ë</th><th>quity</th><th>larke</th><th>quity</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>	0.48	0.56	0.49	0.00	0.14	0.64	0.64	0.58	0.63	0.62	0.69	1.00	Ν	Ë	quity	larke	quity														
0.58         0.55         0.02         0.27         0.87         0.87         0.88         0.88         0.79         0.86         0.86         0.79         0.86         0.80         0.79         0.86         0.80         0.79         0.86         0.80         0.97         0.86         0.97         0.96         0.97         0.66         0.79         0.64         0.20         0.80 <th< td=""><td>0.59</td><td>0.69</td><td>0.61</td><td>0.03</td><td>0.30</td><td>0.85</td><td>0.81</td><td>0.72</td><td>0.83</td><td>0.83</td><td>0.91</td><td>0.68</td><td>1.00</td><td>EAF</td><td>FE EC</td><td>Ng M</td><td>an Ec</td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	0.59	0.69	0.61	0.03	0.30	0.85	0.81	0.72	0.83	0.83	0.91	0.68	1.00	EAF	FE EC	Ng M	an Ec				0										
0.64         0.76         0.64         0.03         0.22         0.86         0.86         0.76         0.76         0.76         0.64         0.03         0.22         0.86         0.76         0.64         0.76         0.64         0.24         0.24         0.26         0.27         0.76 <th< td=""><td>0.54</td><td>0.58</td><td>0.55</td><td>-0.02</td><td>0.27</td><td>0.87</td><td>0.87</td><td>0.79</td><td>0.86</td><td>0.86</td><td>0.88</td><td>0.79</td><td>0.86</td><td>1.00</td><td>EAI</td><td>ergi</td><td>-Jap</td><td>quity</td><td></td><td>ate</td><td>state</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	0.54	0.58	0.55	-0.02	0.27	0.87	0.87	0.79	0.86	0.86	0.88	0.79	0.86	1.00	EAI	ergi	-Jap	quity		ate	state										
0.66         0.79         0.64         0.44         0.44         0.47         0.70         0.74 <th< td=""><td>0.64</td><td>0.76</td><td>0.64</td><td>0.03</td><td>0.22</td><td>0.88</td><td>0.86</td><td>0.77</td><td>0.86</td><td>0.86</td><td>0.98</td><td>0.79</td><td>0.95</td><td>0.91</td><td>1.00</td><td>Em</td><td>a ex</td><td>id E</td><td>itγ</td><td>Esta</td><td>eal E</td><td>tate</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	0.64	0.76	0.64	0.03	0.22	0.88	0.86	0.77	0.86	0.86	0.98	0.79	0.95	0.91	1.00	Em	a ex	id E	itγ	Esta	eal E	tate									
0.65         0.75         0.64         0.075         0.64         0.75         0.64         0.75         0.64         0.75         0.64         0.75         0.64         0.75         0.64         0.75         0.64         0.75         0.64         0.75         0.75         0.64         0.75         0.75         0.64         0.75         0.75         0.64         0.75         0.75         0.75         0.74         0.75         0.74 </td <td>0.66</td> <td>0.79</td> <td>0.64</td> <td>0.04</td> <td>0.24</td> <td>0.76</td> <td>0.77</td> <td>0.70</td> <td>0.74</td> <td>0.78</td> <td>0.84</td> <td>0.66</td> <td>0.83</td> <td>0.80</td> <td>0.88</td> <td>1.00</td> <td>Asi</td> <td>Wor</td> <td>Equ</td> <td>Real</td> <td>ed Re</td> <td>al Es</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	0.66	0.79	0.64	0.04	0.24	0.76	0.77	0.70	0.74	0.78	0.84	0.66	0.83	0.80	0.88	1.00	Asi	Wor	Equ	Real	ed Re	al Es									
0.62         0.74         0.63         0.02         0.23         0.93         0.84         0.94 <th< td=""><td>0.65</td><td>0.75</td><td>0.64</td><td>0.06</td><td>0.24</td><td>0.75</td><td>0.75</td><td>0.68</td><td>0.72</td><td>0.76</td><td>0.82</td><td>0.63</td><td>0.80</td><td>0.79</td><td>0.85</td><td>0.97</td><td>1.00</td><td>AC</td><td>vate</td><td>rect</td><td>₽dd€</td><td>t Re</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	0.65	0.75	0.64	0.06	0.24	0.75	0.75	0.68	0.72	0.76	0.82	0.63	0.80	0.79	0.85	0.97	1.00	AC	vate	rect	₽dd€	t Re									
0.39         0.46 <th>0.62</th> <th>0.74</th> <th>0.63</th> <th>0.02</th> <th>0.23</th> <th>0.95</th> <th>0.93</th> <th>0.86</th> <th>0.93</th> <th>0.94</th> <th>0.95</th> <th>0.74</th> <th>0.94</th> <th>0.92</th> <th>0.97</th> <th>0.90</th> <th>0.87</th> <th>1.00</th> <th>Pri</th> <th>S. Di</th> <th>ilue</th> <th>Direc</th> <th></th> <th>e</th> <th>10</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	0.62	0.74	0.63	0.02	0.23	0.95	0.93	0.86	0.93	0.94	0.95	0.74	0.94	0.92	0.97	0.90	0.87	1.00	Pri	S. Di	ilue	Direc		e	10						
0.19         0.22         0.15         0.04         0.08         0.30         0.31         0.32         0.31         0.23         0.26         0.20         0.20         0.20         0.10         0.10         0.10         0.10         0.10         0.10         0.10         0.10         0.01 <th< th=""><th>0.39</th><th>0.51</th><th>0.46</th><th>-0.04</th><th>0.24</th><th>0.87</th><th>0.92</th><th>0.95</th><th>0.87</th><th>0.87</th><th>0.74</th><th>0.62</th><th>0.71</th><th>0.77</th><th>0.76</th><th>0.69</th><th>0.67</th><th>0.84</th><th>1.00</th><th>3</th><th>S. V</th><th>an [</th><th></th><th>nctur</th><th>pun</th><th>spu</th><th></th><th></th><th></th><th></th><th></th></th<>	0.39	0.51	0.46	-0.04	0.24	0.87	0.92	0.95	0.87	0.87	0.74	0.62	0.71	0.77	0.76	0.69	0.67	0.84	1.00	3	S. V	an [		nctur	pun	spu					
0.19         0.22         0.15         0.04         0.08         0.30         0.31         0.32         0.24         0.24         0.24         0.24         0.24         0.24         0.24         0.24         0.24         0.24         0.24         0.26         0.24 <th< th=""><th>0.19</th><th>0.22</th><th>0.15</th><th>0.04</th><th>0.08</th><th>0.30</th><th>0.31</th><th>0.32</th><th>0.31</th><th>0.28</th><th>0.26</th><th>0.19</th><th>0.23</th><th>0.26</th><th>0.26</th><th>0.22</th><th>0.21</th><th>0.28</th><th>0.29</th><th>1.00</th><th></th><th>Irope</th><th>EITS</th><th>astri</th><th>lge F</th><th>e Fui</th><th></th><th></th><th></th><th></th><th></th></th<>	0.19	0.22	0.15	0.04	0.08	0.30	0.31	0.32	0.31	0.28	0.26	0.19	0.23	0.26	0.26	0.22	0.21	0.28	0.29	1.00		Irope	EITS	astri	lge F	e Fui					
0.20         0.19         0.09 <th< td=""><td>0.19</td><td>0.22</td><td>0.15</td><td>0.04</td><td>0.08</td><td>0.30</td><td>0.31</td><td>0.32</td><td>0.31</td><td>0.28</td><td>0.26</td><td>0.19</td><td>0.23</td><td>0.26</td><td>0.26</td><td>0.22</td><td>0.21</td><td>0.28</td><td>0.29</td><td>0.16</td><td>1.00</td><td>Щ</td><td>S. R</td><td>Infr</td><td>I Hec</td><td>ledg</td><td>spun</td><td>pund</td><td></td><td></td><td></td></th<>	0.19	0.22	0.15	0.04	0.08	0.30	0.31	0.32	0.31	0.28	0.26	0.19	0.23	0.26	0.26	0.22	0.21	0.28	0.29	0.16	1.00	Щ	S. R	Infr	I Hec	ledg	spun	pund			
0.52         0.54         0.44         0.17         0.22         0.74         0.77         0.78         0.77         0.70         0.66         0.55         0.55         0.51         0.70         0.40         0.21         1.00         0	0.20	0.19	0.19	0.05	0.10	0.25	0.25	0.22	0.25	0.25	0.26	0.24	0.25	0.30	0.27	0.24	0.24	0.27	0.21	0.08	0.08	1.00	j	obal	ifiec	en F	ge Fi	lge F			
0.15       0.16       0.01       0.08       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.00       0.00       0.00       0.00       0.00       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.02       0.00       0.01       0.02       0.00       0.01       0.02       0.00       0.01	0.52	0.58	0.44	0.17	0.22	0.74	0.77	0.78	0.77	0.70	0.66	0.50	0.59	0.65	0.66	0.55	0.55	0.71	0.70	0.40	0.40	0.21	1.00	5	ivers	Driv	Hed	Hed	s		
0.37       0.44       0.42       0.06       0.45       0.65       0.66       0.66       0.66       0.67       0.66       0.72       0.74       0.70       0.73       0.66       0.14       0.14       0.21       0.35       0.21       1.00       u       b       b       b       b       b       b       b       0.75       0.75       0.75       0.76       0.75       0.76 <td< td=""><td>0.15</td><td>0.19</td><td>0.16</td><td>-0.01</td><td>0.08</td><td>0.30</td><td>0.29</td><td>0.27</td><td>0.30</td><td>0.29</td><td>0.26</td><td>0.19</td><td>0.26</td><td>0.26</td><td>0.27</td><td>0.23</td><td>0.22</td><td>0.29</td><td>0.27</td><td>0.09</td><td>0.09</td><td>0.07</td><td>0.22</td><td>1.00</td><td></td><td>vent</td><td>Bias</td><td>alue</td><td>pun:</td><td></td><td></td></td<>	0.15	0.19	0.16	-0.01	0.08	0.30	0.29	0.27	0.30	0.29	0.26	0.19	0.26	0.26	0.27	0.23	0.22	0.29	0.27	0.09	0.09	0.07	0.22	1.00		vent	Bias	alue	pun:		
0.47       0.55       0.55       0.04       0.42       0.79       0.82       0.79       0.83       0.84       0.81       0.82       0.79       0.76       0.85       0.81       0.21       0.21       0.22       0.23       0.25       0.89       1.00       1       100       100 <t< td=""><td>0.3/</td><td>0.44</td><td>0.42</td><td>-0.06</td><td>0.39</td><td>0.65</td><td>0.68</td><td>0.58</td><td>0.61</td><td>0.69</td><td>0.67</td><td>0.61</td><td>0.72</td><td>0.75</td><td>0.72</td><td>0.74</td><td>0.70</td><td>0./3</td><td>0.66</td><td>0.14</td><td>0.14</td><td>0.21</td><td>0.35</td><td>0.21</td><td>1.00</td><td>ш́ </td><td>ong</td><td>ve V</td><td>dge I</td><td></td><td></td></t<>	0.3/	0.44	0.42	-0.06	0.39	0.65	0.68	0.58	0.61	0.69	0.67	0.61	0.72	0.75	0.72	0.74	0.70	0./3	0.66	0.14	0.14	0.21	0.35	0.21	1.00	ш́ 	ong	ve V	dge I		
0.52 0.54 0.53 0.46 0.53 0.54 0.53 0.54 0.53 0.54 0.53 0.54 0.53 0.54 0.55 0.54 0.55 0.55 0.55 0.55 0.56 0.55 0.55 0.55	0.4/	0.55	0.55	-0.04	0.42	0.79	0.82	0.75	0.77	0.80	0.79	0.63	0.84	0.81	0.82	0.79	0.76	0.85	0.81	0.21	0.21	0.22	0.53	0.25	0.89	1.00	- 1.00	telati	o He	ties	
0.21 0.35 0.44 0.02 0.08 0.44 0.07 0.12 0.31 0.55 0.76 0.70 0.50 0.76 0.79 0.75 0.75 0.75 0.76 0.59 0.18 0.10 0.22 0.86 0.92 0.86 1.00 2 10 0 1 1 0 0 1 1 0 0 1 1 0 0 0 0 0	0.52	0.64	0.58	-0.06	0.30	0.67	0.88	0.60	0.62	0.8/	0.85	0.71	0.8/	0.86	0.89	0.90	0.86	0.92	0.60	0.22	0.22	0.24	0.55	0.20	0.89	0.94	0.94	1.00	lacro	nodi	
0.41 0.55 0.44 0.07 0.12 0.45 0.47 0.37 0.43 0.47 0.55 0.38 0.65 0.40 0.59 0.62 0.54 0.58 0.40 0.10 0.10 0.10 0.10 0.10 0.10 0.10	0.55	0.54	0.02	0.08	0.54	0.07	0.72	0.01	0.05	0.70	0.70	0.00	0.76	0.70	0.75	0.75	0.73	0.76	0.09	0.10	0.10	0.21	0.40	0.22	0.65	0.92	0.00	0.35	<b>∠</b> 1.00	Comr	
0.32 0.39 0.29 0.19 0.06 0.02 0.05 0.04 0.03 0.05 0.13 0.07 0.17 0.02 0.16 0.28 0.24 0.14 0.04 0.02 0.02 0.00 0.07 0.01 0.23 0.15 0.23 0.16 0.47 0.49 1.00	0.21	0.55	0.10	-0.07	0.12	0.45	0.47	0.10	0.43	0.47	0.55	0.38	0.65	0.40	0.50	0.62	0.54	0.58	0.40	0.10	0.10	0.10	0.26	0.16	0.57	0.58	0.40	0.55	0.48	1.00	plog
	0.32	0.39	0.29	0.19	0.06	0.02	0.05	0.04	0.03	0.05	0.13	0.07	0.17	-0.02	0.16	0.28	0.24	0.14	0.04	0.02	0.02	0.00	0.07	0.01	0.23	0.15	0.23	0.16	0.47	0.49	1.00

fund (macro), as of May 31, 2015. Private equity, hedge funds, real estate, infrastructure and commodities are unlike other asset categories shown above in that there is no underlying medians-the dispersion of returns among managers in these asset classes and strategies is typically far wider than for traditional asset classes.

	Annua	lized V	olatility	y: Squa	are Roo	t of 12				bed												
		۵	nnuali	zed Vo	latility		_		sp	ledg	nds	ged										
	Arithme	etic Ret	urn 20	16 (%)			ation		Bond	ds F	e Bo	Hedg										
	Compound Ret	urn 20	16 (%)				Infla	_	ate	Bon	orati	l sbr	p									
	Compound Return 20	15 (%)					ΠK	Cast	greg	gate	orpo	BOI	edge									
	UK Inflation	2.25	2.25	2.26	1.50	1.25	1.00	Ν	. Ag	gre	de O	Corp	th sh	5	p	ged						
	UK Cash	2.25	2.25	2.25	0.75	0.75	-0.11	1.00	u.s He	3Υ 0.	r Gra	ade	Bone	puo	edge	Hedg						
	U.S. Aggregate Bonds Hedged	4.25	3.75	3.83	4.00	3.75	-0.20	0.09	1.00	Eur	. Inv dged	v Gr	eld I	eld B	IS Ho	l sbr						
	Euro Aggregate Bonds Hedged	3.00	3.00	3.06	3.50	3.50	-0.22	0.01	0.65	1.00	U.S Hec	ul o	ŝh Yi	n Yie	Loar	Bor			p			
	U.S. Inv Grade Corporate Bonds Hedged	5.00	4.25	4.45	6.50	6.25	-0.19	-0.02	0.83	0.60	1.00	Eur	. Ηi	Higl	ged	nent			edge		lged	
	Euro Inv Grade Corp Bonds Hedged	3.25	3.75	3.82	3.75	3.75	-0.12	-0.13	0.53	0.72	0.79	1.00	u.s	ado.	vera	ernr			ds H		Hed	
	U.S. High Yield Bonds Hedged	6.25	6.75	7.17	9.50	8.50	0.00	-0.17	0.18	0.04	0.55	0.55	1.00	Eur	. Le	Gov		spu	Bond	ş	spuc	
M	Europe High Yield Bonds	4.75	6.00	6.84	13.50	12.25	-0.03	-0.05	0.18	0.11	0.49	0.51	0.80	1.00	u.s	ado.	5	d Bo	ent	Bone	nt B(	spuc
00	U.S. Leveraged Loans Hedged	N/A	5.25	5.45	6.50	6.00	0.17	-0.27	-0.10	-0.15	0.28	0.41	0.79	0.58	1.00	Eur	Gilts	inke	rnm	ent	Imer	nt Bc
2	Europe Government Bonds Hedged	3.00	2.75	2.84	4.25	4.00	-0.22	0.04	0.61	0.97	0.47	0.56	-0.10	0.01	-0.28	1.00	NK	ex-li	iove	rnm	verr	Imer
ЕD	UK Gilts	3.25	2.50	2.71	6.50	6.00	-0.22	0.07	0.70	0.55	0.45	0.24	-0.21	-0.13	-0.38	0.57	1.00	Ind	rld 0	Gove	K Go	verr
Ϋ́Ι	Index-linked Bonds	2.25	1.25	1.58	8.25	7.75	-0.13	-0.05	0.54	0.30	0.43	0.24	0.18	0.16	0.04	0.27	0.67	1.00	Wo	rld 0	n-xa	K Go
_	World Government Bonds Hedged	3.00	2.75	2.79	3.00	3.00	-0.24	0.15	0.82	0.82	0.54	0.39	-0.20	-0.11	-0.45	0.85	0.83	0.51	1.00	Wo	rlde	IN-xa
	World Government Bonds	3.00	2.25	2.62	8.75	8.50	-0.24	0.24	0.46	0.44	0.17	-0.01	-0.35	-0.08	-0.55	0.51	0.64	0.36	0.69	1.00	Wo	rld e
	World ex-UK Government Bonds Hedged	3.00	2.75	2.79	3.00	2.75	-0.24	0.15	0.81	0.84	0.53	0.40	-0.19	-0.10	-0.45	0.87	0.79	0.47	1.00	0.68	1.00	Wo
	World ex-UK Government Bonds	2.75	2.25	2.66	9.25	8.75	-0.23	0.24	0.45	0.43	0.16	-0.02	-0.35	-0.07	-0.55	0.50	0.62	0.34	0.68	1.00	0.67	1.00
	Emerging Markets Sovereign Debt Hedged	7.25	6.50	7.01	10.50	9.75	-0.13	0.02	0.57	0.38	0.74	0.64	0.70	0.68	0.37	0.28	0.19	0.27	0.26	0.01	0.27	0.01
	Emerging Markets Local Currency Debt	7.00	6.50	7.11	11.50	10.50	-0.13	0.18	0.41	0.32	0.42	0.35	0.32	0.49	0.04	0.29	0.29	0.30	0.32	0.42	0.31	0.42
	Emerging Markets Corporate Bonds Hedged	6.25	6.50	6.88	9.00	8.50	-0.14	-0.03	0.52	0.34	0.78	0.72	0.72	0.70	0.50	0.19	0.09	0.22	0.14	-0.10	0.14	-0.11
	UK All Cap	7.00	7.25	8.24	14.75	13.50	0.10	-0.14	0.05	0.01	0.34	0.40	0.67	0.74	0.53	-0.07	-0.14	0.12	-0.19	-0.15	-0.20	-0.14
	UK Large Cap	7.00	7.25	8.24	14.75	13.50	0.11	-0.13	0.06	0.01	0.35	0.39	0.66	0.74	0.51	-0.06	-0.13	0.14	-0.18	-0.13	-0.18	-0.12
	UK Small Cap	7.50	7.50	9.12	19.00	16.50	0.07	-0.20	-0.01	-0.01	0.30	0.41	0.67	0.67	0.55	-0.11	-0.17	0.06	-0.23	-0.25	-0.23	-0.25
	U.S. Large Cap	6.75	6.50	7.57	15.25	13.75	0.03	-0.17	0.01	0.02	0.17	0.23	0.48	0.56	0.33	-0.01	0.00	0.21	-0.09	0.15	-0.10	0.15
	U.S. Large Cap Hedged	6.75	7.00	8.09	15.50	14.00	0.11	-0.22	-0.03	-0.07	0.24	0.35	0.69	0.69	0.55	-0.15	-0.24	0.07	-0.28	-0.29	-0.27	-0.28
	Euro Large Cap	7.50	8.00	9.78	20.00	18.25	0.00	-0.06	0.09	0.03	0.31	0.33	0.62	0.79	0.39	-0.02	-0.07	0.18	-0.10	-0.01	-0.10	0.00
ES	Euro Large Cap Hedged	7.75	8.00	9.26	16.75	15.25	0.05	-0.20	-0.01	0.02	0.30	0.43	0.69	0.65	0.60	-0.06	-0.18	0.09	-0.23	-0.29	-0.23	-0.29
Ε	Euro Small Cap	8.00	8.50	10.96	23.75	21.00	0.01	-0.10	0.05	0.00	0.31	0.34	0.66	0.81	0.45	-0.06	-0.13	0.12	-0.16	-0.07	-0.17	-0.07
ηò	Euro Small Cap Hedged	8.25	8.50	10.36	20.50	18.50	0.06	-0.12	0.02	-0.05	0.32	0.38	0.72	0.80	0.53	-0.14	-0.26	0.03	-0.25	-0.32	-0.25	-0.31
Ш	Japanese Equity	5.50	6.00	7.07	15.25	14.25	-0.09	-0.06	0.08	0.11	0.25	0.25	0.32	0.37	0.22	0.08	0.05	0.24	0.01	0.10	0.00	0.10
	Japanese Equity Hedged	5.50	7.25	9.08	20.25	18.75	0.09	-0.19	-0.18	-0.08	0.12	0.25	0.46	0.42	0.46	-0.13	-0.28	0.02	-0.33	-0.47	-0.33	-0.47
	Asia ex-Japan Equity	10.00	9.75	11.65	22.25	19.50	-0.05	-0.01	0.15	0.10	0.38	0.39	0.61	0.66	0.39	0.03	-0.01	0.16	-0.04	-0.01	-0.05	-0.01
	Emerging Markets Equity	9.00	9.50	11.50	22.75	20.00	0.00	0.01	0.11	0.04	0.34	0.35	0.61	0.68	0.41	-0.02	-0.05	0.15	-0.10	-0.05	-0.11	-0.05
	AC World Equity	7.00	7.00	8.06	15.25	14.00	0.02	-0.11	0.06	0.04	0.29	0.33	0.61	0.72	0.41	-0.02	-0.04	0.21	-0.11	0.05	-0.11	0.06
	AC World ex-UK Equity	7.00	7.00	8.09	15.50	14.00	0.01	-0.10	0.07	0.04	0.29	0.32	0.60	0.71	0.40	-0.01	-0.03	0.21	-0.10	0.07	-0.11	0.07
	Developed World Equity	6.75	6.75	7.78	15.00	13.75	0.03	-0.12	0.06	0.04	0.27	0.32	0.59	0.70	0.40	-0.01	-0.03	0.22	-0.10	0.07	-0.11	0.07
	Private Equity	8.00	8.00	9.95	21.00	18.75	0.02	-0.19	-0.10	-0.09	0.13	0.22	0.56	0.55	0.47	-0.15	-0.12	0.13	-0.23	-0.04	-0.24	-0.04
	U.S. Direct Real Estate	6.25	5.00	5.98	14.50	13.75	-0.01	-0.06	0.06	0.04	0.10	0.10	0.19	0.18	0.10	0.03	0.06	0.12	0.04	0.07	0.03	0.07
	European Direct Real Estate	6.00	5.00	5.98	14.50	13.75	-0.01	-0.06	0.07	0.12	0.15	0.20	0.20	0.20	0.15	0.10	0.01	0.06	0.03	-0.03	0.03	-0.03
S	U.S. REITs	6.75	5.50	7.32	20.00	18.50	-0.04	-0.14	0.20	0.13	0.30	0.29	0.50	0.47	0.26	0.11	0.18	0.33	0.12	0.19	0.10	0.18
I < E	European REITs	0.00	7.75	9.89	22.00	20.00	-0.01	-0.17	0.19	0.18	0.35	0.41	0.56	0.64	0.32	0.13	0.06	0.21	0.06	0.04	0.06	0.04
ATI	Global Infrastructure	7.00	6.00	7.10	15.50	14.50	0.10	-0.07	-0.02	-0.04	0.06	0.09	0.20	0.20	0.17	-0.06	-0.08	0.01	-0.10	-0.10	-0.10	-0.10
N N	Diversified Hedge Funds Hedged	4.75	4.25	4.42	6.00	5.75	0.16	-0.13	-0.13	-0.13	0.17	0.29	0.57	0.53	0.61	-0.22	-0.32	0.01	-0.37	-0.45	-0.37	-0.44
TEL	Event Driven Hedge Funds Hedged	6.25	6.00	6.32	8.25	7.75	0.17	-0.19	-0.15	-0.13	0.21	0.39	0.74	0.70	0.73	-0.25	-0.41	-0.04	-0.43	-0.48	-0.43	-0.48
AL	Long Bias Hedge Funds Hedged	5.50	5.50	5.99	10.25	9.75	0.11	-0.13	-0.11	-0.15	0.24	0.35	0.72	0.72	0.64	-0.25	-0.36	-0.02	-0.41	-0.44	-0.40	-0.44
	Relative Value Hedge Funds Hedged	5.25	5.25	5.45	6.50	6.25	0.14	-0.16	-0.03	-0.06	0.35	0.48	0.81	0.70	0.84	-0.19	-0.37	0.03	-0.37	-0.51	-0.36	-0.51
	Macro Hedge Funds Hedged	5.00	5.00	5.27	7.50	7.25	0.01	0.20	0.10	0.09	0.20	0.14	0.16	0.26	0.05	0.06	0.08	0.16	0.06	0.05	0.05	0.05
	Commodities	3.75	2.50	3.68	15.75	14.50	0.19	0.09	0.10	-0.08	0.20	0.13	0.32	0.39	0.21	-0.12	-0.10	0.14	-0.10	0.02	-0.10	0.03
	Gold	4.25	3.00	5.08	21.25	18.75	-0.17	0.21	0.34	0.15	0.22	0.04	-0.08	0.03	-0.24	0.14	0.34	0.24	0.30	0.39	0.28	0.38

Source: J.P. Morgan Asset Management. Data as of September 30, 2015, except hedge funds (diversified, event driven, long bias, and relative value) as of June 30, 2015 and hedge investible index. Hedge fund returns are shown net of manager fees. The return estimates shown for these alternative asset classes and strategies are our estimates of industry

## J.P. MORGAN LONG-TERM CAPITAL MARKET ASSUMPTIONS - STERLING

2016 Estimates - Correlation Matrix

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 the above asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on the above 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 judgement 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.

Emerging Markets Sovereign Debt Hedged	nerging Markets Local Currency Debt	ging Markets Corporate Bonds Hedged																													
1.00	1.00	Emerg	II Cap	Cap	_		p																								
0.89	0.53	1.00	UK A	.arge	l Cap	ap	edge																								
0.58	0.52	0.58	1.00	UK I	Smal	ge C	ap H		ged																						
0.58	0.53	0.57	1.00	1.00	NK	. Lar	.ge	Cap	Hed																						
0.52	0.39	0.55	0.87	0.83	1.00	u.s	. Laı	ırge	Cap		ged																				
0.37	0.59	0.36	0.78	0.78	0.66	1.00	n.	ro Lä	arge	Cap	Hed		ъ																		
0.51	0.41	0.52	0.86	0.85	0.77	0.81	1.00	Eu	Li Li	mall	Cap	>	odge																		
0.58	0.60	0.54	0.91	0.90	0.78	0.80	0.83	1.00	Eu	ro S	mall	Equit	γ He	₹	τ																
0.52	0.41	0.53	0.90	0.88	0.82	0.72	0.85	0.89	1.00	Ē	Iro S	ese I	Equit	Equi	Equ																
0.57	0.55	0.56	0.89	0.87	0.87	0.72	0.79	0.93	0.84	1.00	Щ	pan	ese I	pan	kets																
0.59	0.39	0.61	0.84	0.82	0.84	0.54	0.82	0.86	0.83	0.93	1.00	Ja	apan	x-Ja	Mar	ť	quity	≥													
0.33	0.47	0.32	0.58	0.57	0.50	0.59	0.45	0.58	0.56	0.55	0.42	1.00		sia e	ging	Equi	IK EC	Equi													
0.31	0.23	0.35	0.63	0.61	0.60	0.48	0.62	0.59	0.68	0.57	0.60	0.76	1.00	<b>A</b>	mer	orld	ex-L	orld			te										
0.60	0.60	0.57	0.70	0.75	0.08	0.67	0.07	0.76	0.72	0.78	0.70	0.54	0.52	0.07	1.00	NC M	orld	ом р	>	state	Esta										
0.03	0.09	0.58	0.79	0.78	0.71	0.07	0.70	0.80	0.74	0.82	0.75	0.55	0.55	0.97	0.85	1.00	AC W	lope	quit	eal E	Real										
0.55	0.67	0.52	0.91	0.90	0.70	0.94	0.85	0.92	0.83	0.87	0.73	0.68	0.60	0.84	0.85	1.00	1.00	oeve	ate E	ct Re	ect I				ged	<del>o</del>					
0.52	0.64	0.49	0.90	0.90	0.77	0.95	0.86	0.92	0.84	0.87	0.73	0.68	0.60	0.79	0.81	1.00	1.00	1.00	Priva	Dire	n Dir				Hedg	edge					
0.30	0.45	0.34	0.68	0.66	0.71	0.85	0.76	0.69	0.68	0.72	0.60	0.56	0.52	0.62	0.63	0.82	0.83	0.83	1.00	u.s.	pea	S	ITS	ture	nds	Is He	ed	ged			
0.15	0.22	0.11	0.23	0.23	0.20	0.30	0.24	0.25	0.23	0.23	0.17	0.18	0.12	0.20	0.20	0.29	0.29	0.29	0.28	1.00	Euro	REI <sup>-</sup>	in RE	struc	e Fu	Func	ledg	Hedg			
0.19	0.16	0.19	0.27	0.26	0.24	0.22	0.24	0.27	0.30	0.25	0.24	0.18	0.19	0.23	0.22	0.26	0.25	0.26	0.19	0.07	1.00	u.s.	opea	nfra:	ledg	dge	l sbr	nds			
0.41	0.57	0.30	0.59	0.58	0.50	0.75	0.61	0.64	0.58	0.57	0.43	0.47	0.31	0.52	0.51	0.72	0.72	0.73	0.71	0.40	0.19	1.00	Eur	bal I	ied F	n He	e Fur	e Fu	ged		
0.56	0.55	0.46	0.73	0.71	0.69	0.62	0.65	0.77	0.70	0.74	0.68	0.43	0.39	0.55	0.56	0.70	0.69	0.70	0.56	0.28	0.23	0.72	1.00	Glo	ersif	rive	ledg	ledg	Нед		
0.14	0.11	0.14	0.26	0.26	0.23	0.24	0.30	0.24	0.25	0.23	0.24	0.13	0.19	0.19	0.21	0.25	0.25	0.25	0.22	0.07	0.07	0.18	0.19	1.00	Div	ent D	as H	lue F	spur		
0.36	0.20	0.41	0.68	0.66	0.70	0.42	0.64	0.58	0.71	0.68	0.74	0.41	0.63	0.60	0.66	0.59	0.58	0.57	0.51	0.08	0.19	0.20	0.38	0.20	1.00	Eve	ig Bi	e Va	ge Fl		
0.45	0.25	0.54	0.77	0.75	0.79	0.52	0.79	0.69	0.79	0.78	0.85	0.38	0.62	0.63	0.68	0.67	0.66	0.65	0.64	0.14	0.21	0.36	0.51	0.24	0.89	1.00	Lor	lativ	Hedg	sa	
0.51	0.35	0.57	0.82	0.80	0.80	0.58	0.84	0.76	0.81	0.82	0.89	0.46	0.69	0.75	0.81	0.76	0.75	0.73	0.67	0.15	0.22	0.38	0.52	0.25	0.88	0.94	1.00	Re	cro	oditi	
0.54	0.24	0.61	0.70	0.68	0.71	0.40	0.66	0.59	0.73	0.67	0.76	0.36	0.61	0.60	0.65	0.58	0.56	0.55	0.52	0.11	0.20	0.30	0.45	0.20	0.85	0.92	0.86	1.00	Ма	mm	
0.21	0.24	0.17	0.33	0.32	0.25	0.11	0.22	0.30	0.28	0.35	0.37	0.24	0.21	0.35	0.40	0.28	0.27	0.25	0.10	0.01	0.09	0.04	0.15	0.07	0.60	0.38	0.45	0.33	1.00	S	ple
0.36	0.38	0.37	0.46	0.46	0.35	0.30	0.35	0.39	0.28	0.44	0.42	0.18	0.17	0.41	0.50	0.43	0.42	0.40	0.28	0.07	0.07	0.19	0.25	0.11	0.46	0.43	0.50	0.42	0.46	1.00	60
0.19	0.37	0.14	0.00	0.01	-0.04	0.00	-0.14	0.00	-0.14	0.04	-0.05	0.00	-0.25	0.15	0.17	0.05	0.06	0.03	0.00	0.02	-0.03	0.07	0.02	-0.05	0.04	-0.08	0.01	-0.06	0.39	0.42	1.00

fund (macro), as of May 31, 2015. Private equity, hedge funds, real estate, infrastructure and commodities are unlike other asset categories shown above in that there is no underlying medians-the dispersion of returns among managers in these asset classes and strategies is typically far wider than for traditional asset classes.

		Annua	lized V	olatility	y: Squa	are Roo	t of 12																
			۵	nnuali	zed Vo	latility		E		S		ds											
		Arithme	etic Ret	urn 20	16 (%)			latic		sond	st	Bon											
CompanyControl <th< th=""><th></th><th>Compound Ret</th><th>urn 20</th><th>16 (%)</th><th></th><th></th><th></th><th>o Inf</th><th>Ъ</th><th>ate E</th><th>Bonc</th><th>rate</th><th>sp</th><th>_</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>		Compound Ret	urn 20	16 (%)				o Inf	Ъ	ate E	Bonc	rate	sp	_									
Ten latinice		Compound Return 20	15 (%)					Eun	o Ca	rega	ate	orpo	Bone	dged									
Ter Cash 10: A segare is another of a segare is a segare		Euro Inflation	1.75	1.50	1.51	1.50	1.50	1.00	Eur	Ag£ ged	greg	de Co	orp	6 Hei									
		Euro Cash	1.50	1.25	1.25	0.50	0.50	-0.01	1.00	u.S. Hed	o Ag	Grac	de C	spuo	spu	dged							
Mageregate solutione of the solutione		U.S. Aggregate Bonds Hedged	3.50	2.75	2.83	4.00	4.00	-0.26	0.10	1.00	Eur	Inv ged	, Gra	eld B	d Bo	5 He							
Martial Mar		Euro Aggregate Bonds	2.25	2.00	2.06	3.50	3.50	-0.23	0.02	0.66	1.00	u.S. Hed	o Inv	h Yie	Yiel	oans	nds	p	lged		lged		
The functional constantiant of the functional constant of the functional		U.S. Inv Grade Corporate Bonds Hedged	4.25	3.25	3.42	6.00	5.75	-0.29	0.00	0.84	0.60	1.00	Euro	Hig	High	ed L	t Bo	inke	Hee		Hec		
Martial Mar		Euro Inv Grade Corp Bonds	2.50	2.75	2.82	3.75	3.75	-0.22	-0.13	0.54	0.73	0.79	1.00	u.s.	l adc	erag	men	on-L	spuo		spuc		lged
Mage High Viel fixed Fixed Part of a set of a		U.S. High Yield Bonds Hedged	5.50	5.75	6.17	9.50	8.50	-0.07	-0.16	0.18	0.05	0.55	0.57	1.00	Euro	Lev	vern	flati	nt B	spuo	nt Bo	spuo	: Hec
Magness series and	ME	Europe High Yield Bonds	4.25	5.00	5.43	9.50	9.00	-0.08	-0.27	0.06	0.11	0.47	0.65	0.88	1.00	u.s.	000	vt In	nme	nt B	nme	nt B	Debt
	NCO	U.S. Leveraged Loans Hedged	N/A	4.25	4.45	6.50	6.00	0.00	-0.27	-0.07	-0.13	0.31	0.42	0.82	0.89	1.00	Euro	0 60	over	nme	over	nme	eign
Market functional series of the series of	D	Euro Government Bonds	2.25	1.75	1.83	4.00	4.00	-0.20	0.05	0.61	0.97	0.47	0.57	-0.09	-0.05	-0.27	1.00	Eur	id G	over	5 2	over	vere
	FIXE	Euro Govt Inflation-Linked	2.75	1.50	1.64	5.25	5.00	-0.08	0.08	0.59	0.76	0.62	0.66	0.32	0.27	0.07	0.73	1.00	Wor	-id G	x-Eu	LO G	ts So
Work Work Work Work Work Work Work Work Work Work Work Work Work Work Work Work 		World Government Bonds Hedged	2.25	1.75	1.79	3.00	3.00	-0.22	0.15	0.81	0.82	0.54	0.40	-0.20	-0.27	-0.43	0.86	0.61	1.00	WOI	'ld e	x-Eu	arke
WinderWinde		World Government Bonds	2.25	1.25	1.56	8.00	7.75	-0.24	0.10	0.35	0.46	0.15	0.11	-0.37	-0.30	-0.30	0.48	0.15	0.58	1.00	Wor	-Id e	۳ ۳
World existional convergence with the set of the s		World ex-Euro Government Bonds Hedged	2.25	1.75	1.81	3.50	3.50	-0.19	0.19	0.82	0.59	0.49	0.21	-0.26	-0.38	-0.47	0.62	0.43	0.93	0.54	1.00	Wor	ergir
Image: space s		World ex-Euro Government Bonds	2.50	1.00	1.59	11.00	10.75	-0.23	0.09	0.26	0.32	0.07	0.02	-0.38	-0.31	-0.27	0.33	0.03	0.46	0.99	0.46	1.00	Eme
Image: space s		Emerging Markets Sovereign Debt Hedged	6.25	5.50	5.92	9.50	9.00	-0.06	0.01	0.57	0.39	0.74	0.65	0.70	0.56	0.41	0.28	0.56	0.25	-0.22	0.19	-0.28	1.00
Image: space s		Emerging Markets Local Currency Debt	6.50	5.50	5.95	9.75	9.25	-0.12	0.03	0.32	0.33	0.44	0.48	0.37	0.35	0.28	0.26	0.36	0.21	0.27	0.13	0.25	0.55
Find participant6.56.76.86.76.86.76		Emerging Markets Corporate Bonds Hedged	5.50	5.50	5.88	9.00	8.50	-0.13	-0.04	0.52	0.34	0.78	0.73	0.72	0.67	0.53	0.19	0.48	0.14	-0.22	0.08	-0.27	0.89
Find periment on the part of the part		Europe Large Cap	6.75	6.75	7.81	15.25	14.25	0.01	-0.32	-0.02	0.02	0.31	0.45	0.69	0.73	0.64	-0.08	0.23	-0.25	-0.34	-0.34	-0.35	0.51
SincependenceSincep		Europe Small Cap Equity	7.25	7.25	8.91	19.25	16.75	0.03	-0.29	-0.04	-0.02	0.29	0.41	0.70	0.71	0.61	-0.12	0.21	-0.28	-0.44	-0.35	-0.45	0.52
FigureFigur		U.S. Large Cap	6.25	5.50	6.44	14.25	13.00	0.03	-0.38	-0.11	0.00	0.12	0.31	0.47	0.51	0.55	-0.07	0.07	-0.22	0.01	-0.31	0.03	0.22
Find arge capfind a		U.S. Large Cap Hedged	6.00	6.00	7.10	15.50	14.00	0.12	-0.29	-0.02	-0.06	0.25	0.36	0.68	0.60	0.53	-0.14	0.17	-0.27	-0.55	-0.31	-0.57	0.51
FigureFigur		Euro Large Cap	7.00	7.00	8.24	16.50	15.25	0.03	-0.30	0.00	0.03	0.31	0.42	0.68	0.69	0.59	-0.06	0.26	-0.22	-0.39	-0.30	-0.40	0.53
PI PI PA PA 		Euro Small Cap	N/A	7.50	9.29	20.00	17.75	0.03	-0.30	-0.05	-0.02	0.29	0.41	0.70	0.72	0.62	-0.12	0.21	-0.29	-0.43	-0.36	-0.43	0.50
Image Cap Hedged6256256256266366	ES	UK Large Cap	6.50	6.25	7.22	14.50	13.50	-0.03	-0.34	-0.04	0.00	0.31	0.46	0.64	0.73	0.69	-0.11	0.14	-0.29	-0.21	-0.38	-0.20	0.44
Images       Sum       Sum <t< th=""><th>UITI</th><th>UK Large Cap Hedged</th><th>6.25</th><th>6.25</th><th>7.22</th><th>14.50</th><th>13.50</th><th>0.04</th><th>-0.20</th><th>0.06</th><th>0.02</th><th>0.35</th><th>0.40</th><th>0.65</th><th>0.59</th><th>0.51</th><th>-0.06</th><th>0.25</th><th>-0.18</th><th>-0.46</th><th>-0.23</th><th>-0.48</th><th>0.58</th></t<>	UITI	UK Large Cap Hedged	6.25	6.25	7.22	14.50	13.50	0.04	-0.20	0.06	0.02	0.35	0.40	0.65	0.59	0.51	-0.06	0.25	-0.18	-0.46	-0.23	-0.48	0.58
Japanese Equity Hedged4.756.758.106.278.106.278.106.206.10<	ЕQ	Japanese Equity	5.00	5.00	6.15	15.75	14.75	-0.07	-0.27	-0.03	0.08	0.20	0.29	0.29	0.37	0.38	0.02	0.14	-0.11	0.14	-0.20	0.15	0.17
Ferriging Markets Equipting8.508.508.509.20<		Japanese Equity Hedged	4.75	6.25	8.10	20.25	18.75	0.10	-0.29	-0.17	-0.08	0.12	0.24	0.45	0.47	0.46	-0.14	0.11	-0.33	-0.51	-0.41	-0.52	0.31
Asia ex-Japan Equity9.508.7510.4020.7518.2510.5010.700.07 <th></th> <th>Emerging Markets Equity</th> <th>8.50</th> <th>8.50</th> <th>10.20</th> <th>21.00</th> <th>18.75</th> <th>0.02</th> <th>-0.16</th> <th>0.03</th> <th>0.03</th> <th>0.32</th> <th>0.42</th> <th>0.63</th> <th>0.64</th> <th>0.57</th> <th>-0.07</th> <th>0.24</th> <th>-0.21</th> <th>-0.24</th> <th>-0.28</th> <th>-0.24</th> <th>0.55</th>		Emerging Markets Equity	8.50	8.50	10.20	21.00	18.75	0.02	-0.16	0.03	0.03	0.32	0.42	0.63	0.64	0.57	-0.07	0.24	-0.21	-0.24	-0.28	-0.24	0.55
A Conder Gaminy6.00		Asia ex-Japan Equity	9.50	8.75	10.40	20.75	18.25	-0.05	-0.17	0.07	0.09	0.37	0.46	0.61	0.62	0.54	0.00	0.26	-0.14	-0.15	-0.22	-0.16	0.51
A Condex-EMU Equity6.506.506.606.707.501.50		AC World Equity	6.50	6.00	6.87	13.75	12.50	0.01	-0.34	-0.05	0.02	0.26	0.42	0.63	0.67	0.64	-0.08	0.17	-0.25	-0.14	-0.34	-0.13	0.42
Proveloped World Equity6.256.756.758.758.758.758.758.758.759.75		AC World ex-EMU Equity	6.50	6.00	6.87	13.75	12.50	0.01	-0.35	-0.06	0.02	0.24	0.42	0.60	0.65	0.64	-0.07	0.15	-0.25	-0.09	-0.34	-0.07	0.39
Pivate Equity7.07.008.088.058.009.01 <th></th> <th>Developed World Equity</th> <th>6.25</th> <th>5.75</th> <th>6.59</th> <th>13.50</th> <th>12.25</th> <th>0.01</th> <th>-0.36</th> <th>-0.07</th> <th>0.02</th> <th>0.24</th> <th>0.41</th> <th>0.60</th> <th>0.65</th> <th>0.64</th> <th>-0.08</th> <th>0.15</th> <th>-0.25</th> <th>-0.12</th> <th>-0.34</th> <th>-0.11</th> <th>0.38</th>		Developed World Equity	6.25	5.75	6.59	13.50	12.25	0.01	-0.36	-0.07	0.02	0.24	0.41	0.60	0.65	0.64	-0.08	0.15	-0.25	-0.12	-0.34	-0.11	0.38
Image: Normal bar		Private Equity	7.50	7.00	8.88	20.50	18.50	0.01	-0.34	-0.18	-0.10	0.10	0.26	0.53	0.55	0.60	-0.18	0.03	-0.31	-0.09	-0.36	-0.06	0.18
FurphyFurph		U.S. Direct Real Estate	5.75	4.00	5.02	14.75	14.00	-0.02	-0.10	0.05	0.05	0.10	0.12	0.18	0.15	0.14	0.03	0.09	0.02	0.04	0.00	0.04	0.12
IS. REITSIS. REITSIS. IS. IS. IS. IS. IS. IS. IS. IS. IS.		European Direct Real Estate	5.50	4.00	4.52	10.50	10.00	-0.01	-0.09	0.07	0.12	0.15	0.20	0.20	0.21	0.15	0.10	0.17	0.03	-0.06	-0.02	-0.08	0.19
Bobalex-U.S.REITs6.506.707.007.		U.S. REITS	6.25	4.50	5.69	16.00	15.25	-0.07	-0.25	0.16	0.14	0.30	0.34	0.48	0.40	0.36	0.10	0.26	0.07	0.10	0.02	0.09	0.34
Global Infrastructure       6.00       6.00       6.00       1.00       1.00       0.00 <t< th=""><th>ES</th><th>Global ex-U.S. REITs</th><th>6.25</th><th>5.00</th><th>6.70</th><th>19.25</th><th>17.75</th><th>-0.07</th><th>-0.38</th><th>0.12</th><th>0.18</th><th>0.36</th><th>0.50</th><th>0.60</th><th>0.61</th><th>0.48</th><th>0.10</th><th>0.29</th><th>-0.02</th><th>-0.16</th><th>-0.12</th><th>-0.18</th><th>0.50</th></t<>	ES	Global ex-U.S. REITs	6.25	5.00	6.70	19.25	17.75	-0.07	-0.38	0.12	0.18	0.36	0.50	0.60	0.61	0.48	0.10	0.29	-0.02	-0.16	-0.12	-0.18	0.50
Pipersified Hedge Funds Hedged1.001.021.020.000.010.	TIV	Global Infrastructure	6.50	5.00	6.19	16.00	15.00	0.10	-0.08	-0.02	-0.03	0.05	0.09	0.19	0.17	0.16	-0.05	0.05	-0.09	-0.18	-0.10	-0.18	0.15
Ferret Driven Hedge Funds Hedged       5.0       5.00       5.00       5.00       7.00       0.00 <th>RNA</th> <th>Diversified Hedge Funds Hedged</th> <th>4.00</th> <th>3.25</th> <th>3.42</th> <th>6.00</th> <th>5.75</th> <th>0.06</th> <th>-0.23</th> <th>-0.12</th> <th>-0.12</th> <th>0.19</th> <th>0.29</th> <th>0.59</th> <th>0.64</th> <th>0.61</th> <th>-0.22</th> <th>0.10</th> <th>-0.37</th> <th>-0.47</th> <th>-0.41</th> <th>-0.46</th> <th>0.38</th>	RNA	Diversified Hedge Funds Hedged	4.00	3.25	3.42	6.00	5.75	0.06	-0.23	-0.12	-0.12	0.19	0.29	0.59	0.64	0.61	-0.22	0.10	-0.37	-0.47	-0.41	-0.46	0.38
Kong Bias Hedge Funds Hedged         4.75         4.75         5.70         1.02         9.75         0.02         0.10         0.11         0.12         0.10         0.11         0.10         0.11         <	LTE	Event Driven Hedge Funds Hedged	5.50	5.00	5.32	8.25	7.75	0.07	-0.26	-0.13	-0.12	0.24	0.40	0.75	0.78	0.73	-0.24	0.13	-0.43	-0.56	-0.48	-0.56	0.48
Relative Value Hedge Funds Hedged       4.50       4.50       4.50       6.50       6.00       0.01 </th <th>AI</th> <th>Long Bias Hedge Funds Hedged</th> <th>4.75</th> <th>4.50</th> <th>5.00</th> <th>10.25</th> <th>9.75</th> <th>0.08</th> <th>-0.22</th> <th>-0.10</th> <th>-0.14</th> <th>0.25</th> <th>0.36</th> <th>0.72</th> <th>0.70</th> <th>0.64</th> <th>-0.25</th> <th>0.15</th> <th>-0.41</th> <th>-0.63</th> <th>-0.45</th> <th>-0.63</th> <th>0.52</th>	AI	Long Bias Hedge Funds Hedged	4.75	4.50	5.00	10.25	9.75	0.08	-0.22	-0.10	-0.14	0.25	0.36	0.72	0.70	0.64	-0.25	0.15	-0.41	-0.63	-0.45	-0.63	0.52
Macro Hedge Funds Hedged       4.25       4.00       4.25       7.00       -0.02       0.10       0.01       0.10       0.10       0.10       0.10       0.10       0.10       0.00       0.20       0.00       0.01		Relative Value Hedge Funds Hedged	4.50	4.25	4.45	6.50	6.25	-0.01	-0.21	-0.01	-0.04	0.37	0.49	0.83	0.86	0.84	-0.19	0.20	-0.36	-0.46	-0.43	-0.46	0.56
Commodities       3.25       1.50       2.61       15.25       14.25       0.03       -0.07       -0.11       0.16       0.12       0.37       -0.12		Macro Hedge Funds Hedged	4.25	4.00	4.25	7.25	7.00	-0.02	0.15	0.10	0.09	0.21	0.14	0.16	0.16	0.05	0.06	0.22	0.05	-0.13	0.04	-0.16	0.21
Gold         3.75         2.00         4.06         21.00         18.50         -0.21         0.14         0.25         0.13         0.18         0.08         -0.11         -0.01         0.05         0.20         0.37         0.23         0.38         0.07		Commodities	3.25	1.50	2.61	15.25	14.25	0.03	-0.07	-0.01	-0.11	0.16	0.18	0.32	0.32	0.37	-0.18	0.10	-0.22	-0.10	-0.22	-0.08	0.23
		Gold	3.75	2.00	4.06	21.00	18.50	-0.21	0.14	0.25	0.13	0.18	0.08	-0.11	-0.09	-0.11	0.10	0.05	0.20	0.37	0.23	0.38	0.07

Source: J.P. Morgan Asset Management. Data as of September 30, 2015, except hedge funds (diversified, event driven, long bias, and relative value) as of June 30, 2015 and hedge investible index. Hedge fund returns are shown net of manager fees. The return estimates shown for these alternative asset classes and strategies are our estimates of industry

## J.P. MORGAN LONG-TERM CAPITAL MARKET ASSUMPTIONS - EURO

2016 Estimates - Correlation Matrix

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 the above asset classes and strategies. Please note that all information shown is based on qualitative analysis. Exclusive reliance on the above 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 judgement and are subject to change without notice. We believe the information provided on for, accounting, legal or tax advice.

Emerging Markets Local Currency Debt	ierging Markets Corporate Bonds Hedged	Large Cap	all Cap		ed																								
1.00	E	rope	e Sma	Cap	Hedg																								
0.48	1.00	E	Irope	arge	Cap	_																							
0.43	0.53	1.00	ш	.S. La	arge	e Cap	~																						
0.33	0.55	0.89	1.00		S. L	Large	II Cap		ged																				
0.49	0.28	0.75	0.80	0.70	⊃ 1.00	iuro	Sma	Cap	Hed		pa																		
0.20	0.55	0.85	0.00	0.70	0.85	1 00	Euro	arge	Cap	iity	ledg	uity																	
0.33	0.54	0.90	0.99	0.62	0.79	0.91	1.00	UK L	.arge	e Equ	uity F	s Equ																	
0.46	0.49	0.92	0.79	0.77	0.71	0.85	0.79	1.00	nk I	anes	e Eqi	arket	uity																
0.33	0.57	0.89	0.86	0.62	0.86	0.89	0.84	0.81	1.00	Japa	anes	ы М	ın Eq		uity														
0.49	0.23	0.55	0.45	0.59	0.31	0.51	0.46	0.59	0.38	1.00	Jap	ergir	-Japa	quity	u Eq	uity													
0.26	0.35	0.68	0.65	0.50	0.63	0.68	0.65	0.62	0.62	0.73	1.00	Ē	a ex	Id Ec	K-EM	d Eq													
0.63	0.54	0.78	0.75	0.62	0.64	0.76	0.77	0.75	0.70	0.53	0.59	1.00	Asi	Wor	'ld e	Worl		ate	tate										
0.62	0.53	0.75	0.71	0.63	0.59	0.73	0.72	0.72	0.64	0.52	0.54	0.96	1.00	AC	IOM (	bed	uity	l Est	al Es										
0.57	0.47	0.91	0.80	0.93	0.78	0.87	0.81	0.90	0.78	0.68	0.66	0.83	0.81	1.00	AC	evelo	e Equ	Rea	ct Re				-						
0.59	0.44	0.87	0.76	0.94	0.74	0.82	0.77	0.88	0.73	0.69	0.64	0.82	0.81	1.00	1.00	ä	rivato	irect	Direc				dgec	bed					
0.54	0.44	0.91	0.79	0.95	0.78	0.87	0.79	0.89	0.76	0.68	0.66	0.77	0.76	1.00	0.99	1.00	Ē	S. D	ean		'N	Гe	ls He	Hedg		_			
0.42	0.28	0.67	0.67	0.86	0.65	0.65	0.67	0.65	0.52	0.57	0.52	0.60	0.60	0.83	0.84	0.84	1.00	<b>D</b>	urop	REITS	REIT	uctu	Func	spu	dged	dgec			
0.21	0.09	0.25	0.19	0.29	0.22	0.25	0.19	0.21	0.19	0.17	0.15	0.10	0.10	0.27	0.27	0.27	0.27	0.07	1.00	I.S.F	oean	rastı	dge	ge Fu	s He	ls He			
0.10	0.19	0.29	0.20	0.72	0.24	0.50	0.27	0.23	0.20	0.10	0.19	0.22	0.22	0.20	0.24	0.20	0.10	0.07	0.19	1.00	Eurol	al Inf	ed He	Hedg	Fund	Func	p		
0.43	0.45	0.77	0.74	0.57	0.61	0.76	0.73	0.69	0.67	0.41	0.45	0.54	0.52	0.68	0.64	0.68	0.53	0.10	0.24	0.67	1.00	glob	rsifie	iven	dge I	agba	edge		
0.07	0.15	0.24	0.24	0.21	0.30	0.25	0.23	0.21	0.25	0.09	0.19	0.19	0.17	0.23	0.22	0.23	0.19	0.06	0.07	0.15	0.17	1.00	Dive	it Dr	is He	Je He	H spu		
0.25	0.43	0.72	0.79	0.48	0.64	0.70	0.80	0.69	0.66	0.42	0.64	0.72	0.65	0.68	0.66	0.65	0.54	0.09	0.19	0.23	0.48	0.19	1.00	Evei	g Bia	Valı	e Fur		
0.25	0.56	0.80	0.87	0.54	0.79	0.78	0.87	0.74	0.75	0.35	0.63	0.72	0.65	0.72	0.69	0.70	0.63	0.14	0.21	0.36	0.58	0.23	0.89	1.00	Lon	ative	ledg	s	
0.27	0.58	0.81	0.87	0.52	0.84	0.81	0.87	0.72	0.80	0.37	0.69	0.80	0.72	0.74	0.70	0.70	0.61	0.13	0.22	0.34	0.53	0.25	0.89	0.94	1.00	Rela	cro H	ditie	
0.35	0.63	0.75	0.78	0.48	0.66	0.72	0.79	0.73	0.67	0.39	0.60	0.73	0.67	0.69	0.66	0.66	0.56	0.12	0.20	0.32	0.55	0.19	0.84	0.91	0.85	1.00	Ma	omm	
0.13	0.18	0.27	0.31	0.02	0.22	0.28	0.32	0.23	0.32	0.14	0.20	0.36	0.31	0.21	0.18	0.17	0.03	-0.01	0.09	-0.02	0.14	0.06	0.60	0.37	0.44	0.33	1.00	Ŝ	pl
0.27	0.30	0.32	0.29	0.25	0.22	0.25	0.30	0.45	0.29	0.19	0.18	0.45	0.37	0.37	0.39	0.34	0.26	0.04	0.06	0.11	0.20	0.07	0.49	0.43	0.44	0.48	0.38	1.00	99
0.32	0.08	-0.13	-0.13	-0.06	-0.26	-0.17	-0.13	-0.01	-0.14	0.01	-0.26	0.10	0.09	-0.03	0.00	-0.05	-0.02	0.00	-0.04	0.01	-0.08	-0.09	0.06	-0.09	-0.06	-0.02	0.32	0.40	1.00

fund (macro), as of May 31, 2015. Private equity, hedge funds, real estate, infrastructure and commodities are unlike other asset categories shown above in that there is no underlying medians-the dispersion of returns among managers in these asset classes and strategies is typically far wider than for traditional asset classes.

# GLOSSARY AND ACKNOWLEDGMENTS

**CENTRAL LIMIT THEOREM** is a statistical law that states that as the number of independent risk sources increases, their combined impact will produce a result that increasingly resembles a normal distribution.

**DEBT** is some quantity owed as a result of past or present borrowing.

**DELEVERAGING**, in the macroeconomic context, is a reduction of a nation's total public and private sector debt, especially relative to nominal GDP.

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

**EQUILIBRIUM LEVEL** is 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.

**EX-POST RISK** accounts for the dispersion of returns actually observed over an historical window, in contrast to the returns that might reasonably have been anticipated beforehand (which is known as ex-ante risk).

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

**NON-NORMALITY** is a term we use to describe three characteristics of asset returns typically ignored by traditional mean-variance models. These effects include serial correlation, "fat" left tails and converging correlations. For a fuller treatment of the topic, please refer to "Non-Normality of Market Returns: A Framework for Asset Allocation Decision Making," by Abdullah Z. Sheikh, J.P. Morgan Asset Management, May 2009.

**NORMALIZATION** refers to the restoration of economic conditions, such as interest rates, to more cycle-neutral levels following a temporary dislocation period.

**OECD**, or **THE ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT**, is an international organization of democratic countries with market-based economies, founded in 1961, which "provides governments a setting in which to discuss, develop, and perfect economic and social policy." **PURCHASING POWER PARITY**, or **PPP**, exists when the same bundle of goods (usually that defined by the consumer price index) in two countries has an equal value at the prevailing exchange rate. Adjusting GDP for PPP means converting a country's GDP to another currency using the hypothetical exchange rate that would yield purchasing power parity.

**QUANTITATIVE EASING,** or **QE**, is a form of monetary policy by which a central bank purchases financial assets, thereby expanding its balance sheet, increasing the money supply and stimulating aggregate demand. Quantitative easing is distinct from the more usual policy of targeting interest rates through open market operations and is usually employed when interest rates are already exceptionally low.

**RETURN ON EQUITY**, or **ROE**, is a key measure of corporate profitability, relating the profit earned by a company to the amount of capital shareholders have invested in it. Return on equity is formally defined as net income over the year divided by shareholders' equity at the start of the year.

**RISK PREMIUM** is the return investors expect to earn by holding risky assets, in addition to the return on a virtually riskless asset.

**SERIAL CORRELATION**, also known as autocorrelation or lagged correlation, is the correlation between a time series variable with itself over some interval. If returns are serially correlated at lag 1, then returns in one period are positively related to returns in the prior period.

**SOVEREIGN DEBT** is issued by a national government to finance its operations and may be denominated in either local currency or foreign hard currency.

**STANDARD DEVIATION** is one measure of how dispersed data is around the average. Mathematically, it is calculated as the square root of variance, which is the mean of squared differences from the mean. See also "volatility."

**TAIL RISK** is the risk of the value of an asset or portfolio of assets moving more than three standard deviations from its current value. Managing downside, or left tail, risk has become a major focus for portfolio risk managers. Kurtosis is the statistical measure of tail thickness and is higher for most asset classes than implied by the normal distribution.

**VOLATILITY** is a term used interchangeably with standard deviation to describe the variation in changes of some financial level or rate over time.

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