NOTICE OF A SPECIAL MEETING OF THE BOARD OF INVESTMENTS

LOS ANGELES COUNTY EMPLOYEES RETIREMENT ASSOCIATION

LOEWS SANTA MONICA BEACH HOTEL

1700 OCEAN AVENUE, SANTA MONICA, CA 90401

MONDAY, JULY 1, 2019
9:00 A.M. – ARCADIA BALLROOM

The Board may take action on any item on the agenda, and agenda items may be taken out of order.

I. WELCOME – BUILDING A MORE RESILIENT PORTFOLIO
Jonathan Grabel, Chief Investment Officer

II. PUBLIC COMMENT

III. GEOPOLITICAL RISKS
Jude Pérez; Kristina Hooper – Invesco; Joachim Fels – PIMCO

Economies and investment markets are connected and LACERA's portfolio is intentionally global. Two guest speakers will discuss the global economy, geopolitical risks, and potential implications for investment portfolios. This panel discussion will be moderated by investment staff and questions from the audience will be welcomed.

IV. ACTUARIAL DISCUSSION AND LONG-TERM ECONOMIC FORECASTS
Ted Granger; Vache Mahseredjian; Nick Collier – Milliman; Benjamin R. Mandel – JPMorgan; Michael Buchenholz – J.P. Morgan

LACERA's Board of Investments is responsible for setting the economic and demographic assumptions used in the Actuarial Valuation. LACERA's actuary, Milliman, will highlight key concepts—including investment return assumption and amortization policy—in preparation for the 2019 triennial Experience Study and annual Valuation. Next, JPMorgan will describe their approach to developing long-term capital market expectations. To conclude, all presenters will engage in a lively Q&A session.

V. INTERNAL ASSET MANAGEMENT
Ted Wright; Michael Viteri – Oregon State Treasury; Rich Eggett – Utah State Retirement Systems

Implementing an internal asset management program, even one focused on passive index strategies, is an exercise that requires thorough analysis and thoughtful consideration. Guest speakers from two public pension plans with direct involvement in implementing internal strategies will discuss their experience and answer questions from the Board.

VI. STANDING COMMITTEE REVIEW
Cindy Rivera; Leandro Festino – Meketa

In presenting committee survey results, Meketa will facilitate a discussion on the effectiveness, structure, primary goal, and meeting times of the standing committees.

VII. CYBERSECURITY IN INVESTMENT MANAGEMENT
James Rice; Phil Venables – Goldman Sachs

Cybersecurity has emerged as a key business and national security risk. The investment industry, while benefiting from efficiencies gained in moving transactional and other data, faces its own unique cyber risks in its dependence on digital transactions. An experienced practitioner who led the cybersecurity and operational efforts of one of the world's largest investment organizations will lead an interactive discussion on this topic focusing on the risks faced by investors.

VIII. CLOSING

IX. GOOD OF THE ORDER
(For Information Purposes Only)

X. ADJOURNMENT

Documents subject to public disclosure that relate to an agenda item for an open session of the Board of Investments that are distributed to members of the Board of Investments less than 72 hours prior to the meeting will be available for public inspection at the time they are distributed to a majority of the Board of Investments Members at LACERA's offices at 300 N. Lake Avenue, Suite 820, Pasadena, CA 91101, during normal business hours of 9:00 a.m. to 5:00 p.m. Monday through Friday.

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Geopolitical Risk

Board of Investments

July 1, 2019

Jude Pérez – Principal Investment Officer

Kristina Hooper – Chief Global Market Strategist at Invesco

Joachim Fels – Managing Director, Global Economic Advisor at PIMCO

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Introduction

Geopolitics is defined as the study of how geography and economics influence politics and the relations between countries.

- Understanding geopolitical risk is critical in a world that has become increasingly connected due to rapid advances in communications and the rise of globalization.

- Geopolitical risks have the potential to move markets aggressively in the short-term, especially in an environment of slowing growth and elevated uncertainty.

Introduction

Current Themes

1. US-China
2. European populism
3. Gulf tensions
4. Global trade tensions
5. LatAm policy
6. Major cyberattack
7. North Korea conflict
8. Russia-NATO conflict
9. Major terror attack

Forward-looking estimates may not come to pass. Source: BlackRock Investment Institute. March 2019.

Speaker Bios

Kristina Hooper, CFP®, CAIA, CIMA®, ChFC®

Kristina Hooper is the Chief Global Market Strategist at Invesco. She entered the financial industry in 1995. Prior to joining Invesco, Ms. Hooper was the US investment strategist at Allianz Global Investors. Prior to Allianz, she held positions at PIMCO Funds, UBS (formerly PaineWebber) and MetLife. She has regularly been quoted in The Wall Street Journal, Financial Times, The New York Times, Reuters and other financial news publications. She was featured on the cover of the January 2015 issue of Kiplinger's magazine, and has appeared regularly on CNBC, Bloomberg TV, Yahoo Finance and Reuters TV. She has also been a mainstage speaker at numerous national and regional conferences.

Ms. Hooper earned a BA degree, cum laude, from Wellesley College; a JD from Pace University School of Law, where she was a Trustees' Merit Scholar; an MBA in finance from New York University Stern School of Business, where she was a teaching fellow in macroeconomics and organizational behavior; and a master's degree from the Cornell University School of Industrial and Labor Relations, where she focused on labor economics.

Ms. Hooper holds the Certified Financial Planner (CFP), Chartered Alternative Investment Analyst (CAIA), Certified Investment Management Analyst (CIMA) and Chartered Financial Consultant (ChFC) designations. She serves on the board of trustees of Hour Children, and previously served on the board of Jefferson Insurance Company and on the board of the Foundation for Financial Planning, which is the pro bono arm of the financial planning industry.

Speaker Bios

Joachim Fels

Global Economic Advisor

Mr. Fels is a managing director and global economic advisor based in the Newport Beach office. He is a member of the Investment Committee and leads PIMCO's quarterly Cyclical as well as the Secular Forum process. He also serves as a member of PIMCO's Executive Committee.

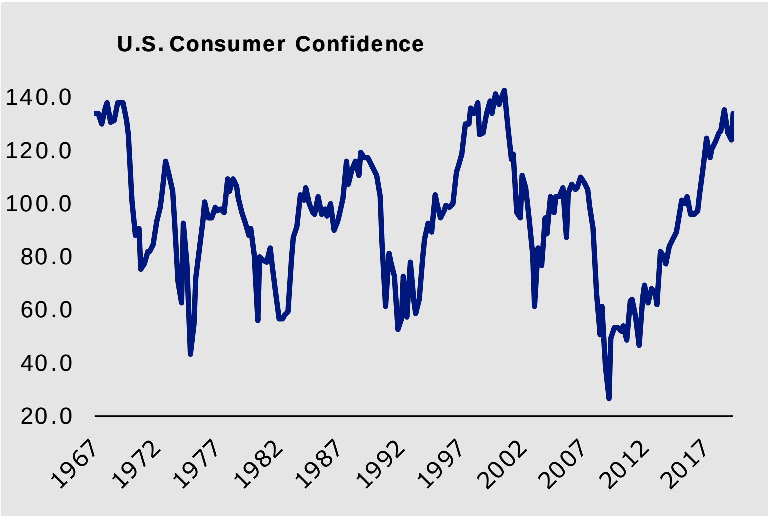
Prior to joining PIMCO in 2015, he was global chief economist at Morgan Stanley in London. Previously he was an international economist at Goldman Sachs and a research associate at the Kiel Institute for the World Economy.

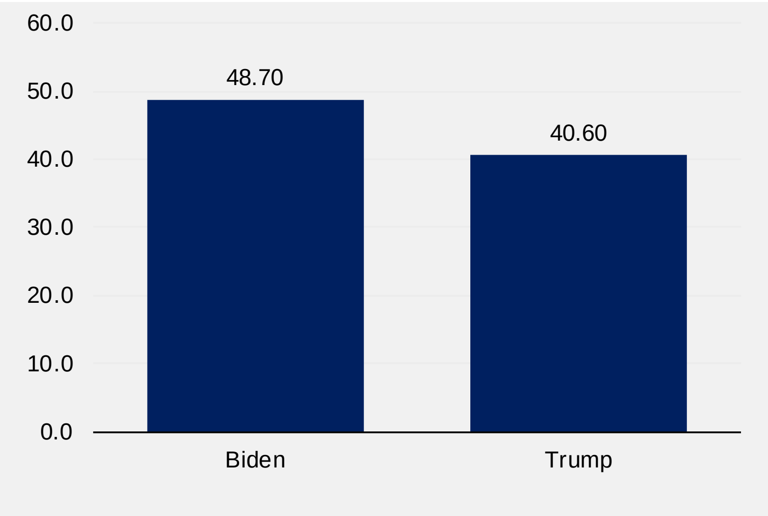
He has 31 years of macro research experience and holds a diploma in international studies from the Johns Hopkins University School of Advanced International Studies in Bologna, Italy; a master's degree in economics from Universität des Saarlandes in Saarbrücken, Germany; and an undergraduate degree from Christian-Albrechts-Universität in Kiel, Germany.

Discussion Topic #1 – Trade Wars

Invesco

The trade war is likely to persist





- The large majority of investors came into 2019 expecting a trade agreement between the U.S. and China. The markets were disappointed and are responding in kind.

- Don't be surprised if the trade standoff goes on for longer than expected.
  - The Trump administration likely feels they are operating from a position of strength given that consumer confidence is high and Fed tightening is off the table.
  - China, for its part, is likely playing a long game, hoping to resist making any major concessions in the hopes that the Trump Administration will capitulate and take minor concessions in advance of the 2020 election, or that a new president will be elected.

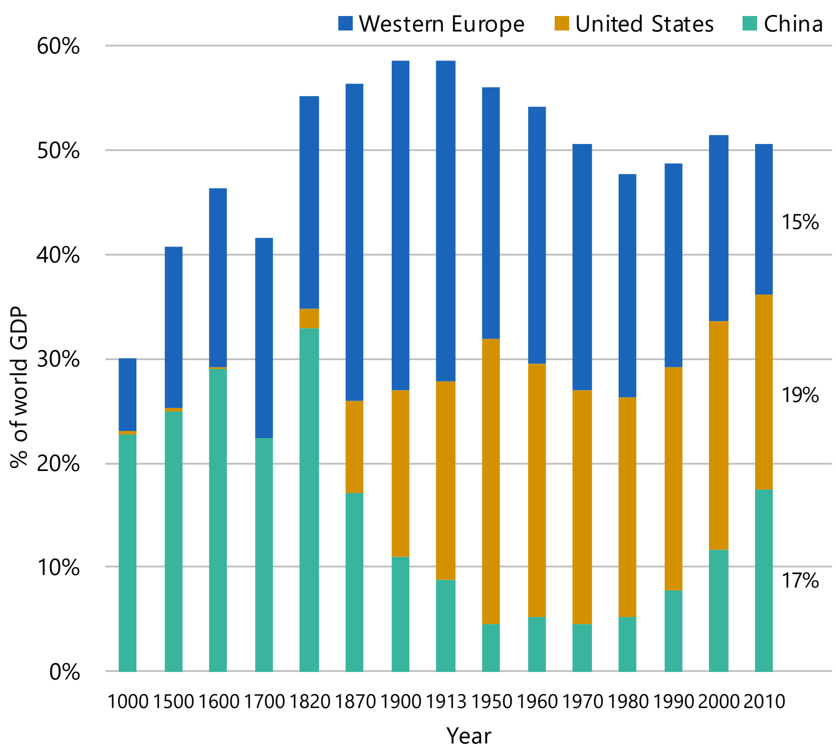
Source: Conference Board, Real Clear Politics, as of June 5, 2019

Discussion Topic #1 – Trade Wars

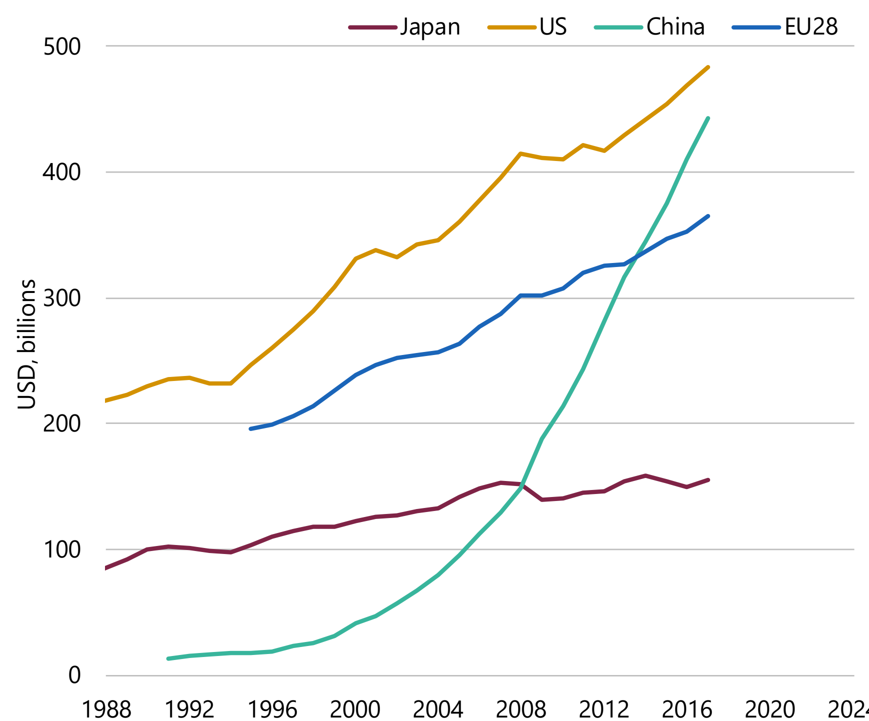
PIMCO

Disruptor: China and Trade

Share of world GDP growth



Research and development spending



Source: OECD, Maddison Project Database, PIMCO calculations, As of May 2019

Discussion Topic #2 – Monetary Policy

Monetary policy in flux

US	Bank of Canada, Bank of England	Bank of Japan (BoJ), European Central Bank (ECB)
– On pause – Balance sheet normalization ending	– On pause	– Low key rates – ECB stimulating again after end of QE – BoJ is still expanding its balance sheet

Key Takeaways

Monetary policy has the potential to create some disruption for several reasons:

- Uncertainty about new ECB leadership in the fall of 2019.
- The Fed has prematurely ended balance sheet normalization and the rate hike cycle, raising questions about how they might respond to the next crisis.
- Central banks are becoming increasingly politicized.

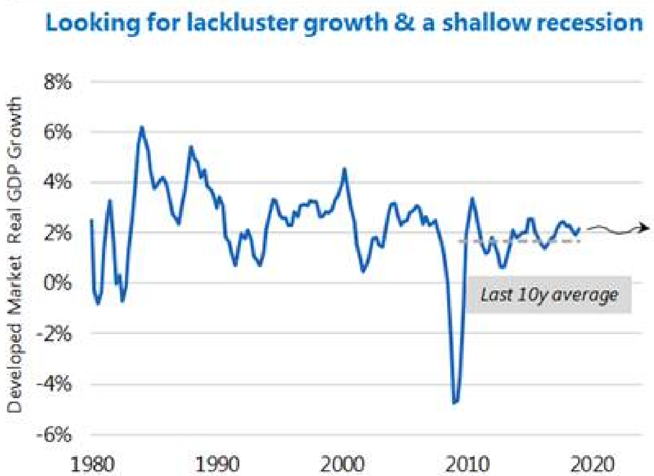
Source: Invesco, as of March 31, 2019

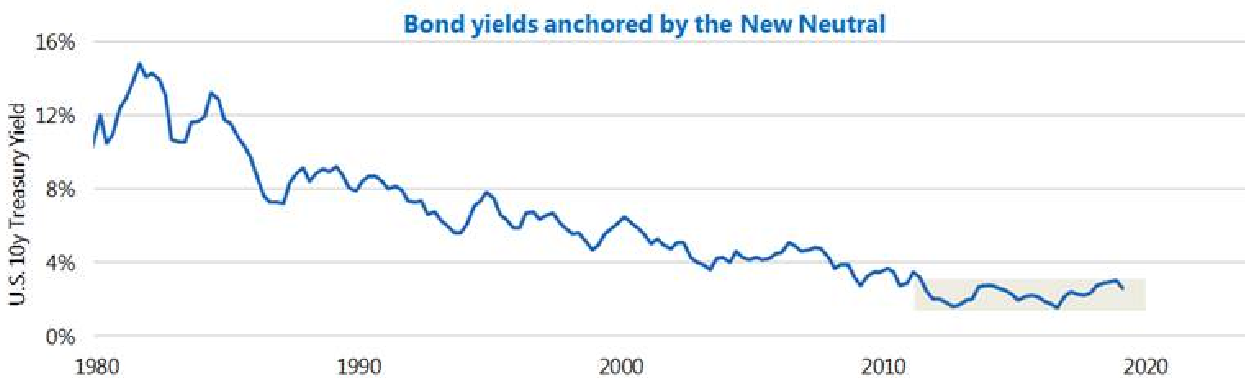
Discussion Topic #2 – Monetary Policy

PIMCO

New Normal / New Neutral continues to rule

Monetary Policy: Expect lowflation and more aggressive central bank action in a downturn





As of 31 March 2019

Source: Haver, Bloomberg, PIMCO. Developed market = Australia, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, UK, US.

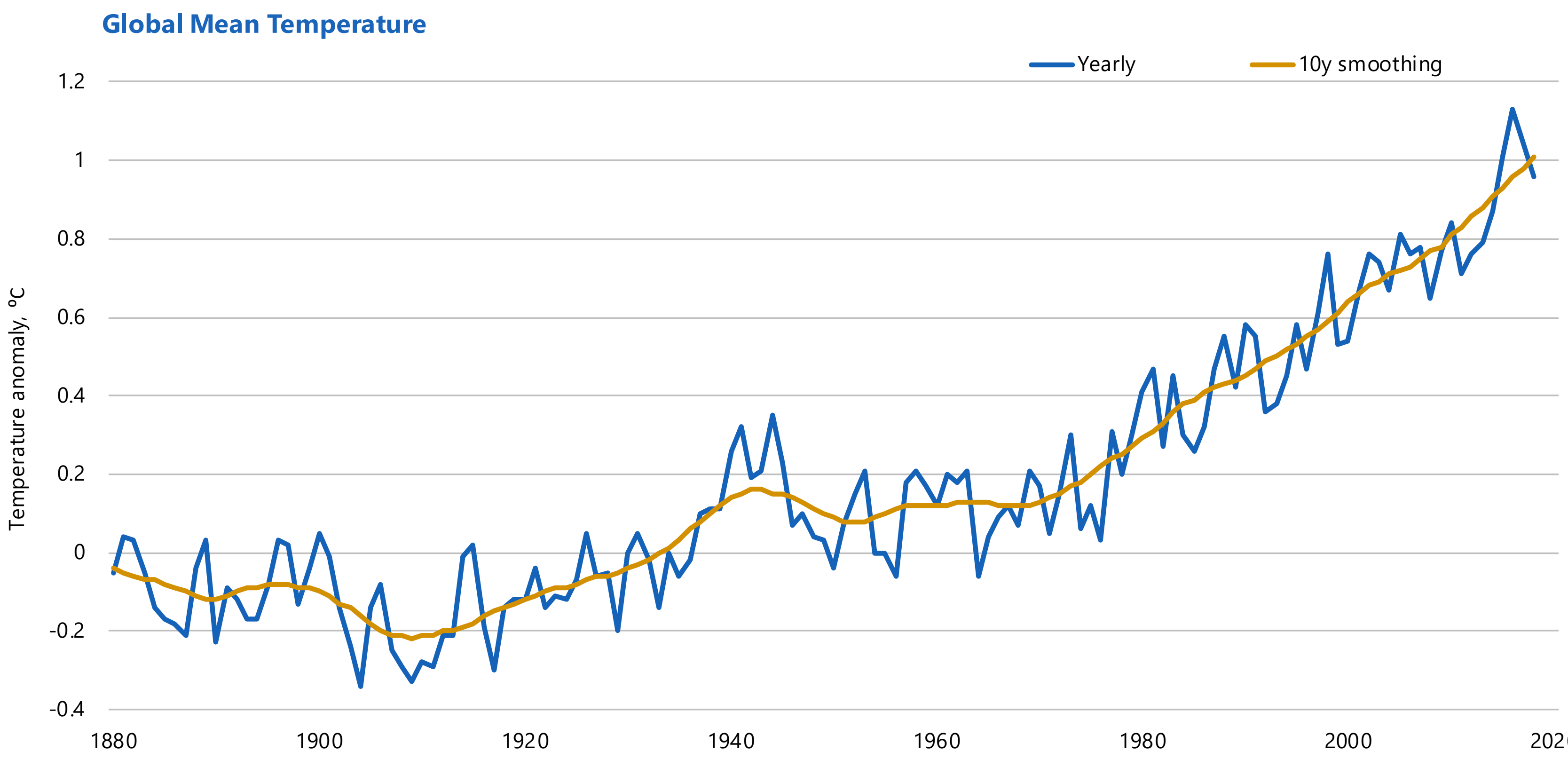
Discussion Topic #3 – Climate Change

- Climate change is expected to have a significant impact on GDP growth within several decades
- Red states will face greater climate costs than blue states (source: Brookings Institution)
- Many industries will be impacted, especially insurance

Discussion Topic #3 – Climate Change

PIMCO

Super-secular disruptor: Climate Change



Source: NASA, IPCC. Land-ocean temperature index, 1880 to present, where 1951-1980 is the base period. As of May 2019

Discussion Topic #4 – Technology

Innovation-driven disruption

Technology	Impact
Artificial intelligence — driverless cars	Industry disruption
Blockchain	Higher growth and productivity
Cloud computing	Structural unemployment

Key Takeaway

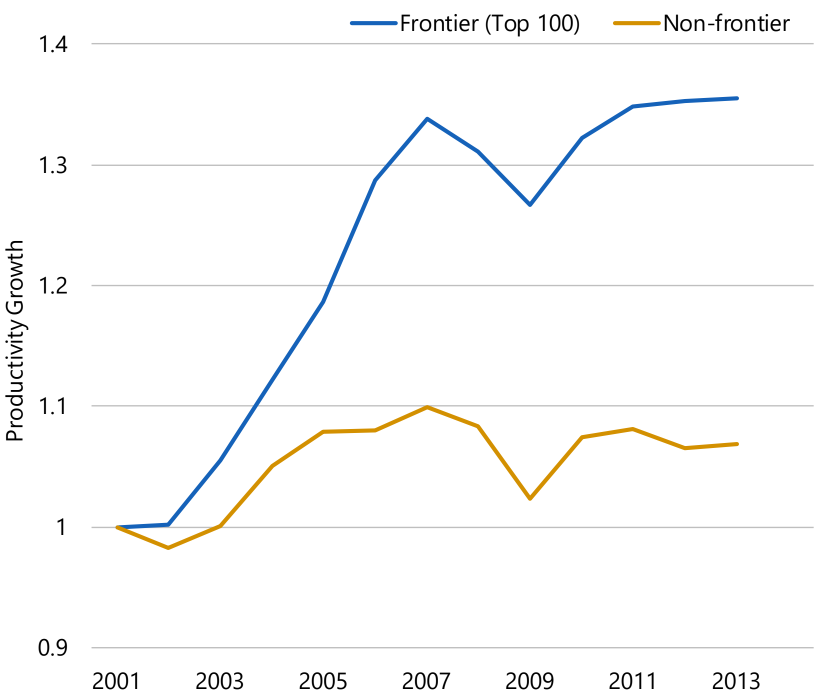
We are in the midst of a fourth industrial revolution. Sectors and firms that are being disrupted by novel technologies or by new entrants are likely to see lower market shares, rising credit risk and spreads as well as surging equity risk premia; conversely, firms that are disrupting or are using innovation to their advantage are likely to see higher market shares, lower credit risk and spreads and lower equity risk premia.

Source: Invesco, as of March 31, 2019

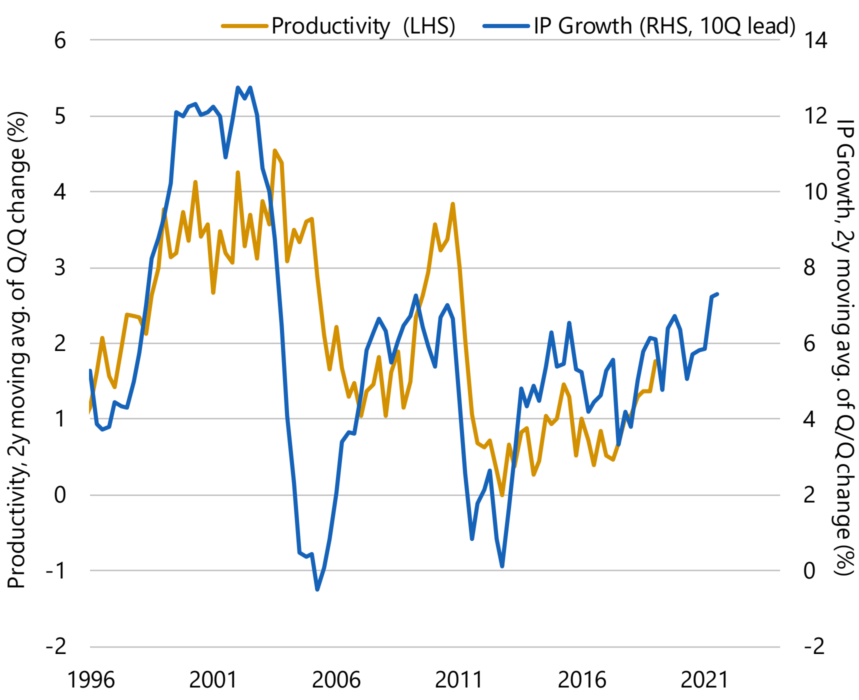
Discussion Topic #4 – Technology

PIMCO

Productivity growth – corporate sector leaders vs. laggards



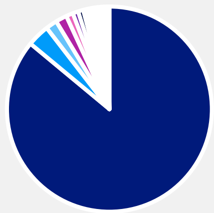
U.S. intellectual property investment on the rise

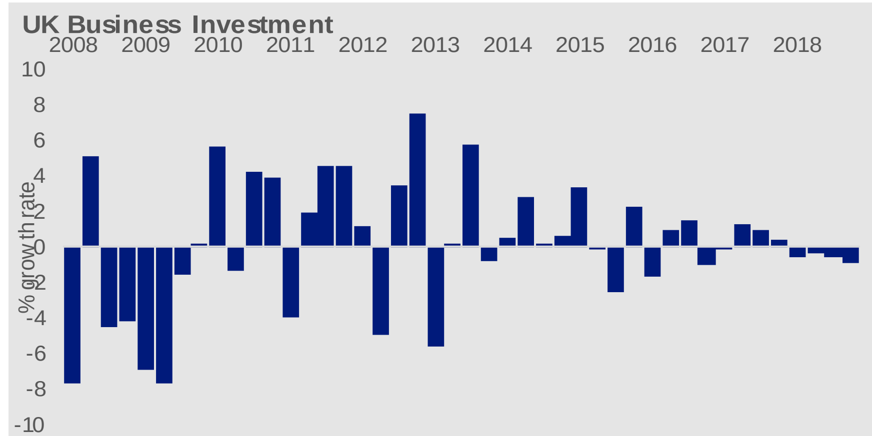


Source: OECD, BEA, Haver, PIMCO Calculations. Left chart: OECD preliminary results based on Andrews, D., C. Criscuolo and P. Gal, 2016. Notes 2001 = 1 (log points); represents average across 24 OECD countries and 22 manufacturing and 27 market services industries. Chart excludes financial sector. Global frontier is defined as the 100 most productive firms within each industry, by each year. Right chart: Intellectual property products include manufacturing and non-manufacturing research and development and investment in software and art/ entertainment. As of May 2019

Economic policy uncertainty may accelerate quickly

Donald J. Trump
@realDonaldTrump
"On June 10th, the United States will impose a 5% Tariff on all goods coming into our Country from Mexico, until such time as illegal migrants coming through Mexico, and into our Country, STOP. The tariff will gradually increase until the Illegal Immigration problem is remedied,…"
1:30 AM – May 31, 2019





- The "trade war" may be entering in a new and more dangerous frontier with President Trump imposing a 5% tariff on all Mexican exports to the U.S. unless the "immigration problem is remedied". The tariffs could eventually increase to 25%. This is the first time the Administration has used tariffs for purposes beyond trade arrangements.
- This injects far more economic policy uncertainty into the environment.
- An example of a serious form of economic policy uncertainty can be found in the UK, where there is still a number of possible Brexit outcomes. This uncertainty is having a negative impact on business investment, which tends to be negatively impacted by such uncertainty.

Source: Conference Board, Real Clear Politics

Additional Themes for Consideration

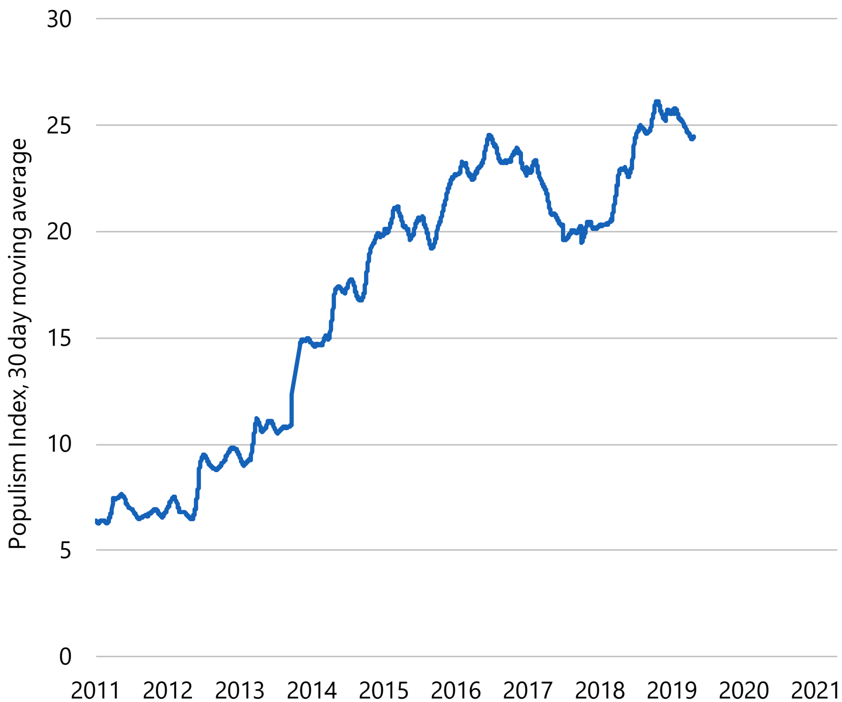
Risk of Politicization of Central Banks

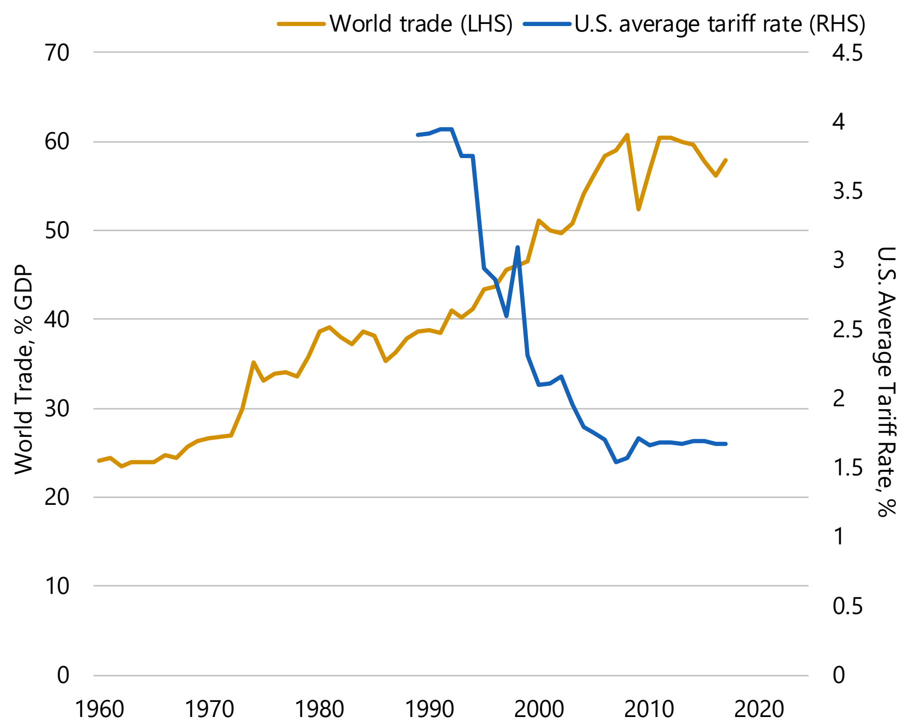
- Central banks succeeded in rescuing developed economies from the Global Financial Crisis because they were independent
- Now that independence is being threatened by the forces of economic nationalism and populism
- This in turn creates a risk of not having enough 'dry powder' to adequately combat the next crisis

Additional Themes for Consideration

PIMCO

Disruptor: Populism





Left chart: The Eurozone Populism Index aggregates support for anti-establishment parties across the Eurozone, weighted by respective national GDP weights.
Source: Various pollsters, PIMCO calculations, World Bank. As of May 2019

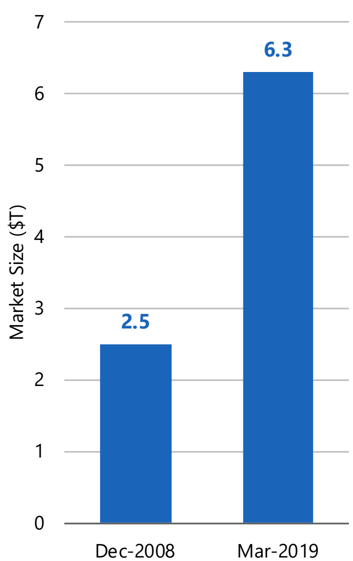
Additional Themes for Consideration

PIMCO

Corporate Credit: Rife with more highly levered companies

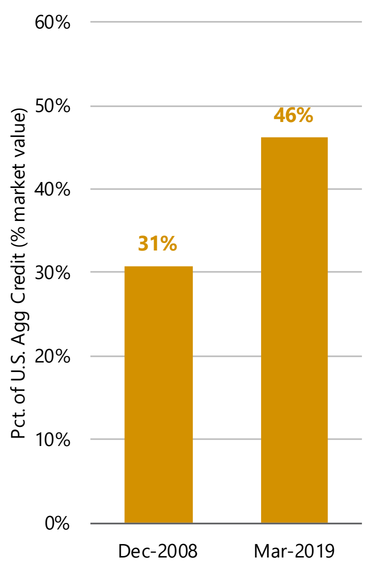
GROWING MARKET

The investment grade credit market has more than doubled since 2008



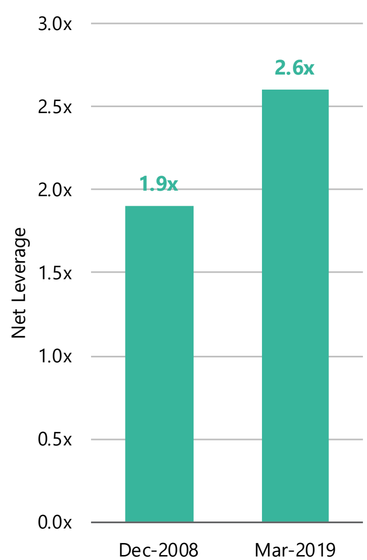
INCREASED CREDIT RISK

The share of BBBs in the U.S. Credit market has increased 15% since 2008. BBBs now make up <u>twice</u> the size of the high yield market vs. 1x in 2008



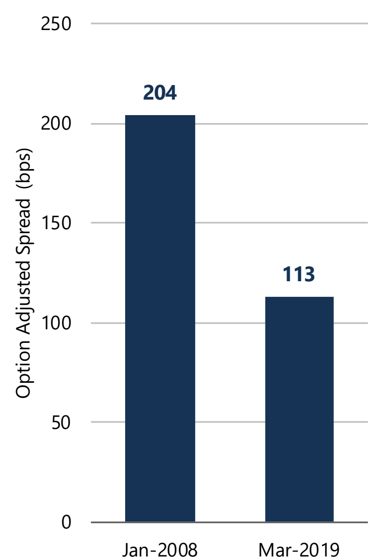
HIGHER LEVERAGE

Companies are taking on more debt and leverage has increased 0.7x



REDUCED COMPENSATION FOR RISK

Companies can borrow at lower rates as credit spreads have come down ~90 basis points since 2008



Source: PIMCO, Bloomberg, Barclays. As of March 31, 2019
Market size and OAS based on Bloomberg Barclays U.S. Credit Index. Leverage based on IG CDX 31

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LACERA Board of Investments Offsite
July 1, 2019

Actuarial Discussion and
Long-Term Economic Forecasts

Vache Mahseredjian, LACERA Investments

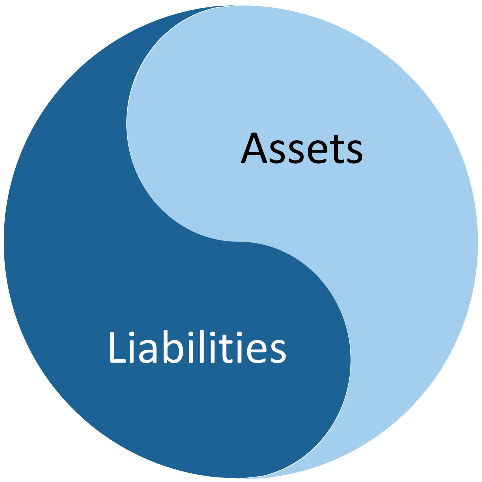
Ted Granger, LACERA FASD

Presenters:

- Nick Collier, Milliman
- Ben Mandel, J.P.Morgan
- Michael Buchenholz, J.P.Morgan

Offsite Theme: BUILDING A MORE RESILIENT PORTFOLIO

LACERA PORTFOLIO



Resilience: The ability to withstand or recover from difficult conditions

Preliminary Investment Return Assumption Analysis & Amortization Period Follow-up

Nick Collier

JULY 1, 2019

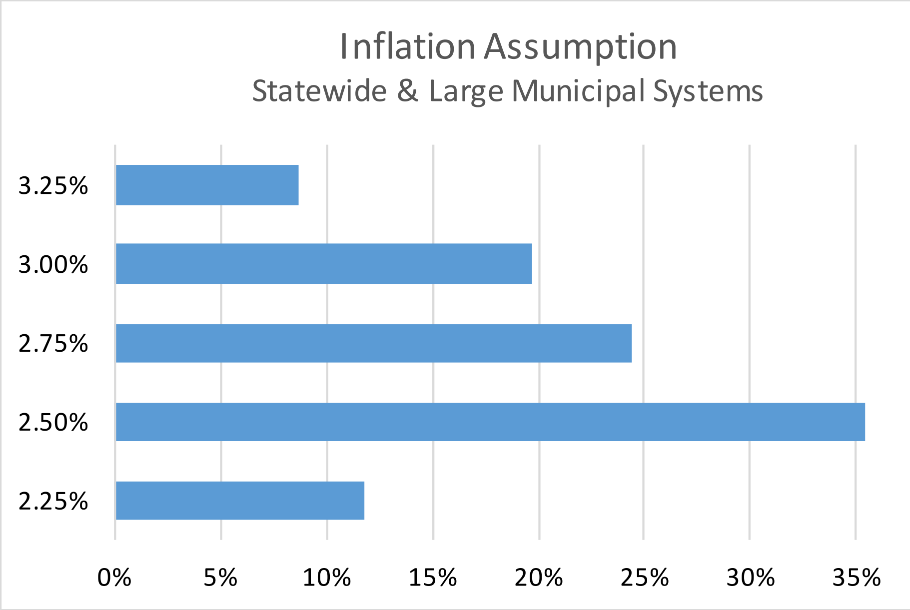
Milliman

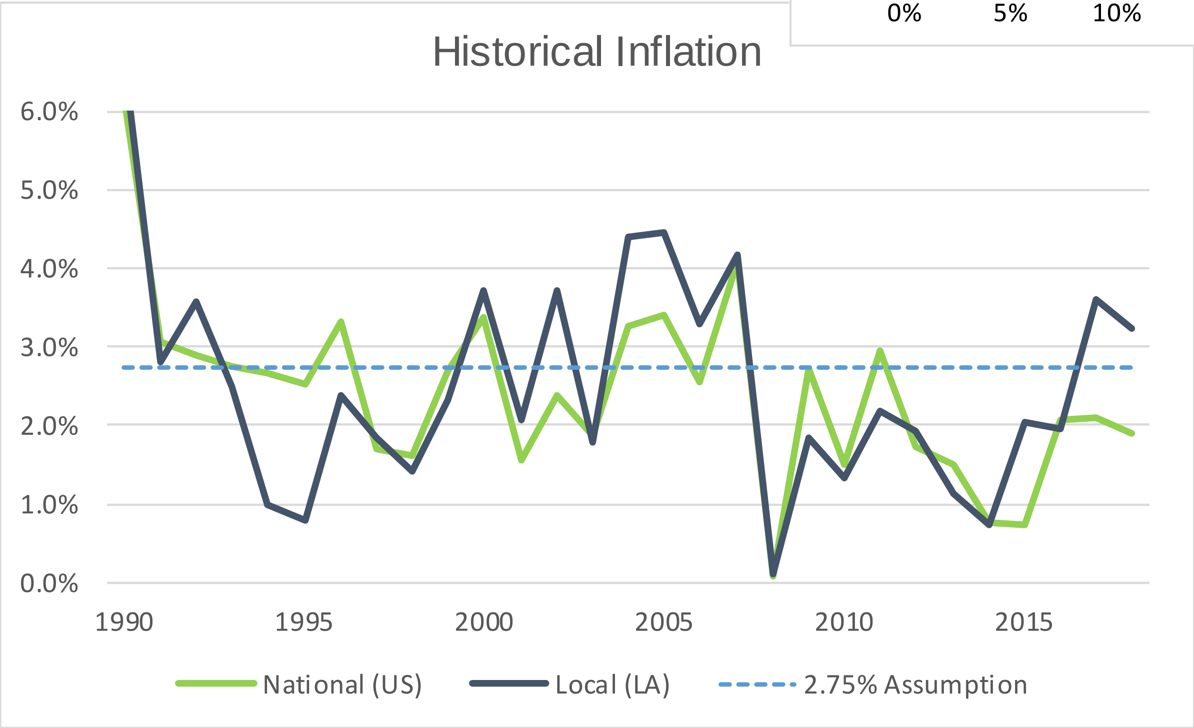
Overview of Presentation

- Discussion only with decisions to be made in the Fall
- Investment return assumption
  - Preliminary analysis of expected return
  - What happens if we don’t make our assumed return
- Amortization period
  - Preliminary discussion at January BOI meeting
  - Follow-up information requested by the BOI

Inflation

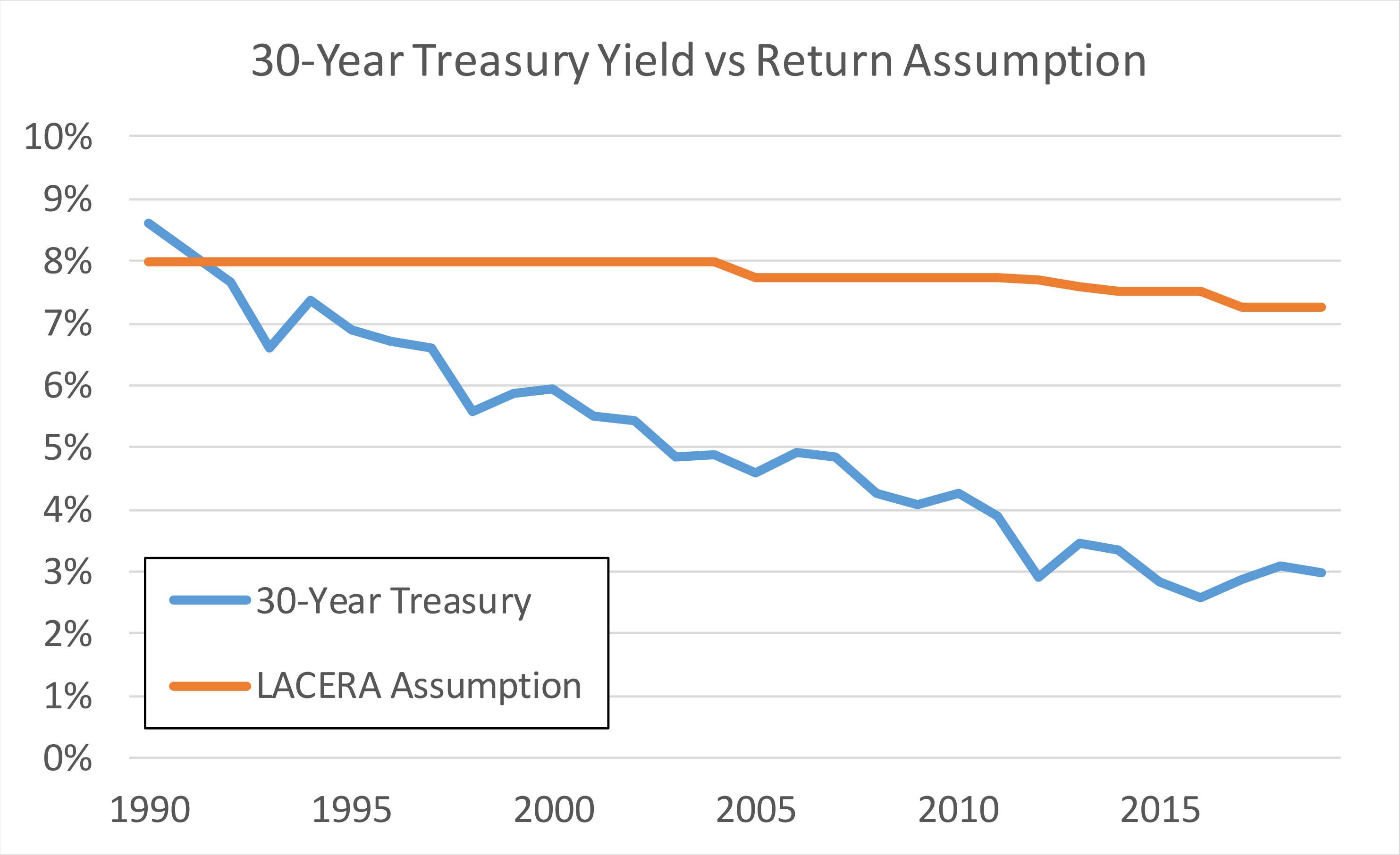
- Current inflation assumption is 2.75%
  - CalPERS and CalSTRS also at 2.75%
  - 2.75% is median assumption for large systems
- Long-range Social Security projection is 2.6%





Change in Investment Environment

- Significant increase in investment risk needed to achieve return assumption



Current Environment for Expected Returns

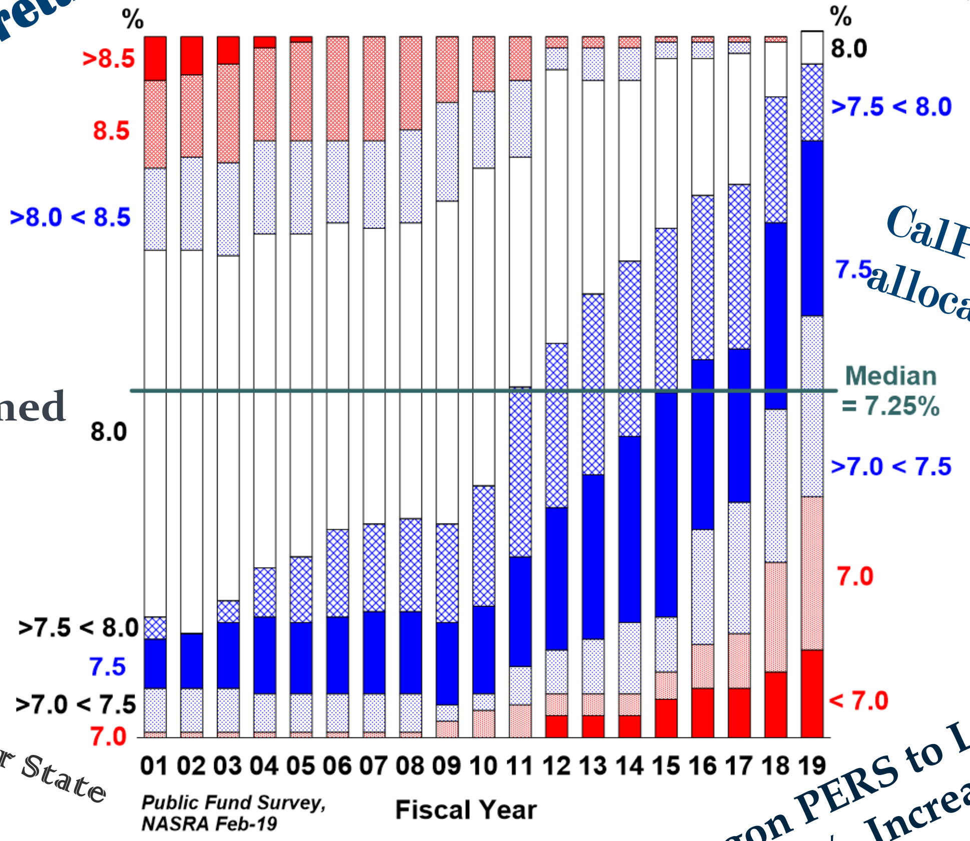
Ohio PERS lowers return expectation to 7.2 pct

CalSTRS to cut assumed rate of return to 7%

NC pension fund will be a bit less optimistic about its investments

IPERS cuts key target; unfunded pension liabilities up $1.3 billion

Florida Retirement System lowers assumed rate of return by 10 basis points (7.5%)



CalPERS sees 6.2 pct 10-year return with new allocation; below 7 pct goal

New York Lowers Return Assumption for State Retirement System from 7.5% to 7.0%

Oregon PERS to Lower Fund's Assumed Rate 0.3%, Increasing Unfunded Liability

Employees Retirement System of Texas lowers expectations

Teacher Retirement System of Texas Votes 5-4 to Lower Rate of Return Assumption (8.0% to 7.25%)

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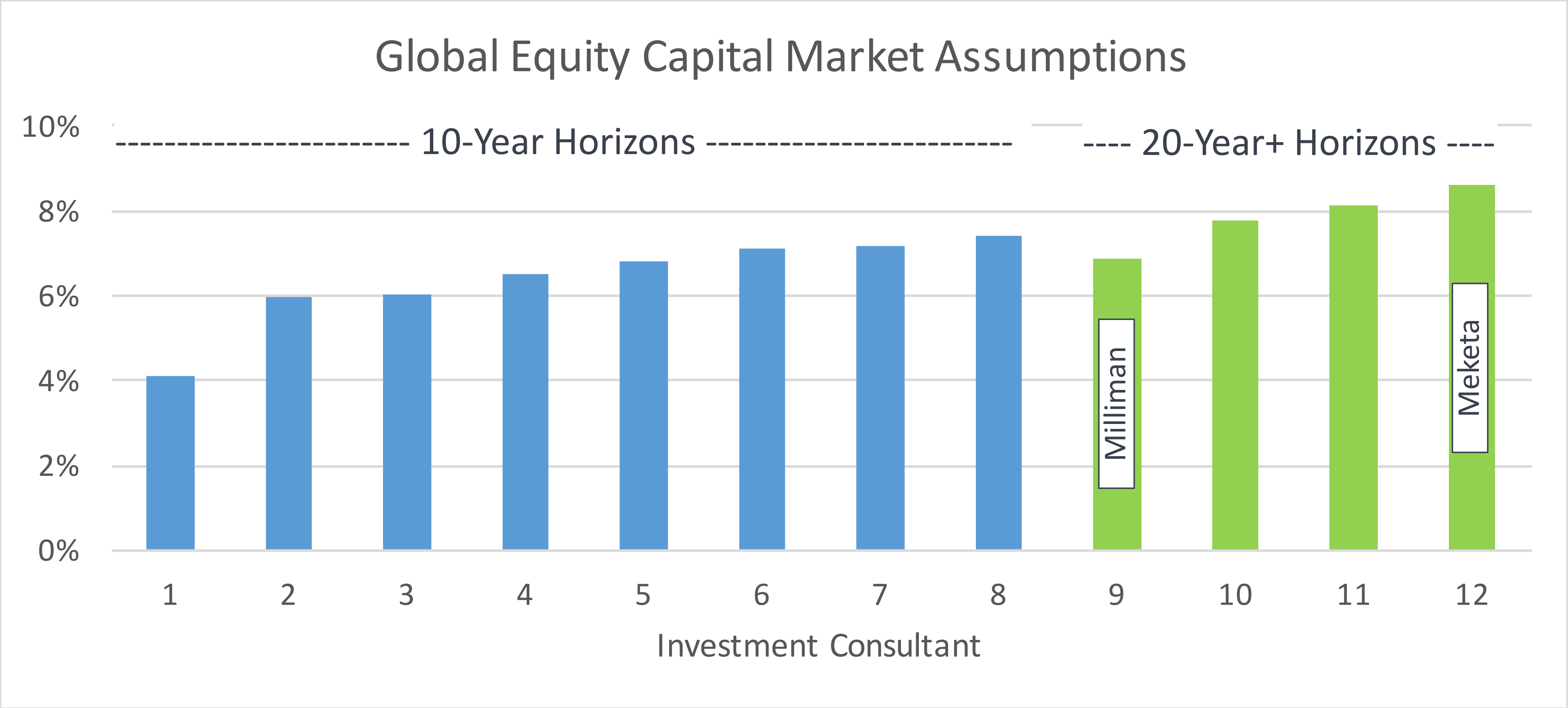
Perspectives on Expected Return

- Role of professionals
  - Investment consultant: Assist system with setting asset allocation
  - Actuary: Assist system with setting contribution rates to fund benefits
- Overlap is use of capital market assumptions
  - Investment consultant: Uses capital market assumptions to analyze different allocations
    - Expected returns by class are less important than relative expected return in comparison with other classes
  - Actuary: Uses capital market assumptions to calculate expected return to help set investment return assumption used in calculating contribution rates
- Different purposes result in different focus of capital market assumptions
  - Investment consultants tend to have shorter term focus (10 years or less)
  - Actuaries tend to have longer term focus (20 to 30 years)

Expected Return – Variance in Capital Market Assumptions

- Greatest variance appears to be in expectation of future equity returns (example, Global Equity)

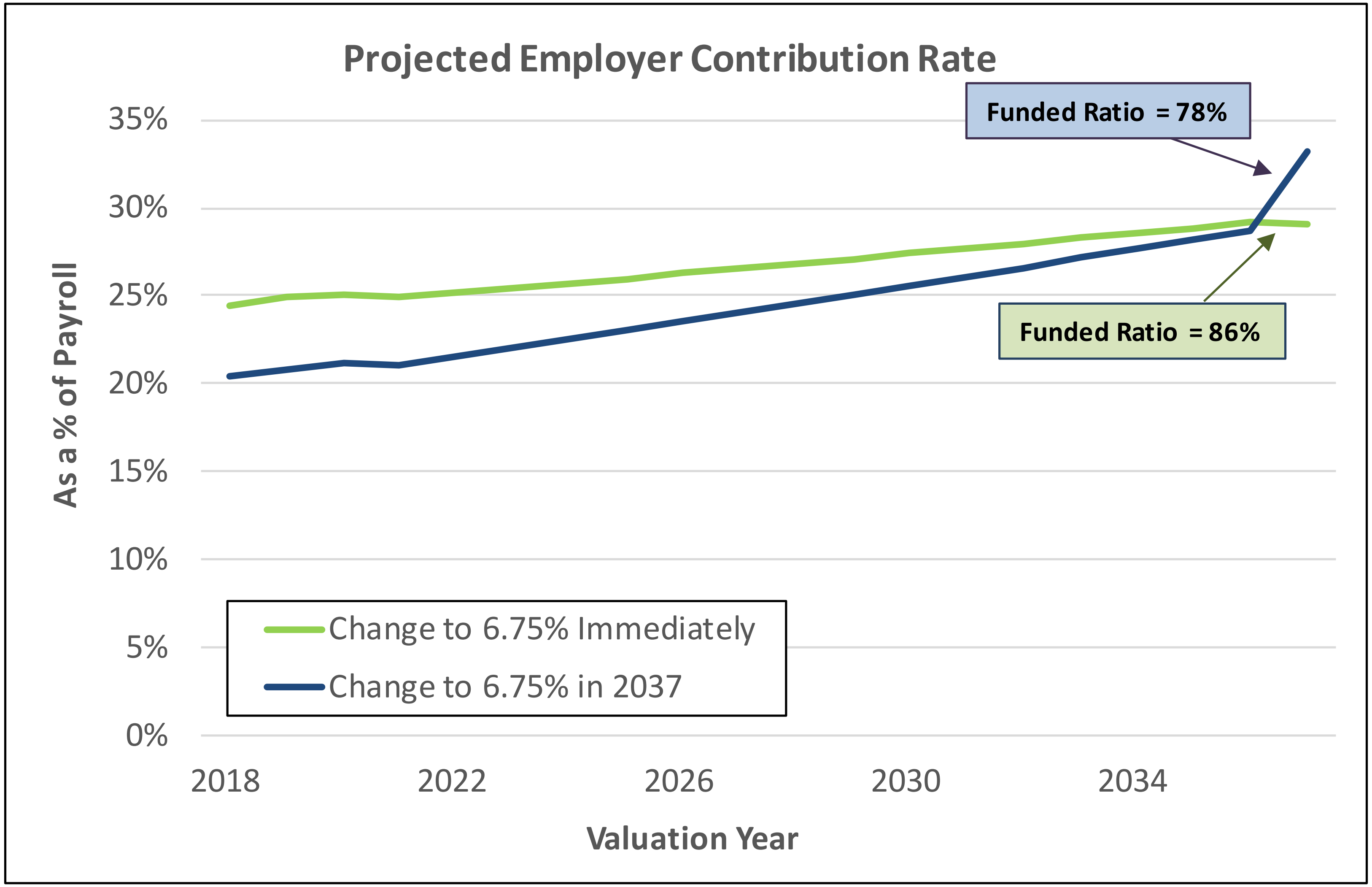


Financial Impact of Lowering Return Assumption

- Short-term impact (if assumption is lowered)
  - Higher member and employer contribution rates
  - Lower <u>reported</u> funded ratio
- Long-term impact (if assumption is lowered)
  - Employer rates and total dollar contributions will ultimately be lower
    - Not for a long time in the future
  - Member rates will remain higher
  - Better funded, although <u>reported</u> funded ratio may not be higher
  - Easier to recover from bad experience
- If inflation is lowered by the same amount as the investment return assumption, this would offset about half of the impact
- Examples show projected impact of lowering return assumption ½% compared to staying at current 7.25% assumption
  - First scenario is bad returns and second scenario is good returns

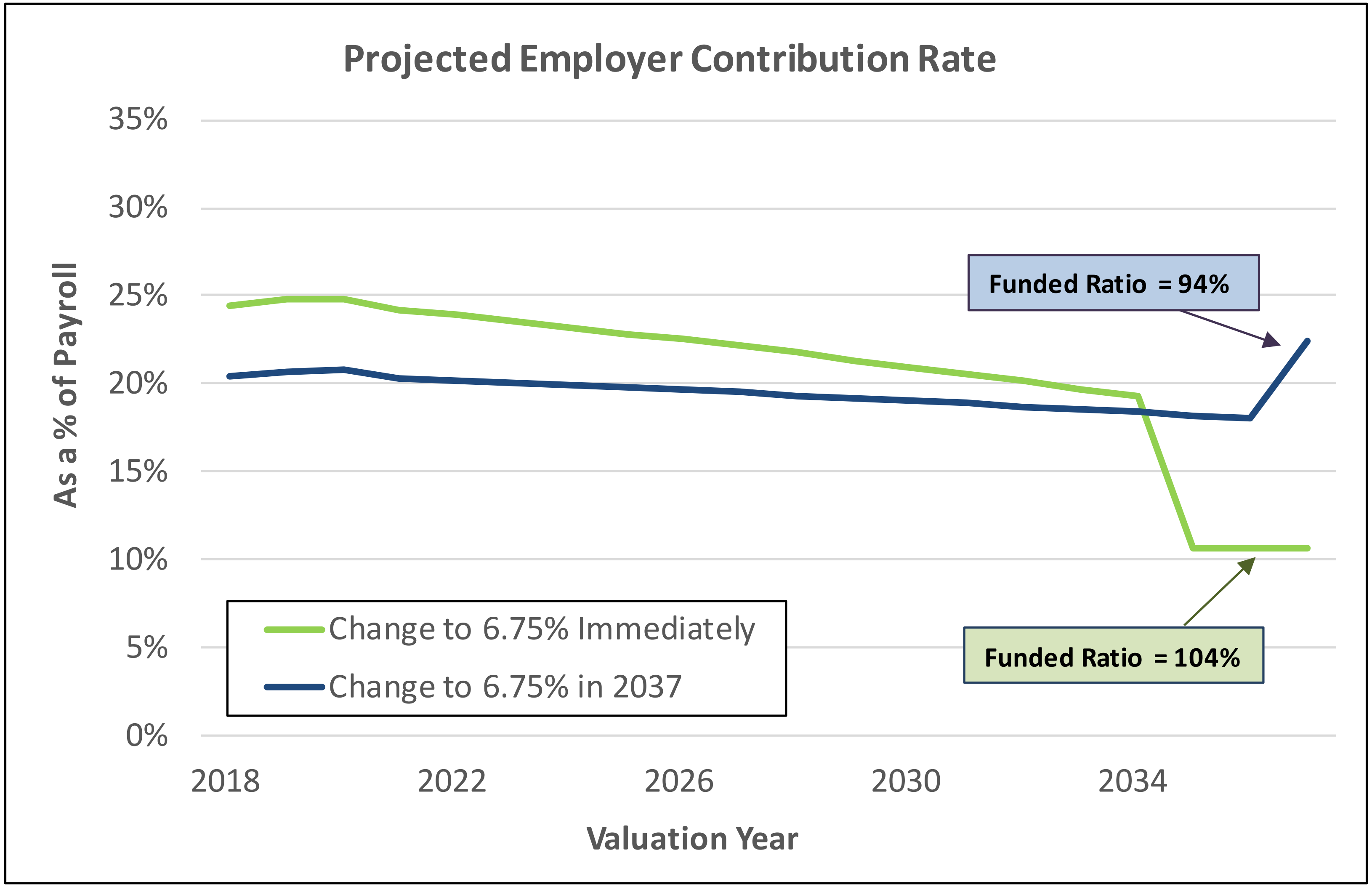
Impact of Lowering Return Assumption – Low Returns

- Actual future returns assumed to be 6.0% each year



Impact of Lowering Return Assumption – Good Returns

- Actual future returns assumed to be 7.5% each year



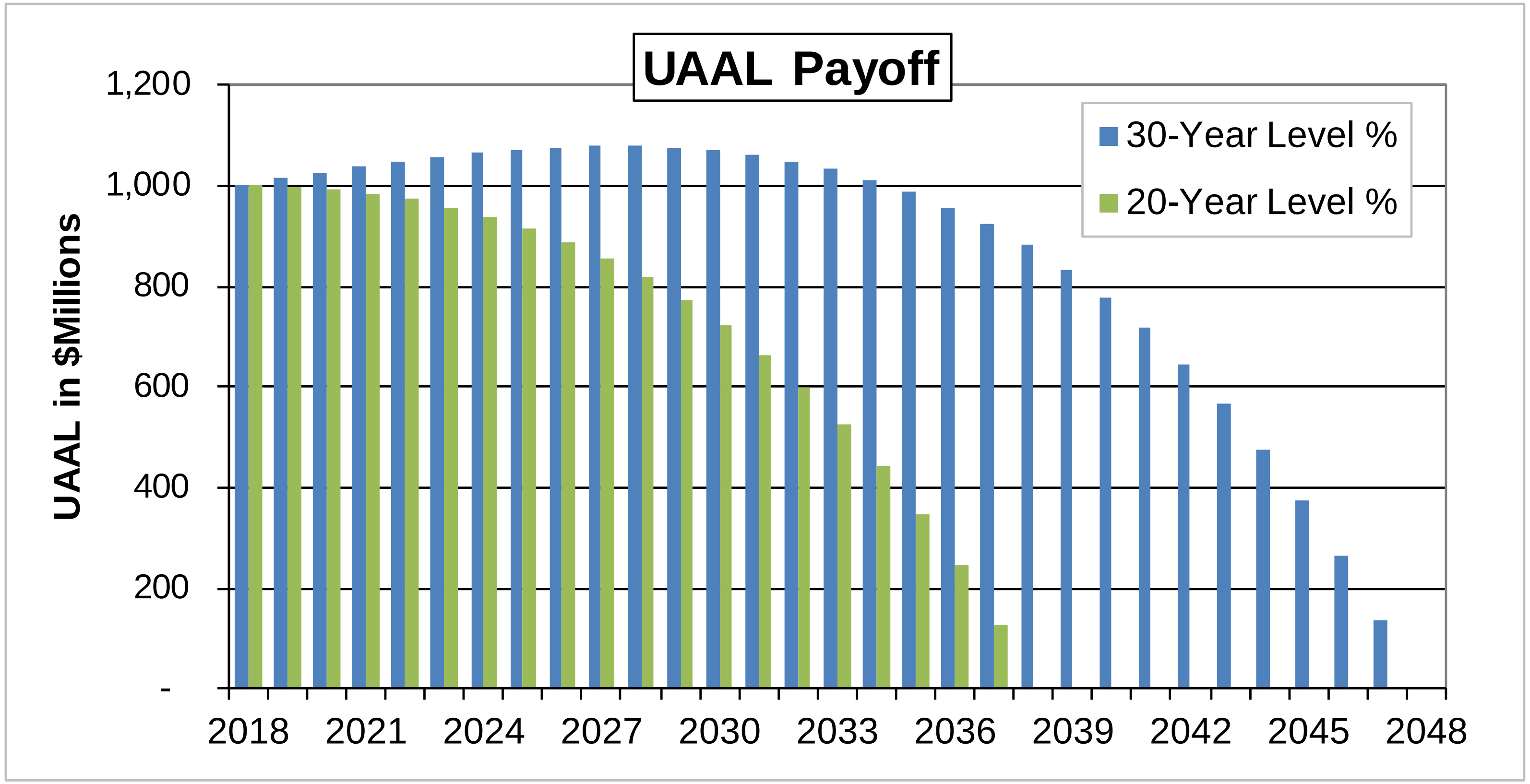
Amortization Policy

Amortization Period

- Quick recap and follow-up to discussion at January BOI meeting
- LACERA uses 30-year layered amortization method for Unfunded Actuarial Accrued Liability (UAAL)
  - Recent actuarial guidance suggest periods of 20 years or less
  - CalPERS and other ‘37 Act systems all have periods of 20 years or less now
- Shorter amortization period creates savings in that contributions come in earlier and have longer period to earn interest
  - Opposite is true when gains are recognized over shorter period
- Compared to 20-year period, a 30-year amortization of a UAAL increase will result in:
  - Generally lower funded ratios
  - Reduced year-to-year contribution rate volatility
  - Lower employer contribution rates in the short term

Comparison of UAAL Amortization Periods

- LACERA's current funding policy has negative amortization (increasing UAAL) for a number of years for new payment layers
  - Example of one layer with a $1 billion actuarial loss in 2018



Transitioning Away from Negative Amortization

- Three options:

Option	Year UAAL Payment is Projected to be Positive	Impact on Employer Contribution Rate	Future Outlook
No Change (30-year period)	Between 2020 and 2021	No Change	Negative amortization may recur
Existing UAAL: No change Future UAAL: 20 years	Between 2020 and 2021	No Change[(1)]	Negative amortization is unlikely to recur
Existing UAAL: 20 years Future UAAL: 20 years	Immediately	Increase of 0.7% of pay[(2)]	Negative amortization is unlikely to recur

1. *No immediate change, but future annual changes (either increases or decreases) will be greater than current method.*
2. *Based on 6/30/2018 valuation, actual impact would depend on results of 6/30/2019 valuation. Future annual changes (either increases or decreases) will also be greater than current method.*

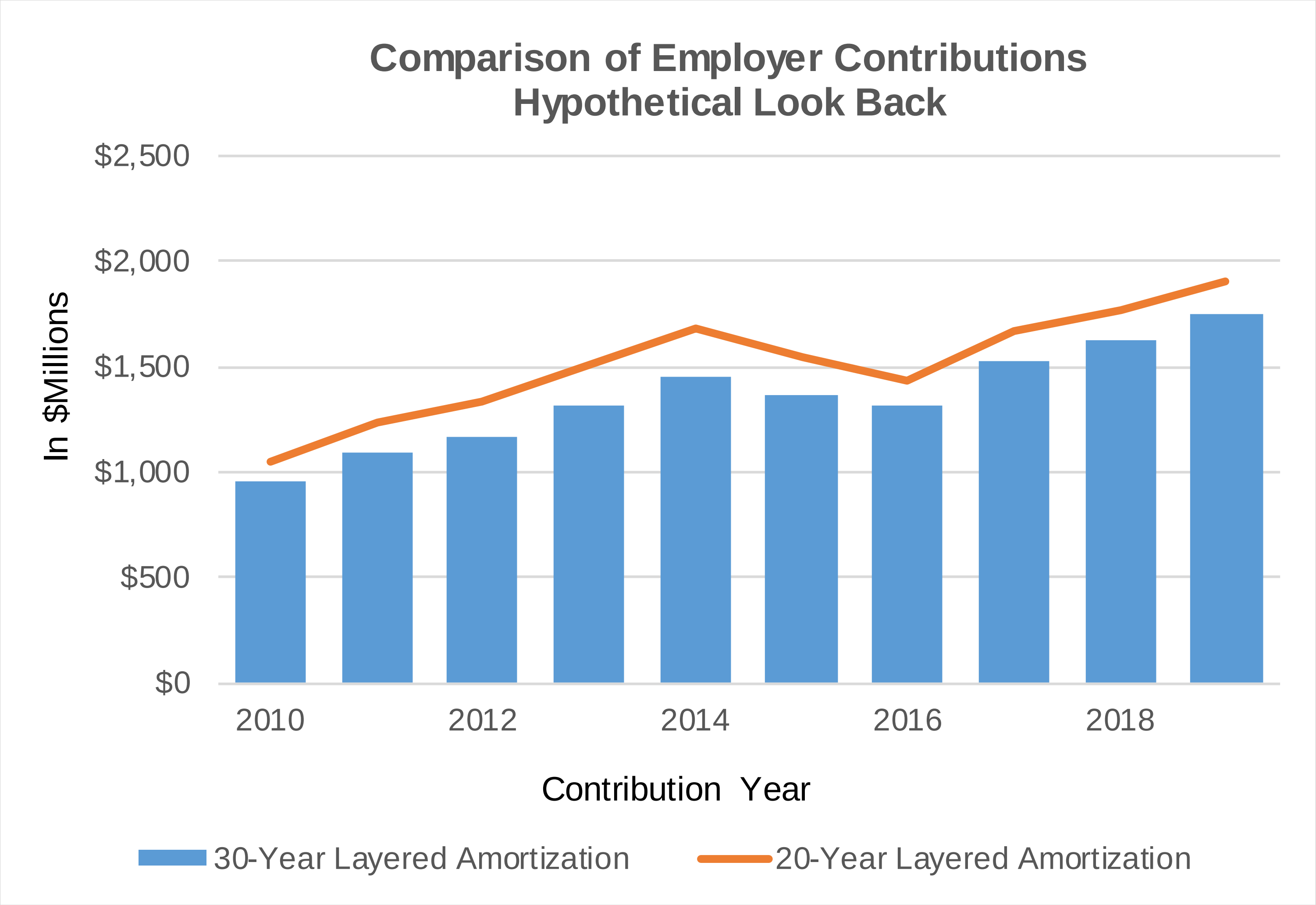
What if 20-Year Amortization Period had been Adopted?

- If 20-year amortization had been adopted for 2009 valuation:
  - 2018 valuation would have had higher funded ratio
  - Employer contribution rates between 2010 and 2019 would have been greater
  - Year-to-year contribution rate changes between 2010 and 2019 would have been larger
- Created alternative hypothetical scenario as if 20-year amortization had been in place for the period 2009-2019

Comparison of Amortization Periods – Employer Rate

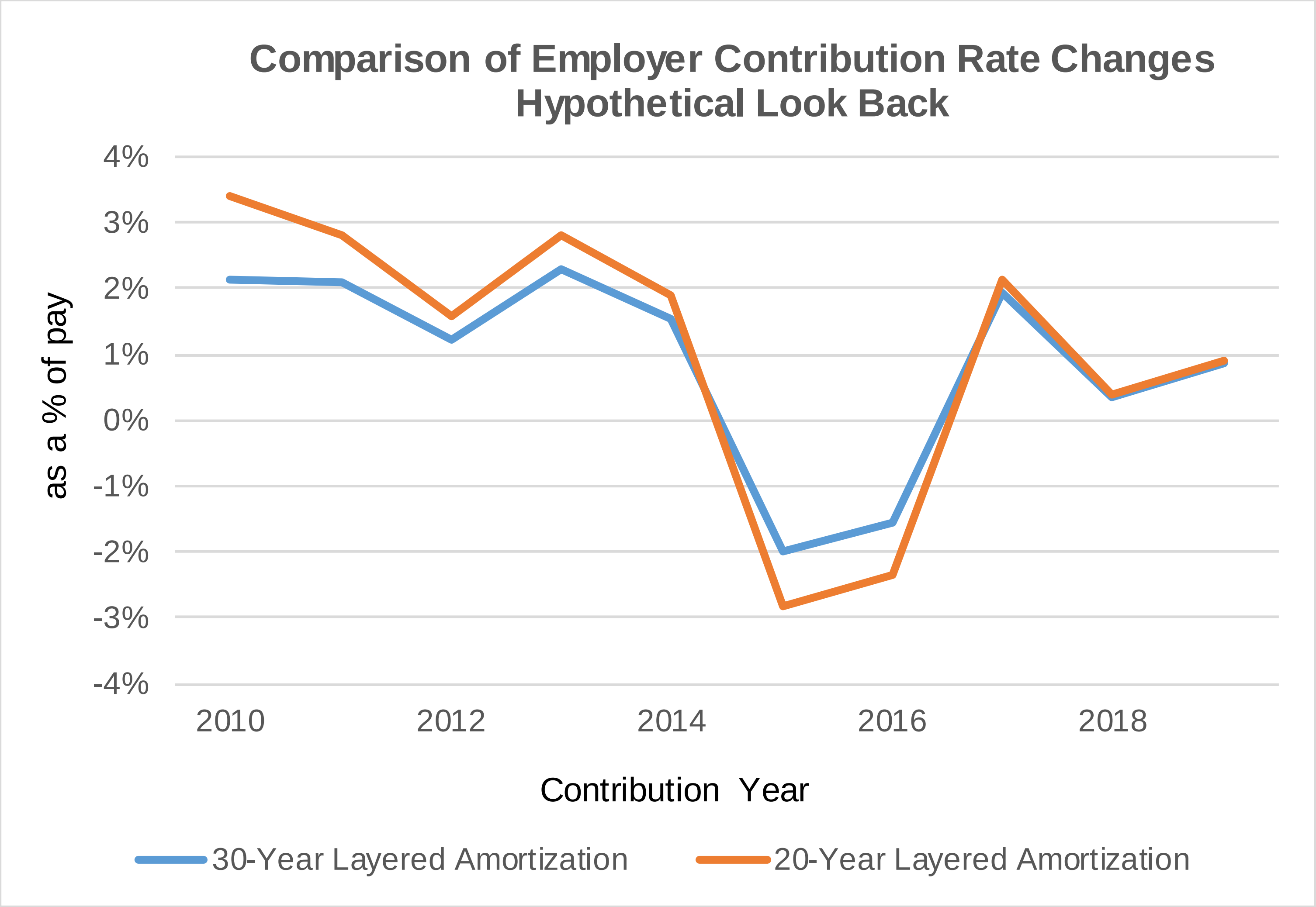
- Employers would have had to contribution $100 to $200 million more each year if 20-year amortization period had applied.
- Total estimated employer contributions for 2010-2019:
  - 30-Year = $12.6 billion
  - 20-Year = $14.1 billion

➔ Increase of $1.5 billion in employer contributions if 20-year amortization had been used



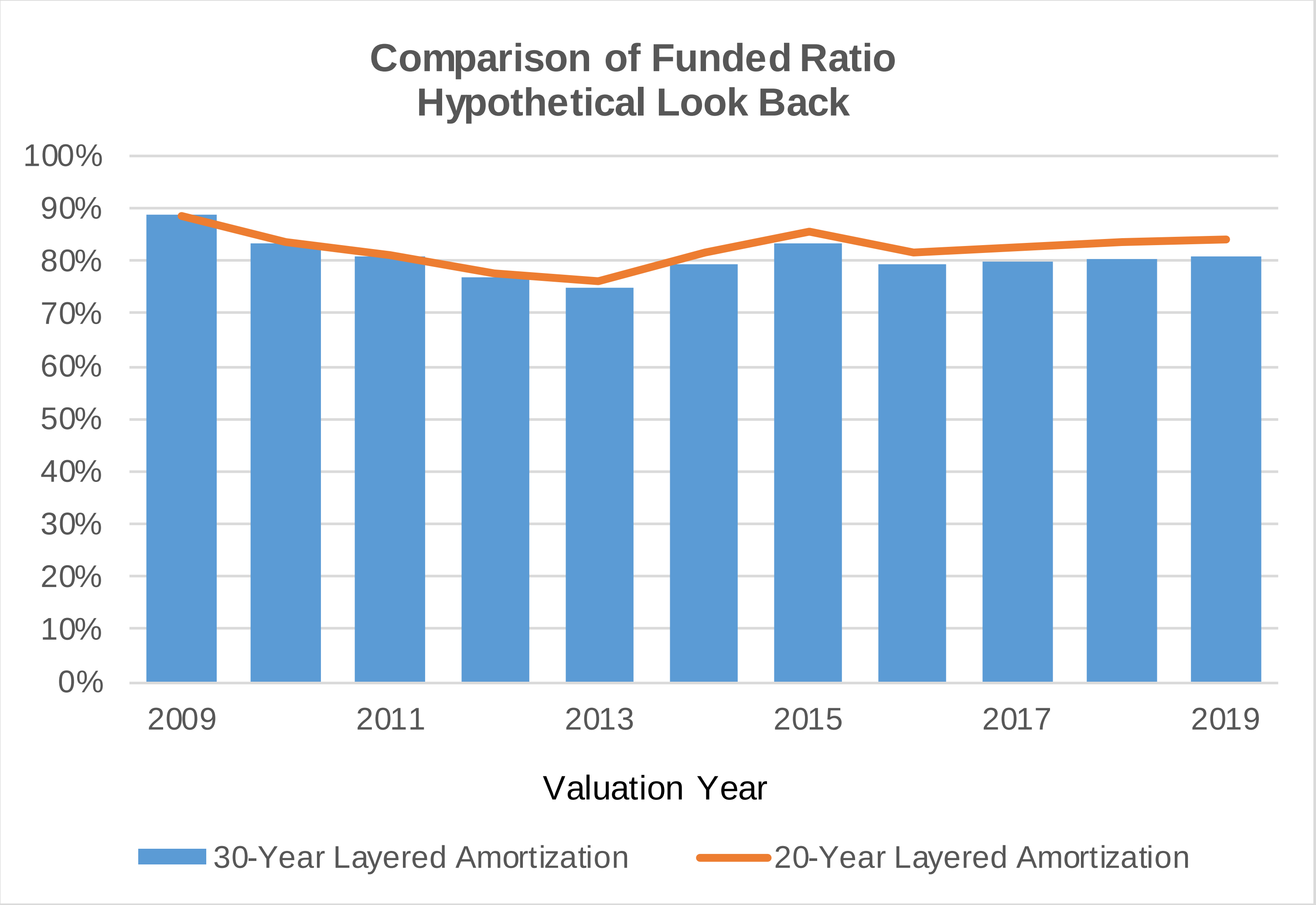
Comparison of Amortization Periods – Employer Rate Change

- Actual (30-year amortization) employer rate changes ranged from a 2.0% decrease to a 2.3% increase
- Employer rate changes under 20-year amortization would have ranged from a 2.8% decrease to 3.4% increase



Comparison of Amortization Periods – Funded Ratio

- It is projected the Valuation Assets would have been $2.0 billion greater at 6/30/2019 if a 20-year amortization period had been used
- An additional $2.0 billion in assets is equivalent to an increase in the funded ratio of 2.8%



Summary

- Investment return assumption
  - Milliman will make recommendation in the Fall
  - Milliman economist scheduled to be at October BOI meeting
- Amortization period
  - Current 30-year period is outside the recommended period
  - 20-year period generally provides better funding but subjects employer contribution rate to greater volatility

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Questions

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Nick Collier – Consulting Actuary

Nick is a consulting actuary with Milliman. He has over 25 years of actuarial consulting experience with public sector retirement systems. His clients include two statewide retirement systems (CalSTRS and the Texas County & District Retirement System), as well as two ’37 Act Systems (LACERA and SamCERA). In addition to his retained clients, Nick has extensive experience performing actuarial audits, including having worked with over half of the ’37 Act systems.

Nick has a B.A. in Mathematics and Economics from Claremont McKenna College. He is an Associate of Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA. Nick has served on the California Actuarial Advisory Panel.

Caveats and Disclaimers

This presentation is based on the data, methods, assumptions and plan provisions described in our actuarial valuation report dated November 29, 2018. The statements of reliance and limitations on the use of this material is reflected in the actuarial report and still apply to this presentation.

These statements include reliance on data provided, on actuarial certification, and the purpose of the report.

Milliman's work product was prepared exclusively for LACERA for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning LACERA’s operations, and uses LACERA’s data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

Long-term Capital Market Assumptions

2019 | 23rd ANNUAL EDITION

Los Angeles County Employees Retirement Association

2019 Board of Investments Offsite Meeting

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What will the global economy and markets look like over the next 10-15 years?

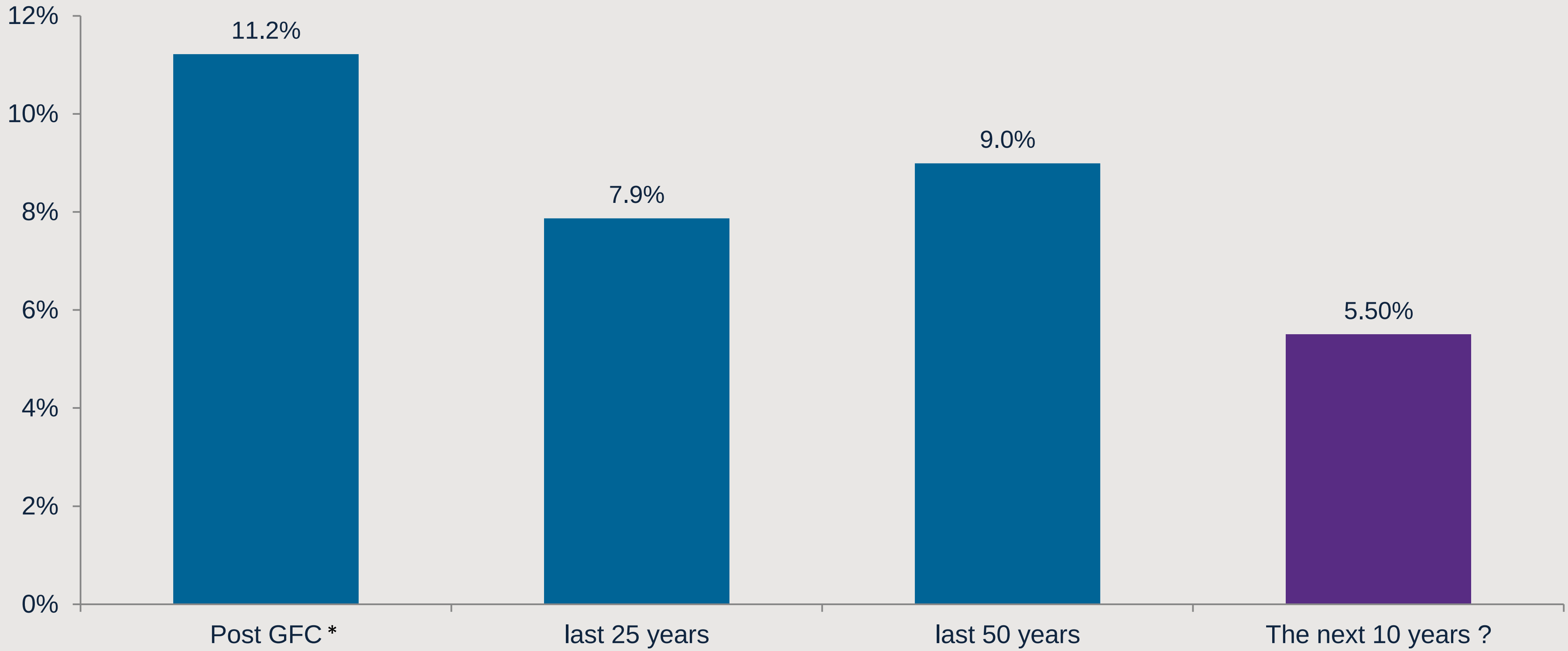
- Our Long-Term Capital Market Assumptions is a cycle-neutral framework of macroeconomic and asset class return projections over the next 10-15 years
- As a general matter, future returns will be lower than they were historically. This reflects economic growth and inflation outcomes that have declined over time and are expected to remain low by historical standards
- That said, forward looking expectations have now stabilized after a decade-long series of downgrades
- Key themes in our projections include:
  - A flatter trade-off between risk and return, favoring bonds over equities at the margin
  - High U.S. asset valuations and emerging market growth, supporting international diversification
  - A growing role for private markets as diversifiers and a means of accessing the 'new' economy

Source: JPMAM Global Multi-Asset Strategy.

J.P.Morgan Asset Management

The 'returns challenge' faced by investors is alive and well in 2019…

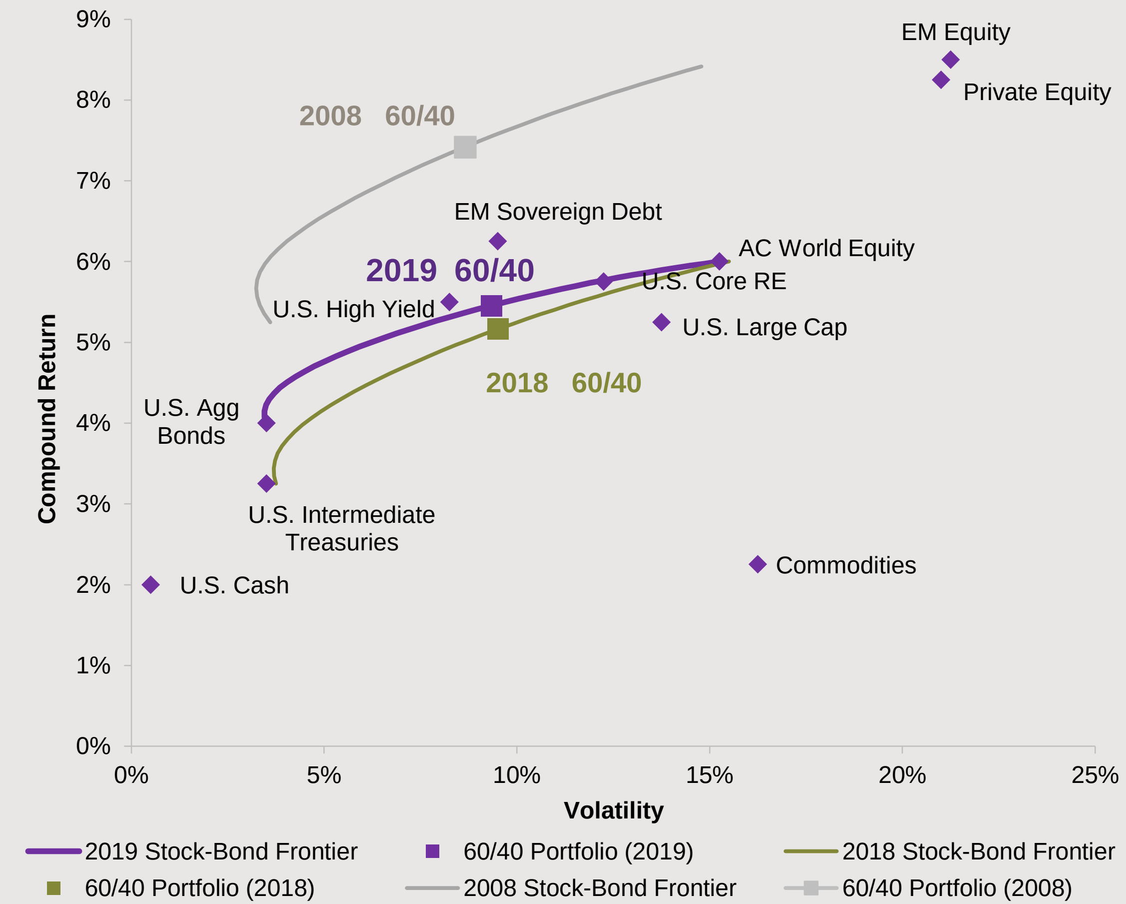
USD 60/40 stock/bond return (% annualized)



[1]Source: Bloomberg, Datastream, J.P. Morgan Asset Management Multi-Asset Solutions. Data as of 30 September 2018. *GFC: Global financial crisis. Note: Next 10 years return estimate is taken from 2019 Long Term Capital Market Assumptions

…but the outlook has stabilized and the risk-return trade-off has flattened out

Stock-bond frontiers: 2019 vs. 2018 and 2008 assumptions (USD)



KEY PORTFOLIO CONSIDERATIONS

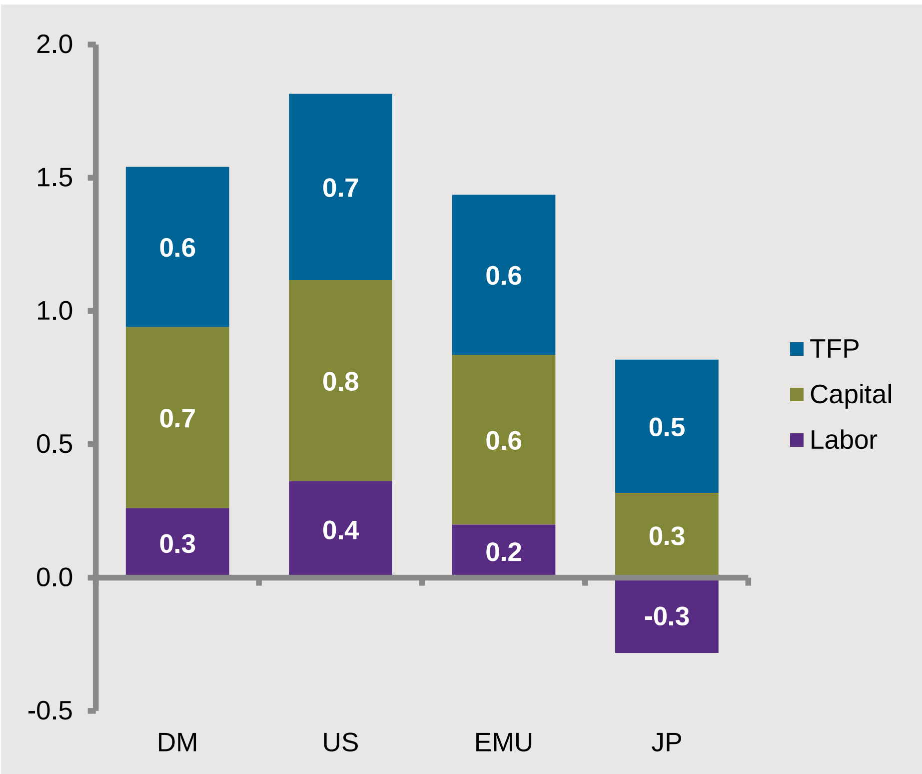
- 60/40 stock-bond returns up 25bps – clockwise rotation of frontier typical of late cycle, but not mirrored outside U.S.
- Global equity returns broadly flat
- U.S. Aggregate Bond Index returns better as rate normalization progressed over 2019
- Credit and EM debt seem to be the brighter spots in Fixed Income
- But traditional volatility metrics may not account for the additional liquidity risks associated with these assets
- Real assets relatively undervalued
- Portfolio construction for private markets needs to account for manager dispersion

Source: J.P. Morgan Asset Management; estimates as of September 2017 and September 2018. *EM: Emerging Markets; DM: Developed Markets

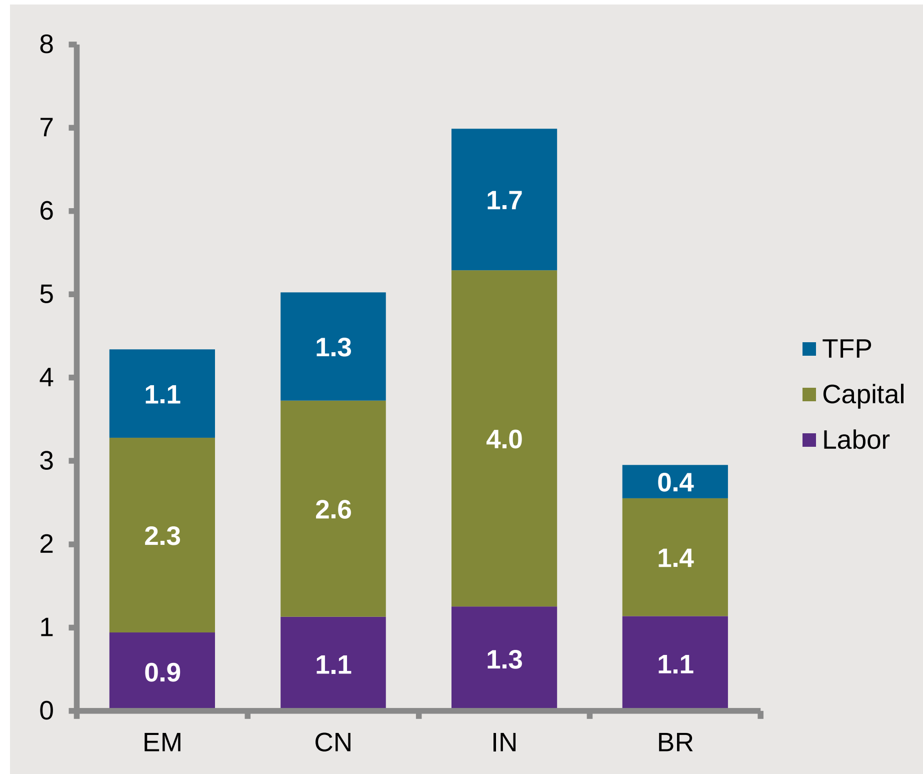
J.P.Morgan Asset Management

Economic outlook: Demographics the key differentiator among developed markets

Contributions to projected Developed Markets real GDP growth (p.p.)



Contributions to projected Emerging Markets real GDP growth (p.p.)

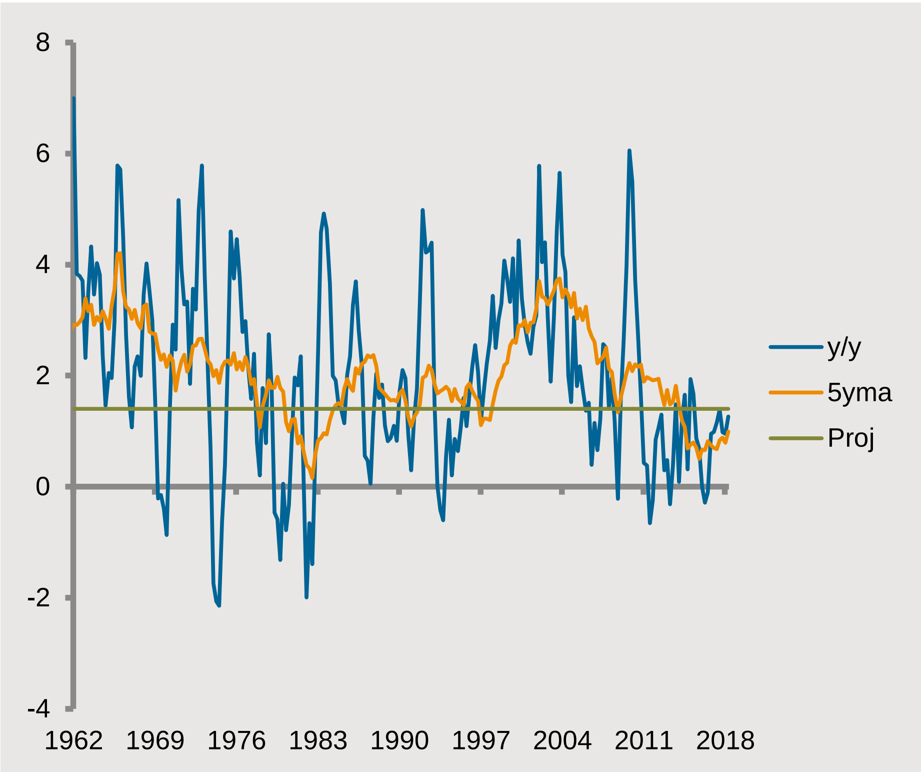


Source: Penn World Table, Haver Analytics, J.P. Morgan Asset Management; data and forecasts as of September 30, 2018.

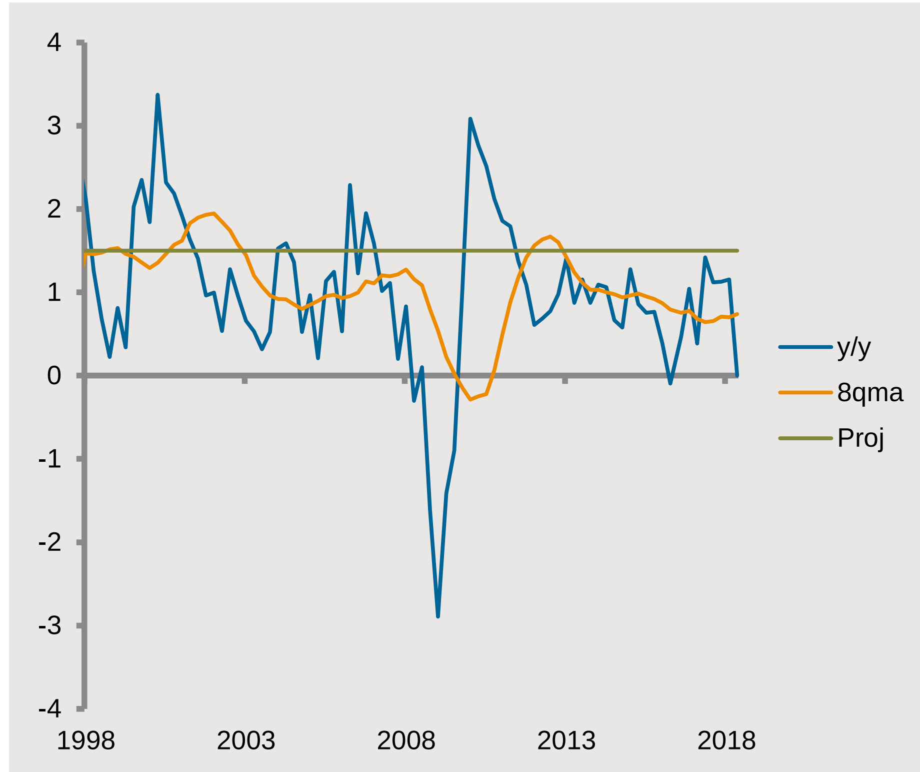
*DM: Developed markets, EM: Emerging markets, TFP: Total factor productivity.

Economic outlook: Productivity has accelerated, but our projections call for more

U.S. labor productivity and LTCMA projection (%)



Euro area labor productivity and LTCMA projection (%)

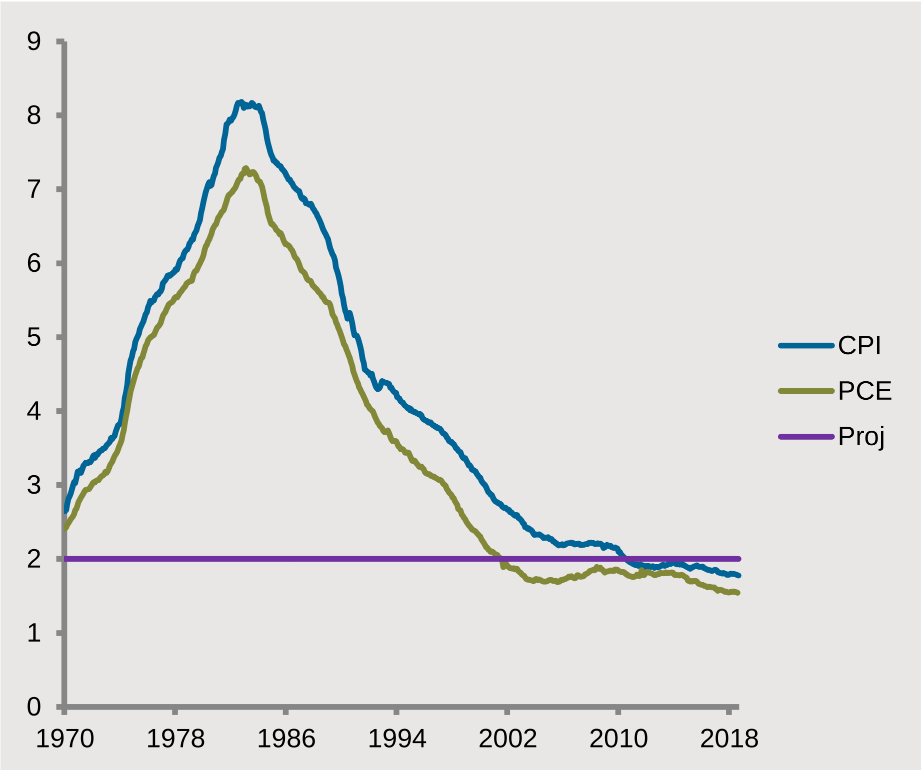


Source: Haver Analytics, J.P. Morgan Asset Management; data and forecasts as of September 30, 2018

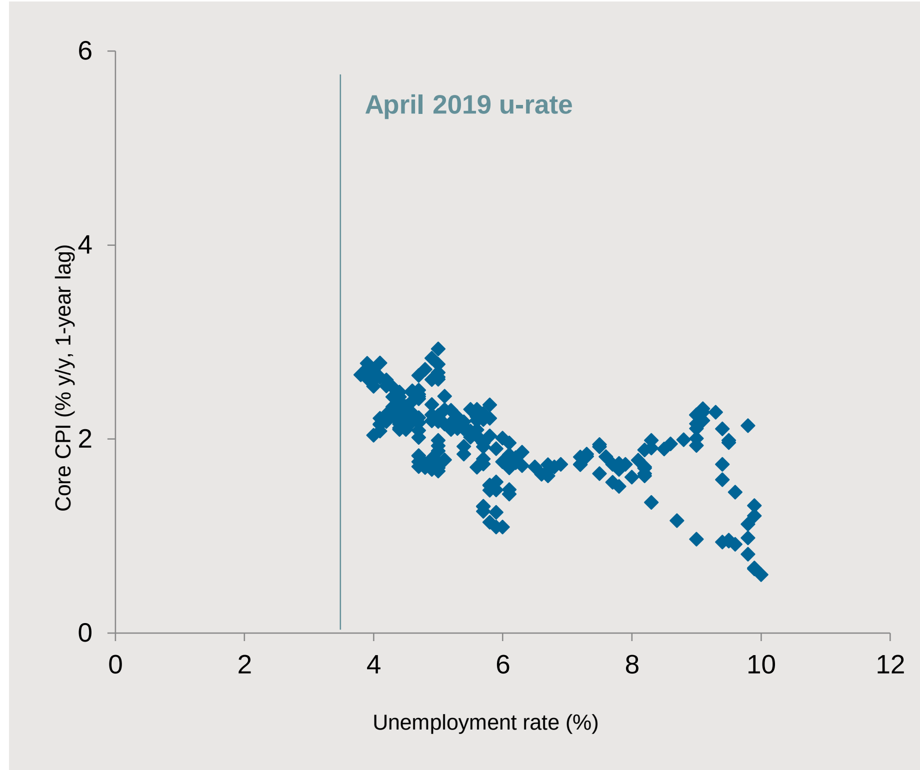
J.P.Morgan Asset Management

Economic outlook: U.S. inflation track record has ground lower

U.S. core inflation (% y/y, 10y avg) and LTCMA projection



U.S. Phillips curve: unemployment and inflation

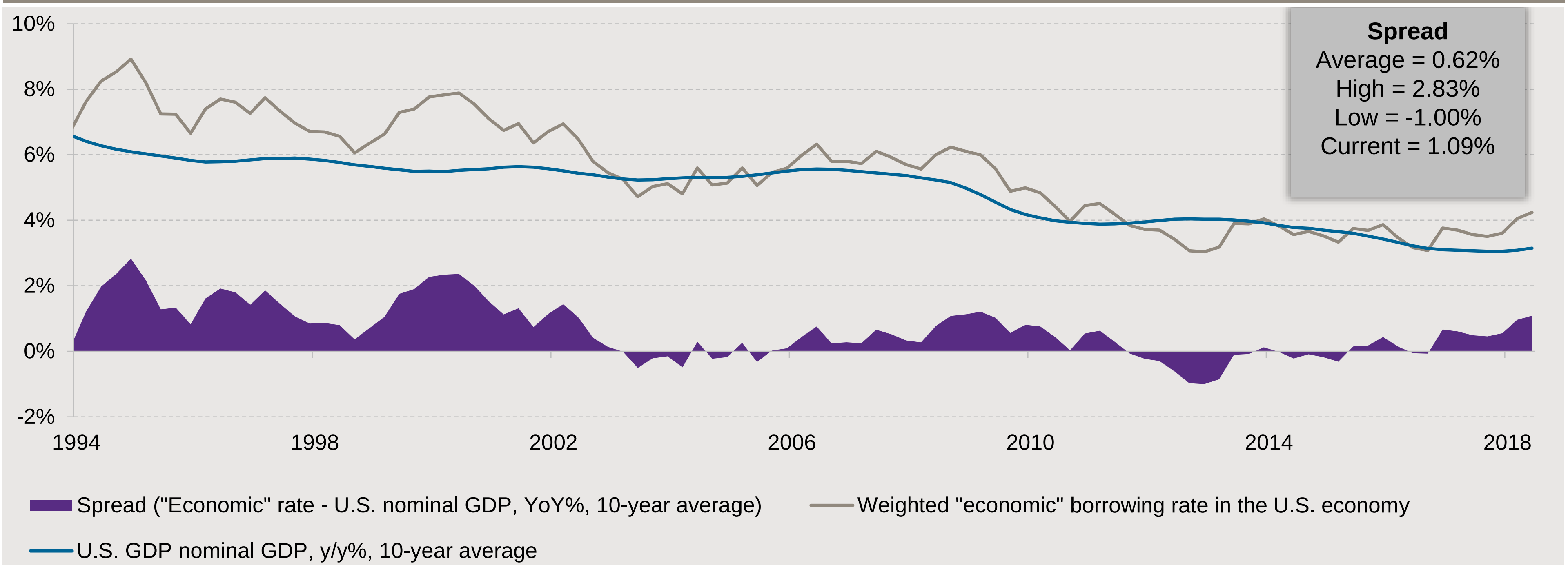


Source: Haver Analytics, JPMorgan Asset Management; data and forecasts as of May 2019.

J.P.Morgan Asset Management

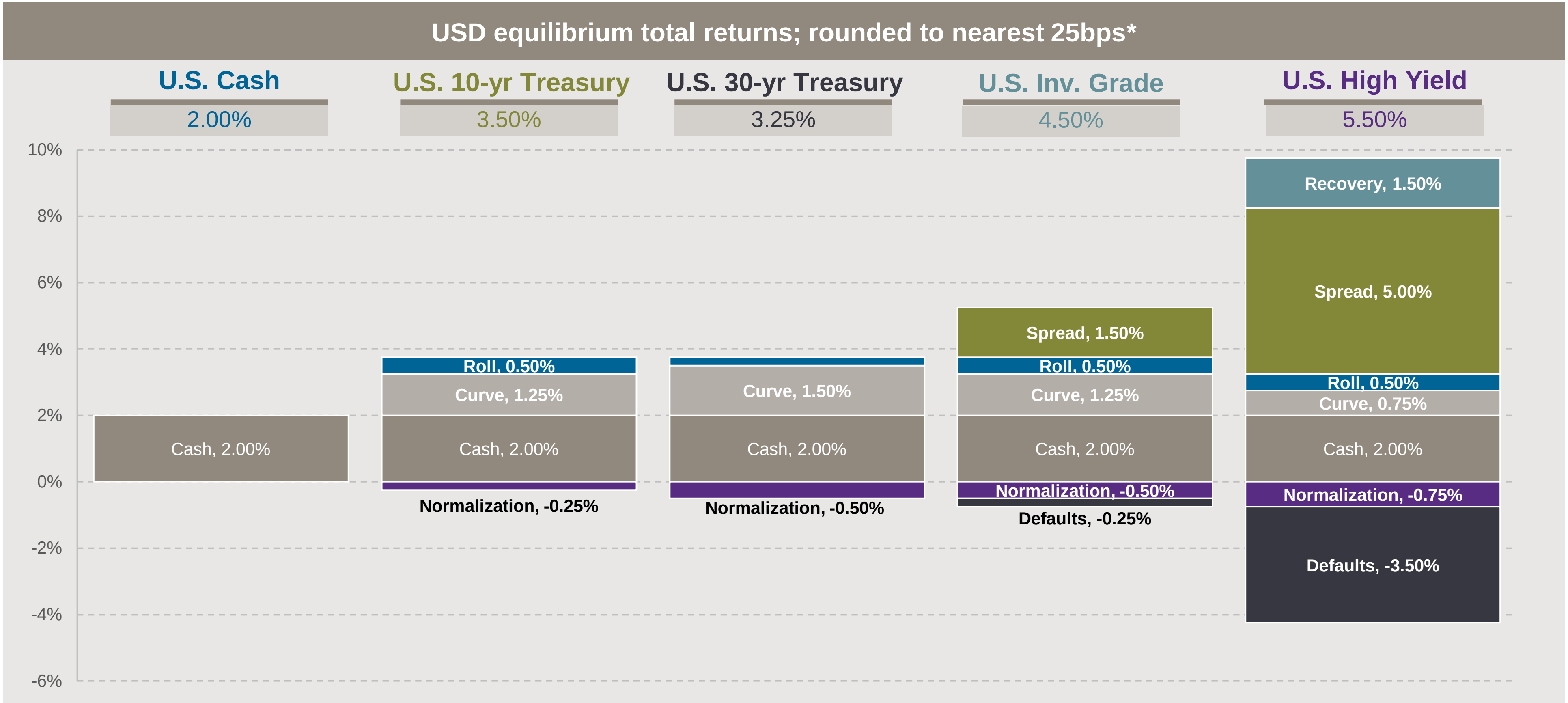
Equilibrium interest rates will continue to track nominal GDP

Economy-wide borrowing costs track nominal GDP



Source: Bloomberg, Haver, *Estimated borrowing cost is approximated from 0.2 *Treasury yield + 0.4 * mortgage rate + 0.4 * corporate yield; GDP = Gross Domestic Product

Fixed income: Lower equilibrium yields, but better cyclical position

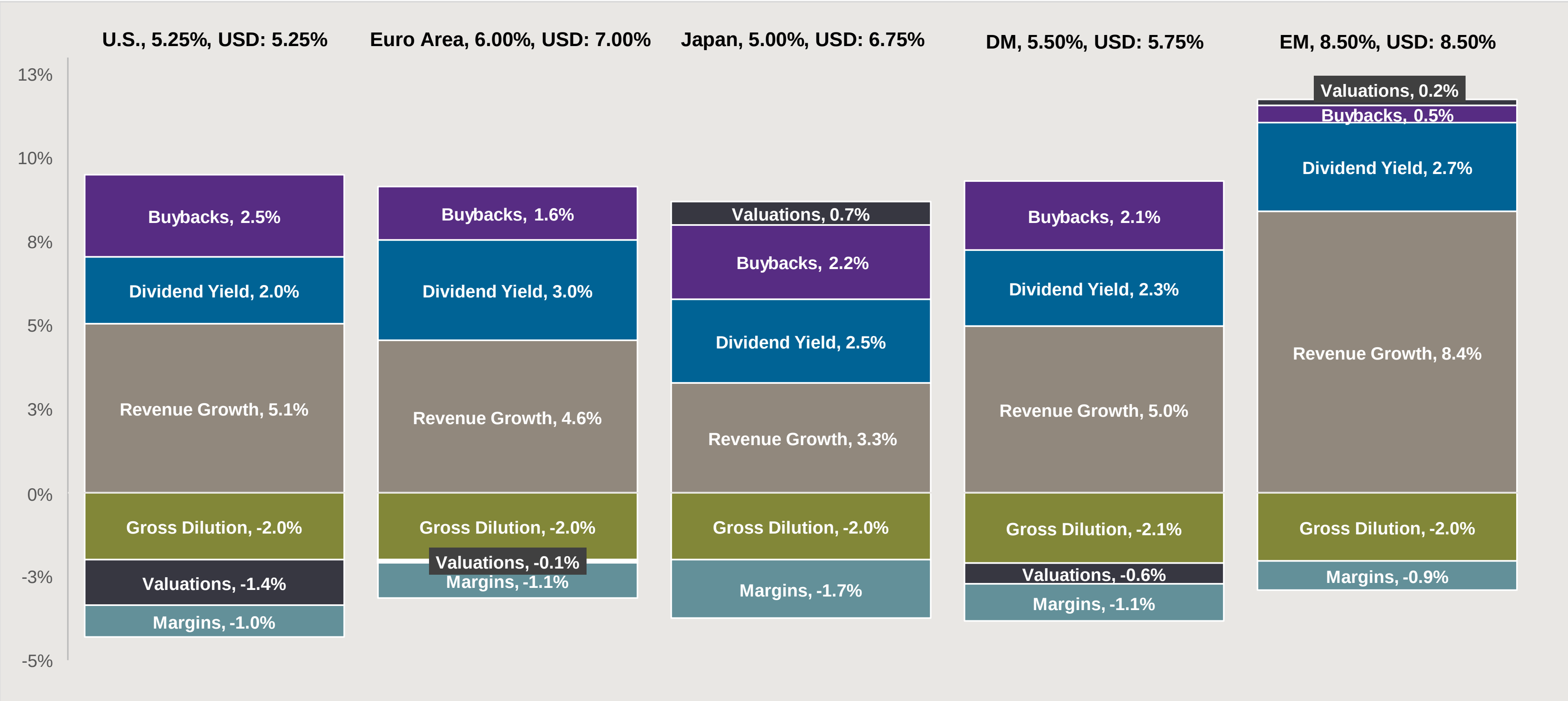


Source: J.P. Morgan Asset Management as of September 2018. Note that final return assumptions are rounded to nearest 25bps, and sum of building blocks will therefore differ slightly. Opinions, estimates, forecasts, projections and statements of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. There can be no guarantee they will be met. * Note: totals may not sum due to rounding. IG: Investment grade; HY: High yield

Note: Normalization/cyclical comprises path of rates to equilibrium and credit spread vs. equilibrium for IG and HY, but is purely rate normalization for the government bonds

Equities: Big regional disparities in valuations and distributions to shareholders

Equilibrium total returns; rounded to nearest 25bps*



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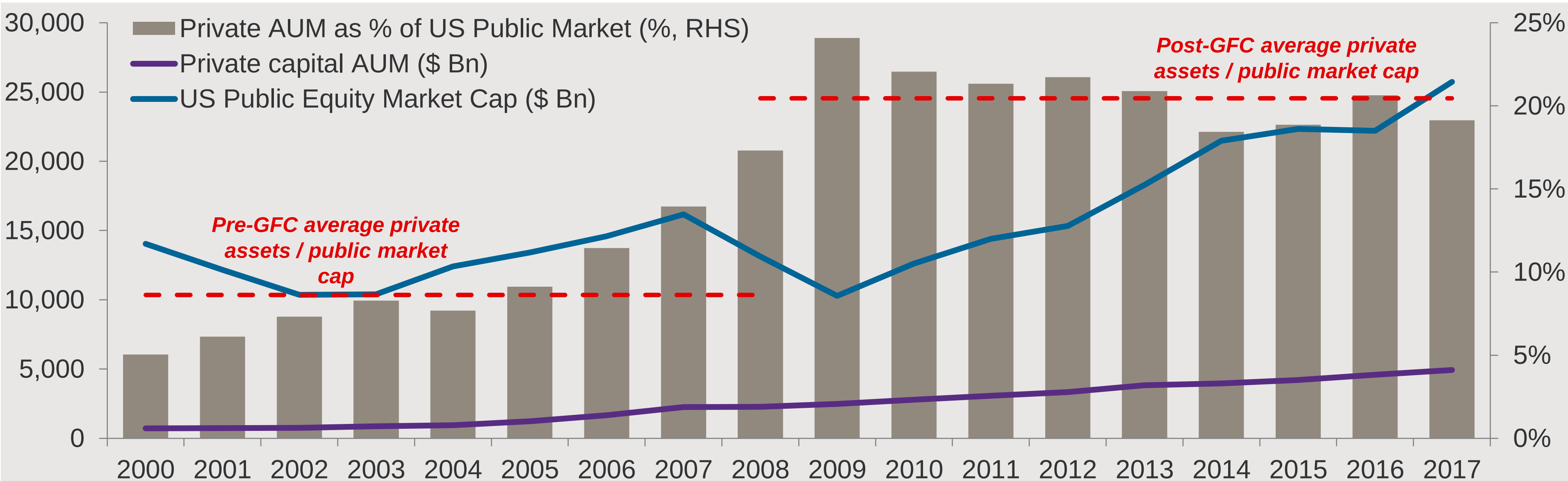
Market structure has shifted: Private assets more accessible to investors

Private capital AUM growth vs. U.S. equity market capitalization



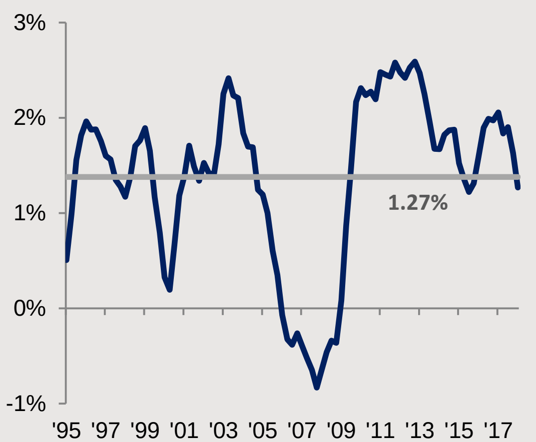
Source: Thomas Reuters Datastream, Bain Capital, Preqin, J.P. Morgan Asset Management; data as of 31 December 2017.

J.P.Morgan Asset Management

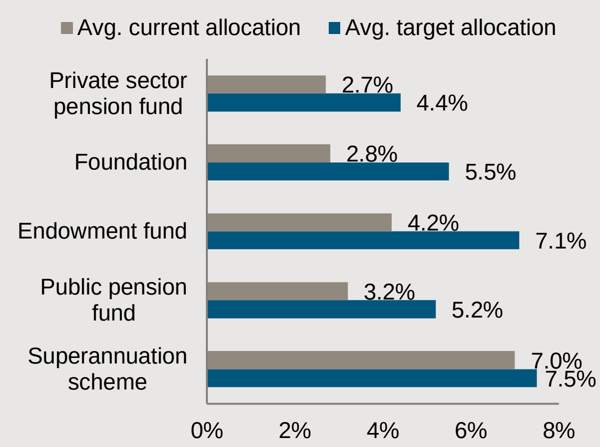
Real Assets: real estate valuations not overwrought this cycle

	Real Estate – Direct (local currency, %)							Infrastructure (USD, %)			Commodities (USD, %)	
	U.S. Core	U.S. Value-Added	European ex-UK Core	European ex-UK Value-Added[1]	UK Core	UK Value-Added[1]	Asia-Pacific Core		Equity–Direct	Debt		Commod.	Gold
2019 Levered	5.75	7.75	5.50	8.00	5.00	7.25	6.00	2019 Levered	6.00	4.75	2019 Net of fess	2.25	2.50
2019 Unlevered	5.45	5.25	4.55	5.00	4.40	4.65	5.05	2018 Levered	6.25	4.25	2019 Gross of fess	3.00	3.25
2018 Unlevered	5.25	6.50	4.75	N/A	4.75	N/A	5.50				2018 Gross of fees	3.75	4.00

Cap rate spread to BBB corporate bonds



Institutional investors' current and target allocations to infrastructure



REAL ASSETS – KEY POINTS

- Core real estate leverage remains muted, loan-to-value is still at the low end of historical ranges, and discipline generally is being maintained relative to past cycles, especially the most recent one
- For value-added, we introduce an assumption further out on the risk curve
- The outlook for infrastructure equity remains strong, despite a marginal reduction in this year's assumptions due to higher recent valuations and, hence, a less robust valuation impact

Source: (Top) J.P. Morgan Asset Management; estimates as of September 30, 2017, and September 30, 2018. (Bottom Left) Moody's, NCREIF NPI Transaction Cap Rates, J.P. Morgan Asset Management, data as of June 2018. (Bottom Right) Preqin, data as of December 2017. Based on survey data, subject to self-reporting bias. Percentage allocations shown exclude investors who have no allocation to infrastructure equity.

[1] 2019 publication introduces assumptions for European ex-UK value added and UK value-added. 2018 European ex-UK non-prime assumption is not comparable to 2019 European ex-UK value added assumption.

Private Equity: Compelling returns but a wide range of outcomes across managers

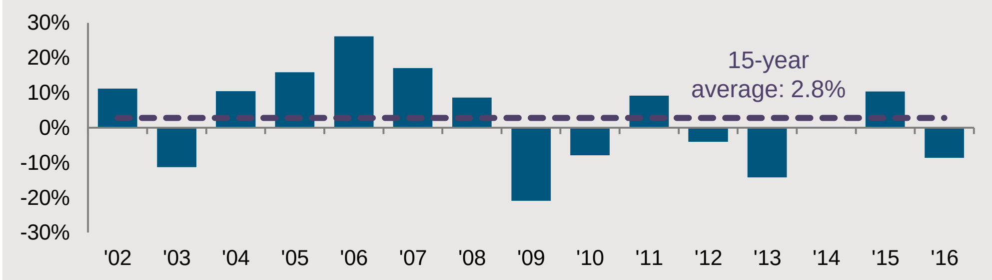
KEY POINTS

- New deployment opportunities – whether in the "new digital economy" in the U.S. or in Asia – partially offset high purchase price multiples, sizeable dry powder and new non-sponsor competitors.
  - The ability to drive operating performance through "new digital economy" adaptation is key to the alpha upgrade
- The alpha trend is significantly below the 15-year average and most investors' expectations for an illiquidity premium
- Public market exposure up ~25bps in the case of large/mega PE, primarily driven by international equity exposures

PE assumptions and return framework

	Small PE (<$500mn)	Mid PE ($500mn-$2bn)	Large/mega PE (>$2bn)	Cap-Weighted[1, 2]
PUBLIC MARKET EXPOSURES				
U.S. mid cap	✓	✓	✓	
Europe			✓	
Asia ex-Japan			✓	
ASSUMPTIONS (%)				
Public market exposure	5.75	5.75	6.25	6.00
Alpha trend	2.00	2.25	2.25	2.25
2019 LTCMA	**7.75**	**8.00**	**8.50**	**8.25**
2018 LTCMA	6.50	6.75	7.50	7.25

Historical premium of private equity to U.S. mid cap (2002-16)[3, 4]

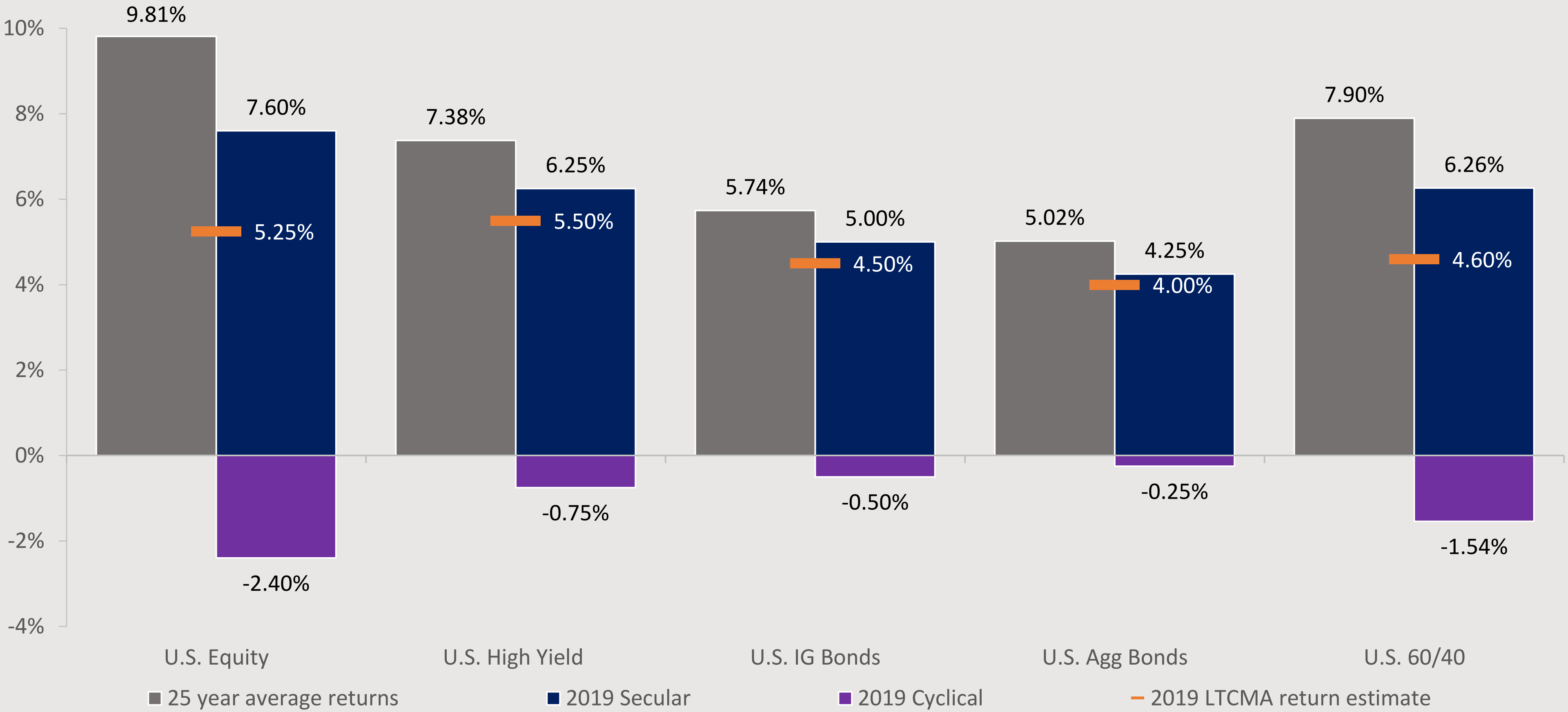


Source: (Top Right) J.P. Morgan Asset Management; estimates as of September 30, 2017 and September 30, 2018. [1] The PE composite is AUM-weighted: 60% large cap and mega cap, 30% mid cap and 10% small cap. Capitalization size categories refer to the size of the asset pool, which has a direct correlation to the size of companies acquired, except in the case of mega cap. [2] The regional weights for the capitalization-weighted PE composite are: U.S.: 55%; Europe: 25%; Asia and other: 20%. (Bottom Right) Bloomberg, Burgiss Private iQ, J.P. Morgan Asset Management; data as of March 31, 2018. [3] Includes buyout and expansion capital funds. [4] The historical premium to U.S. mid cap returns (shown in the chart) is not directly comparable to the forward-looking PE cap-weighted composite alpha trend assumption (in the table above). Our alpha trend assumption reflects a range of public market exposures (across regions and size categories) in addition to U.S. mid cap, the dominant market exposure.

J.P.Morgan Asset Management

An even longer-term view: Equilibrium returns stable; cyclical position a drag

Historical 25-year average returns and this year's estimates, split into secular (equilibrium) and cyclical components



Source: Bloomberg, Datastream, J.P. Morgan Asset Management Multi-Asset Solutions; data as of September 30, 2018. For equities, 'cyclical' components are the valuation and margins components of our building block framework. For bonds, the 'cyclical' component is the normalization impact as rates and spreads are forecasted to return towards our equilibrium estimates.

J.P.Morgan Asset Management

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  - A growing role for private markets as diversifiers and a means of accessing the 'new' economy

Source: JPMAM Global Multi-Asset Strategy.

Appendix

Economic assumptions: 2019 vs. 2018

Compound 10- 15-year GDP Growth and Inflation (%)

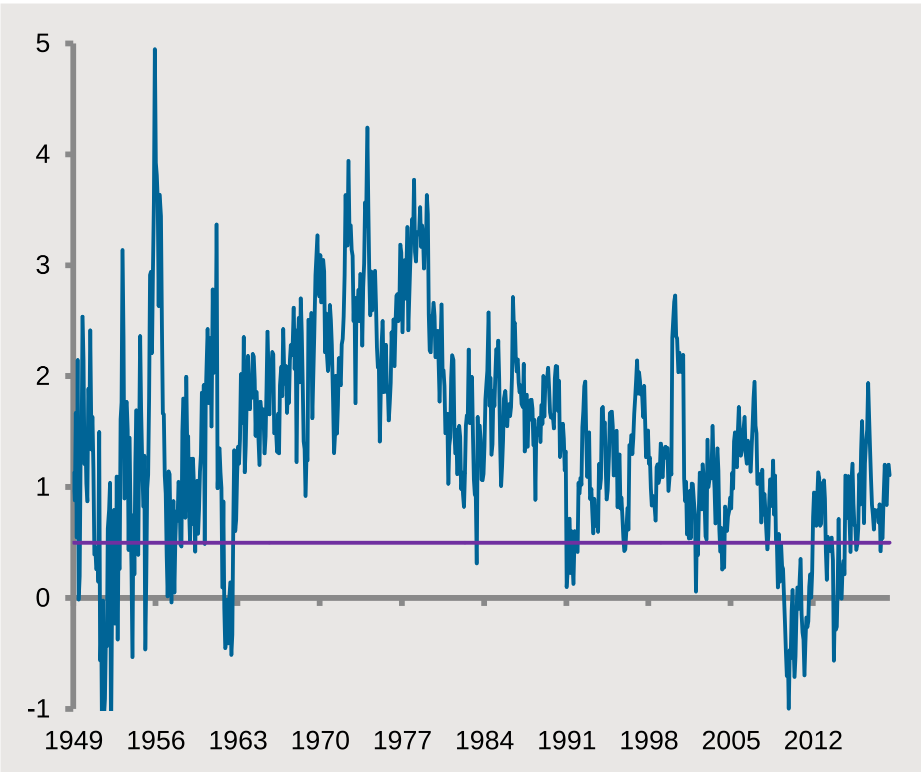
	DM	U.S.	Europe	U.K.	Japan
2019 LTCMAs					
Real GDP	1.50	1.75	1.50	1.25	0.50
Inflation	1.75	2.00 ↓	1.50	2.00	1.00
2018 LTCMAs					
Real GDP	1.50	1.75	1.50	1.25	0.50
Inflation	1.75	2.25	1.50	2.00	1.00

	EM	China	India	Brazil	Russia
2019 LTCMAs					
Real GDP	4.25 ↓	5.00	7.00	3.00	1.25 ↓
Inflation	3.50	2.75	5.00	4.75 ↓	5.50
2018 LTCMAs					
Real GDP	4.50	5.00	7.00	3.00	1.50
Inflation	3.50	2.75	5.00	5.00	5.50

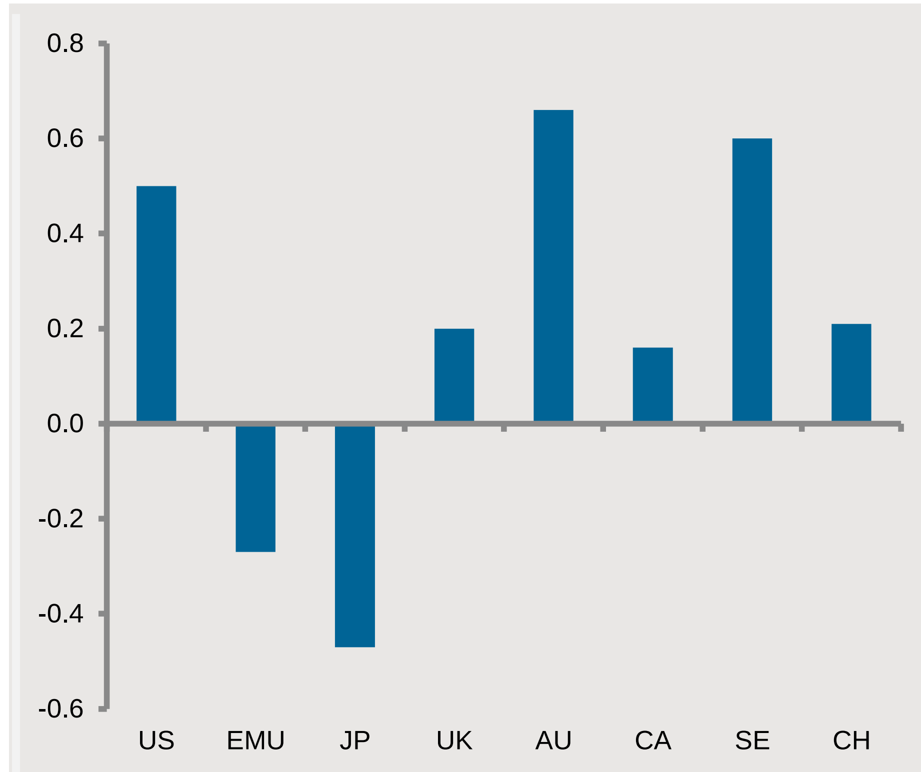
Source: J.P. Morgan Asset Management; estimates as of September 30, 2018.

Demographics will continue to dampen growth relative to history

U.S. labor force growth and LTCMA projection (% y/y)



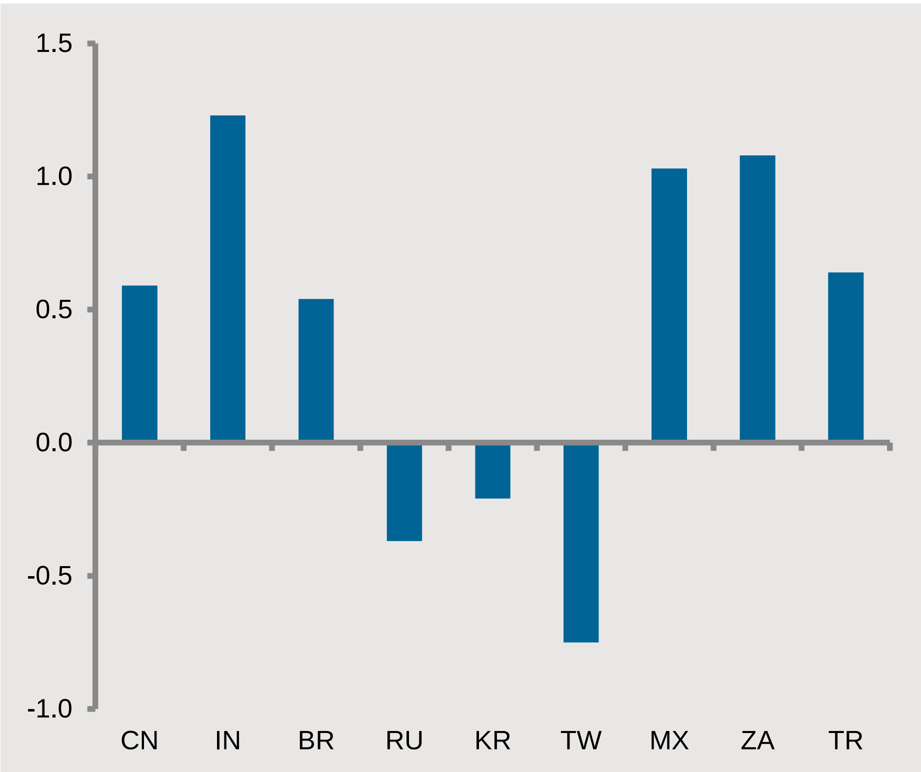
DM countries: LTCMA labor force growth projections (% p.a.)



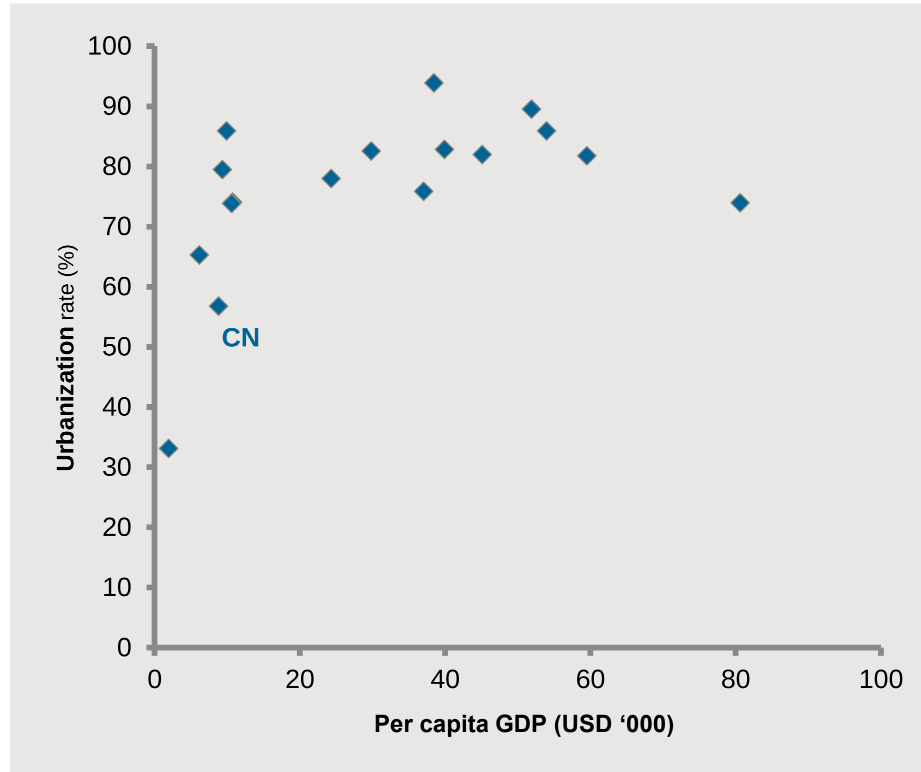
Source: U.S. Census Bureau, Haver Analytics, J.P. Morgan Asset Management; data and forecasts as of September 30, 2018

EM demographics vary widely; ongoing Chinese urbanization will help

EM countries: LTCMA labor force growth projections (% p.a.)



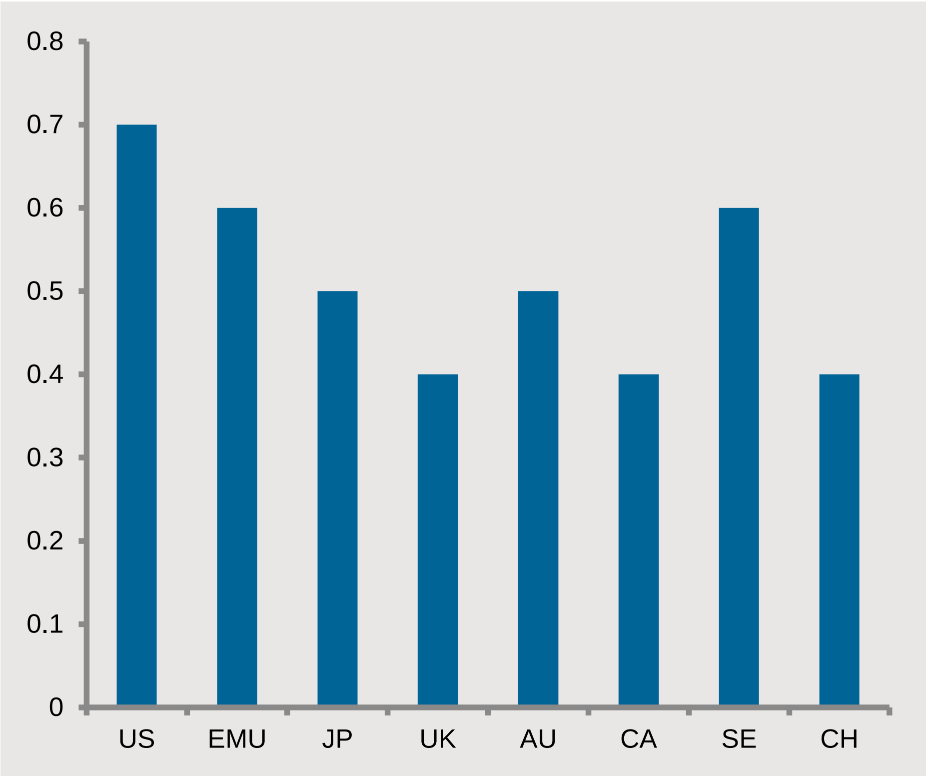
Per capita GDP and urbanization rates



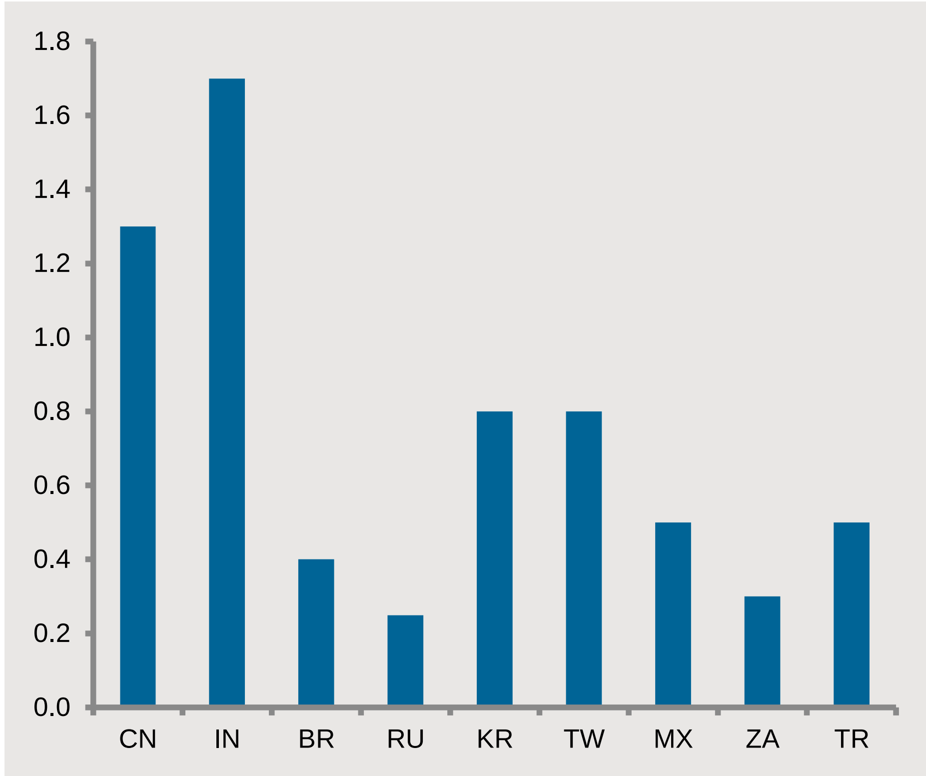
Source: U.S. Census Bureau, Haver Analytics, JPMorgan Asset Management; data and forecasts as of September 30, 2018

TFP: EM convergence led by Asian manufacturers

DM countries: LTCMA total factor productivity projections (% p.a.)



EM countries: LTCMA total factor productivity projections (% p.a.)

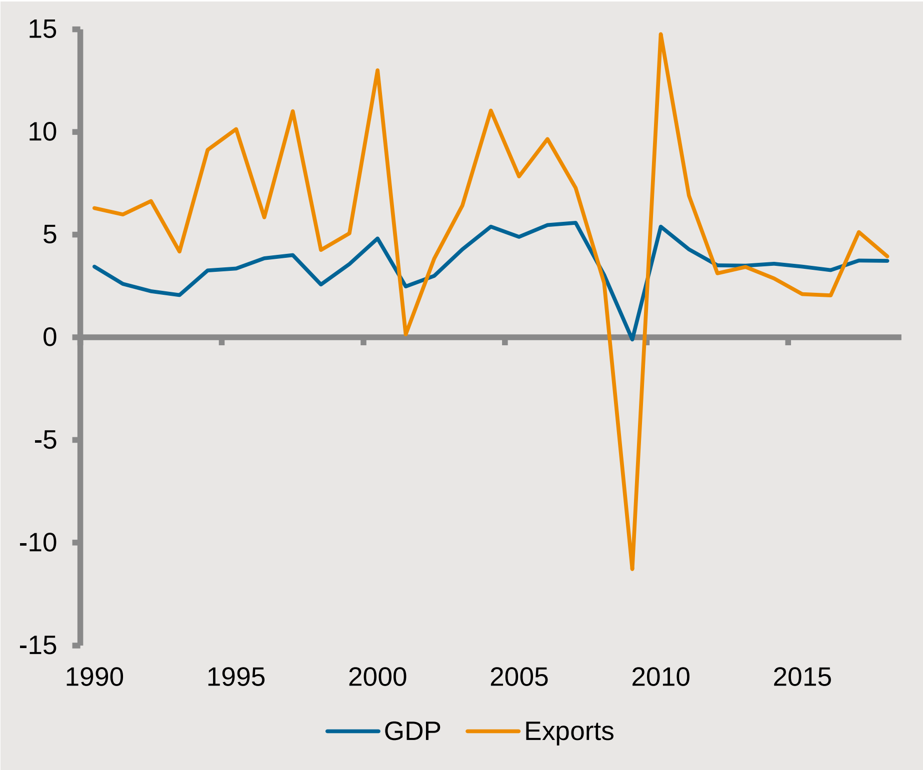


Source: Penn World Table, J.P. Morgan Asset Management; data and forecasts as of September 30, 2018

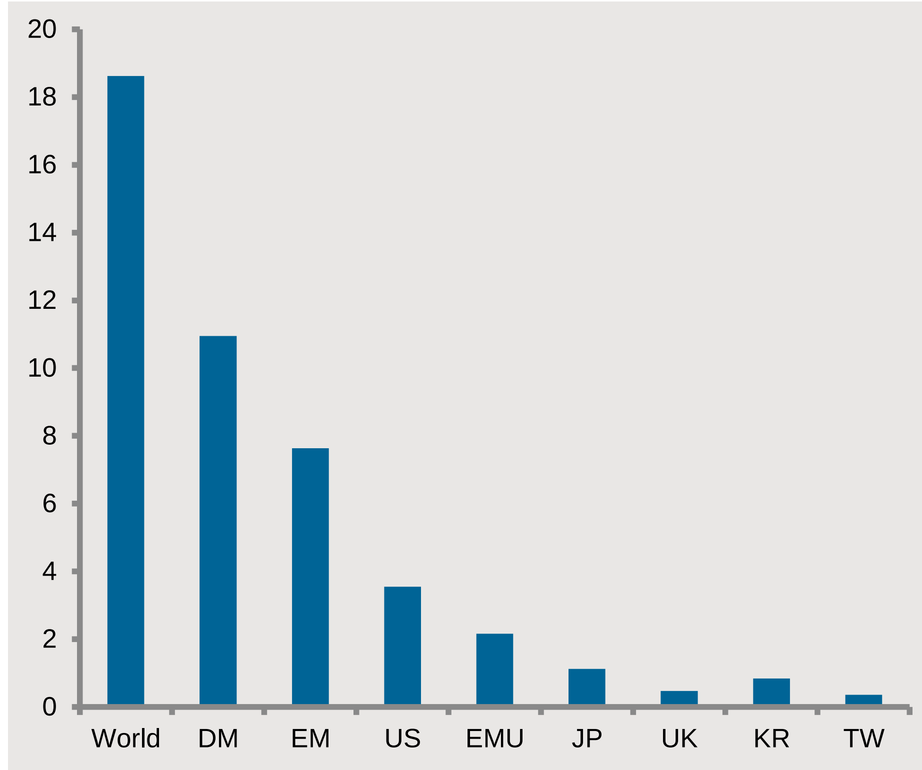
J.P.Morgan Asset Management

China in spotlight as already sluggish globalization may go into reverse

GL real GDP and export growth (% y/y)



China exports to major destinations (% of GDP)



Source: International Monetary Fund, Haver Analytics, JPMorgan Asset Management; data and forecasts as of September 30, 2018

J.P.Morgan Asset Management

J.P. Morgan’s 2019 Long-Term Capital Market Return Assumptions

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

		Compound Return 2019 (%)	Arithmetic Return 2019 (%)	Annualized Volatility (%)	Compound Return 2018 (%)	U.S. Cash	U.S. Intermediate Treasuries	U.S. Long Treasuries	TIPS	U.S. Aggregate Bonds	U.S. Short Duration Government/Credit	U.S. Long Duration Government/Credit	U.S. Inv Grade Corporate Bonds	U.S. Long Corporate Bonds	U.S. High Yield Bonds	U.S. Leveraged Loans	World Government Bonds hedged	World Government Bonds	World ex-U.S. Government Bonds hedged	World ex-U.S. Government Bonds	Emerging Markets Sovereign Debt	Emerging Markets Local Currency Debt	Emerging Markets Corporate Bonds	U.S. Muni 1-15 Yr Blend	U.S. Muni High Yield	U.S. Large Cap	U.S. Mid Cap	U.S. Small Cap	Euro Area Large Cap	Japanese Equity	Hong Kong Equity	UK Large Cap	EAFE Equity hedged	EAFE Equity	Emerging Markets Equity	AC Asia ex-Japan Equity	AC World Equity	U.S. Equity Value Factor	U.S. Equity Momentum Factor	U.S. Equity Quality Factor	U.S. Equity Minimum Volatility Factor	U.S. Equity Dividend Yield Factor	U.S. Equity Diversified Factor	Global Convertible	Global Credit Sensitive Convertible	Private Equity	U.S. Core Real Estate*	U.S. Value-Added Real Estate*	European ex-UK Core Real Estate*	Asia Pacific Core Real Estate*	U.S. REITs	Global Infrastructure Equity	Global Infrastructure Debt	Diversified Hedge Funds	Event Driven Hedge Funds	Long Bias Hedge Funds	Relative Value Hedge Funds	Macro Hedge Funds	Direct Lending*	Commodities*	Gold*
FIXED INCOME	U.S. Cash	2.00	2.00	0.50	2.00	1.00																																																							
	U.S. Intermediate Treasuries	3.25	3.31	3.50	3.00	0.22	1.00																																																					
	U.S. Long Treasuries	3.25	3.83	11.00	2.50	0.04	0.80	1.00																																																				
	TIPS	3.25	3.38	5.25	2.75	0.07	0.65	0.56	1.00																																																		
	U.S. Aggregate Bonds	4.00	4.06	3.50	3.25	0.09	0.81	0.82	0.77	1.00																																																
	U.S. Short Duration Government/Credit	3.25	3.27	2.00	3.50	0.39	0.76	0.45	0.66	0.75	1.00																																															
	U.S. Long Duration Government/Credit	4.00	4.41	9.25	3.25	-0.01	0.68	0.90	0.65	0.91	0.51	1.00																																													
	U.S. Inv Grade Corporate Bonds	4.50	4.67	6.00	3.50	-0.05	0.42	0.50	0.64	0.82	0.61	0.79	1.00																																												
	U.S. Long Corporate Bonds	4.50	4.97	10.00	3.75	-0.07	0.40	0.61	0.57	0.81	0.47	0.88	0.96	1.00																																											
	U.S. High Yield Bonds	5.50	5.82	8.25	5.25	-0.11	-0.25	-0.23	0.31	0.20	0.15	0.12	0.57	0.46	1.00																																										
	U.S. Leveraged Loans	5.00	5.27	7.50	5.00	-0.15	-0.50	-0.42	0.05	-0.07	-0.10	-0.10	0.32	0.24	0.79	1.00																																									
	World Government Bonds hedged	2.75	2.84	3.00	2.50	0.10	0.84	0.86	0.52	0.80	0.58	0.79	0.51	0.55	-0.19	-0.43	1.00																																								
	World Government Bonds	2.75	3.04	6.25	2.50	0.12	0.64	0.50	0.64	0.68	0.65	0.58	0.56	0.53	0.17	-0.14	0.57	1.00																																							
	World ex-U.S. Government Bonds hedged	2.50	2.61	2.75	2.25	0.07	0.70	0.75	0.42	0.70	0.49	0.71	0.48	0.52	-0.15	-0.36	0.97	0.50	1.00																																						
	World ex-U.S. Government Bonds	2.75	2.96	8.00	2.25	0.10	0.53	0.38	0.59	0.59	0.59	0.49	0.53	0.49	0.23	-0.07	0.47	0.99	0.41	1.00																																					
	Emerging Markets Sovereign Debt	6.25	6.67	9.50	5.25	-0.03	0.23	0.21	0.57	0.60	0.47	0.51	0.77	0.68	0.71	0.39	0.29	0.54	0.28	0.56	1.00																																				
	Emerging Markets Local Currency Debt	6.75	7.44	12.25	6.25	0.10	0.15	0.06	0.45	0.40	0.39	0.32	0.55	0.48	0.60	0.29	0.14	0.60	0.13	0.65	0.81	1.00																																			
	Emerging Markets Corporate Bonds	6.00	6.32	8.25	5.25	-0.08	0.10	0.07	0.50	0.52	0.45	0.41	0.78	0.67	0.74	0.53	0.13	0.43	0.14	0.45	0.89	0.72	1.00																																		
	U.S. Muni 1-15 Yr Blend	3.25	3.29	3.00	2.50	0.03	0.47	0.49	0.53	0.66	0.47	0.57	0.58	0.53	0.26	0.10	0.52	0.40	0.47	0.35	0.51	0.25	0.39	1.00																																	
	U.S. Muni High Yield	4.50	4.72	6.75	4.50	-0.12	-0.01	0.10	0.32	0.30	0.08	0.26	0.40	0.33	0.43	0.54	0.10	0.08	0.12	0.08	0.42	0.21	0.38	0.58	1.00																																
EQUITIES	U.S. Large Cap	5.25	6.03	13.75	5.50	-0.07	-0.31	-0.31	0.05	0.00	-0.05	-0.02	0.27	0.23	0.68	0.55	-0.25	0.14	-0.19	0.21	0.51	0.58	0.54	-0.01	0.19	1.00																															
	U.S. Mid Cap	5.75	6.79	15.75	5.75	-0.08	-0.33	-0.31	0.07	0.00	-0.05	-0.02	0.29	0.24	0.73	0.58	-0.26	0.11	-0.21	0.18	0.51	0.57	0.55	0.01	0.21	0.96	1.00																														
	U.S. Small Cap	6.00	7.47	18.25	5.75	-0.08	-0.36	-0.34	-0.02	-0.09	-0.11	-0.09	0.18	0.15	0.64	0.50	-0.29	0.03	-0.23	0.10	0.41	0.49	0.44	-0.07	0.09	0.90	0.95	1.00																													
	Euro Area Large Cap	7.00	9.03	21.50	6.75	0.02	-0.21	-0.26	0.14	0.08	0.11	0.03	0.36	0.29	0.69	0.49	-0.19	0.32	-0.15	0.39	0.61	0.69	0.60	0.04	0.16	0.85	0.82	0.74	1.00																												
	Japanese Equity	6.75	7.68	14.50	6.25	-0.09	-0.26	-0.19	0.11	0.07	0.03	0.09	0.38	0.34	0.60	0.46	-0.18	0.18	-0.14	0.24	0.48	0.56	0.54	-0.01	0.13	0.69	0.68	0.60	0.71	1.00																											
	Hong Kong Equity	6.75	8.50	20.00	6.50	0.03	-0.19	-0.20	0.20	0.16	0.16	0.10	0.47	0.39	0.68	0.54	-0.17	0.24	-0.14	0.30	0.64	0.68	0.67	0.14	0.29	0.68	0.67	0.56	0.72	0.63	1.00																										
	UK Large Cap	6.50	7.79	16.75	6.25	-0.02	-0.30	-0.32	0.12	0.05	0.04	0.01	0.38	0.31	0.72	0.62	-0.27	0.24	-0.22	0.32	0.59	0.64	0.62	0.04	0.28	0.85	0.82	0.72	0.90	0.70	0.76	1.00																									
	EAFE Equity hedged	6.50	7.41	13.50	6.25	-0.05	-0.39	-0.32	-0.03	-0.03	-0.08	-0.02	0.31	0.27	0.69	0.60	-0.27	-0.04	-0.19	0.02	0.51	0.52	0.56	-0.01	0.23	0.87	0.85	0.77	0.87	0.79	0.72	0.87	1.00																								
	EAFE Equity	6.75	7.94	16.75	6.25	-0.01	-0.25	-0.26	0.16	0.10	0.10	0.06	0.41	0.35	0.74	0.56	-0.21	0.31	-0.17	0.38	0.64	0.73	0.66	0.04	0.21	0.88	0.86	0.76	0.97	0.82	0.79	0.95	0.91	1.00																							
	Emerging Markets Equity	8.50	10.43	21.25	8.00	0.06	-0.19	-0.21	0.24	0.14	0.17	0.09	0.43	0.36	0.72	0.54	-0.17	0.33	-0.15	0.40	0.68	0.80	0.68	0.05	0.25	0.76	0.76	0.66	0.82	0.67	0.87	0.82	0.75	0.87	1.00																						
	AC Asia ex-Japan Equity	8.50	10.35	20.75	8.25	0.05	-0.18	-0.18	0.23	0.16	0.17	0.12	0.46	0.39	0.71	0.53	-0.14	0.30	-0.11	0.36	0.66	0.75	0.67	0.07	0.25	0.75	0.74	0.65	0.80	0.66	0.91	0.79	0.75	0.85	0.98	1.00																					
	AC World Equity	6.00	7.18	15.25	6.00	-0.02	-0.29	-0.29	0.13	0.06	0.05	0.03	0.37	0.32	0.75	0.58	-0.24	0.25	-0.19	0.33	0.62	0.71	0.64	0.02	0.22	0.95	0.93	0.84	0.93	0.77	0.80	0.93	0.91	0.97	0.89	0.87	1.00																				
	U.S. Equity Value Factor	6.00	7.04	15.00	-	-0.10	-0.32	-0.31	0.04	-0.02	-0.05	-0.04	0.26	0.22	0.69	0.54	-0.24	0.11	-0.19	0.18	0.49	0.56	0.52	-0.03	0.17	0.98	0.97	0.92	0.82	0.67	0.63	0.81	0.85	0.85	0.72	0.71	0.92	1.00																			
	U.S. Equity Momentum Factor	5.50	6.41	14.00	-	-0.06	-0.33	-0.31	0.08	-0.01	-0.06	-0.03	0.27	0.23	0.70	0.58	-0.28	0.11	-0.23	0.18	0.50	0.55	0.53	0.00	0.23	0.97	0.97	0.90	0.82	0.67	0.70	0.83	0.86	0.86	0.78	0.77	0.94	0.93	1.00																		
	U.S. Equity Quality Factor	5.25	5.98	12.50	-	-0.07	-0.28	-0.27	0.07	0.02	-0.03	0.00	0.28	0.24	0.67	0.52	-0.22	0.16	-0.16	0.22	0.52	0.59	0.54	0.01	0.18	0.99	0.96	0.91	0.83	0.66	0.67	0.83	0.85	0.86	0.75	0.73	0.94	0.97	0.97	1.00																	
	U.S. Equity Minimum Volatility Factor	5.50	6.07	11.00	-	-0.09	-0.21	-0.15	0.11	0.11	-0.01	0.10	0.34	0.31	0.67	0.51	-0.09	0.19	-0.03	0.25	0.56	0.60	0.53	0.10	0.24	0.93	0.92	0.86	0.77	0.61	0.62	0.77	0.80	0.81	0.69	0.68	0.88	0.93	0.92	0.95	1.00																
	U.S. Equity Dividend Yield Factor	6.00	6.87	13.75	-	-0.08	-0.24	-0.19	0.13	0.11	0.01	0.09	0.36	0.32	0.72	0.56	-0.14	0.18	-0.09	0.24	0.57	0.61	0.58	0.11	0.26	0.95	0.95	0.89	0.79	0.64	0.64	0.81	0.83	0.83	0.73	0.70	0.90	0.96	0.92	0.96	0.97	1.00															
	U.S. Equity Diversified Factor	5.50	6.23	12.50	-	-0.09	-0.29	-0.26	0.09	0.04	-0.03	0.02	0.31	0.27	0.71	0.56	-0.20	0.15	-0.14	0.21	0.54	0.59	0.56	0.05	0.22	0.98	0.98	0.91	0.82	0.67	0.67	0.82	0.85	0.86	0.75	0.73	0.93	0.97	0.97	0.98	0.97	0.97	1.00														
	Global Convertible	5.50	5.92	9.50	5.00	-0.05	-0.32	-0.30	0.13	0.08	0.08	0.04	0.45	0.36	0.81	0.67	-0.23	0.12	-0.17	0.19	0.63	0.60	0.70	0.08	0.30	0.86	0.88	0.78	0.86	0.74	0.79	0.86	0.89	0.89	0.84	0.84	0.91	0.84	0.87	0.84	0.78	0.82	0.85	1.00													
	Global Credit Sensitive Convertible	4.75	4.94	6.25	4.25	-0.07	-0.13	-0.20	-0.01	-0.02	-0.04	0.01	0.17	0.17	0.27	0.33	-0.10	0.08	-0.06	0.11	0.17	0.21	0.26	-0.03	0.21	0.36	0.33	0.28	0.38	0.30	0.31	0.43	0.40	0.40	0.29	0.28	0.39	0.31	0.35	0.33	0.29	0.31	0.32	0.38	1.00												
ALTERNATIVES	Private Equity	8.25	10.20	21.00	7.25	0.06	-0.53	-0.56	0.07	-0.27	-0.18	-0.34	0.19	0.02	0.69	0.66	-0.52	-0.07	-0.46	0.03	0.54	0.56	0.64	-0.08	0.44	0.74	0.76	0.69	0.75	0.53	0.74	0.82	0.71	0.78	0.83	0.79	0.80	0.70	0.76	0.72	0.64	0.67	0.73	0.80	0.28	1.00											
	U.S. Core Real Estate*	5.75	6.45	12.25	5.25	-0.07	-0.41	-0.32	0.06	-0.21	-0.30	-0.21	0.09	0.01	0.54	0.64	-0.38	-0.23	-0.35	-0.19	0.35	0.30	0.46	-0.23	0.57	0.56	0.57	0.54	0.39	0.41	0.37	0.52	0.48	0.46	0.44	0.42	0.52	0.57	0.54	0.54	0.59	0.57	0.57	0.42	0.32	0.49	1.00										
	U.S. Value-Added Real Estate*	7.75	9.53	20.00	6.50	-0.07	-0.41	-0.32	0.06	-0.21	-0.30	-0.21	0.09	0.01	0.54	0.64	-0.38	-0.23	-0.35	-0.19	0.35	0.30	0.46	-0.23	0.57	0.56	0.57	0.54	0.39	0.41	0.37	0.52	0.48	0.46	0.44	0.42	0.52	0.57	0.54	0.54	0.59	0.57	0.57	0.42	0.32	0.49	1.00	1.00									
	European ex-UK Core Real Estate*	6.50	7.74	16.50	5.75	0.03	-0.58	-0.55	0.08	-0.34	-0.26	-0.37	0.12	-0.03	0.64	0.66	-0.58	-0.08	-0.54	0.03	0.43	0.44	0.55	-0.18	0.46	0.61	0.65	0.56	0.68	0.51	0.55	0.77	0.60	0.71	0.71	0.65	0.70	0.58	0.64	0.60	0.51	0.57	0.61	0.70	0.23	0.86	0.56	0.56	1.00								
	Asia Pacific Core Real Estate*	6.00	6.91	14.00	5.50	0.07	-0.38	-0.32	0.31	-0.06	-0.12	-0.12	0.30	0.18	0.72	0.76	-0.38	0.02	-0.35	0.10	0.59	0.47	0.66	0.07	0.71	0.64	0.67	0.56	0.61	0.45	0.58	0.71	0.57	0.65	0.68	0.64	0.68	0.61	0.67	0.62	0.64	0.68	0.66	0.63	0.36	0.60	0.73	0.73	0.69	1.00							
	U.S. REITs	6.25	7.35	15.50	6.25	-0.07	0.00	0.06	0.22	0.29	0.10	0.27	0.44	0.42	0.61	0.35	0.11	0.29	0.13	0.31	0.55	0.57	0.46	0.22	0.24	0.72	0.76	0.73	0.63	0.51	0.47	0.58	0.62	0.65	0.54	0.54	0.69	0.75	0.70	0.74	0.81	0.81	0.76	0.61	0.17	0.44	0.65	0.65	0.40	0.66	1.00						
	Global Infrastructure Equity	6.00	6.64	11.75	6.25	-0.03	-0.20	-0.22	0.32	0.05	0.09	-0.01	0.40	0.26	0.50	0.46	-0.23	0.25	-0.23	0.31	0.51	0.43	0.55	0.12	0.30	0.40	0.40	0.27	0.49	0.41	0.57	0.57	0.35	0.53	0.59	0.55	0.51	0.32	0.43	0.36	0.26	0.32	0.36	0.51	0.10	0.59	0.32	0.32	0.61	0.41	0.21	1.00					
	Global Infrastructure Debt	4.75	4.95	6.50	4.25	-0.06	0.44	0.55	0.67	0.81	0.58	0.78	0.92	0.88	0.47	0.31	0.53	0.48	0.50	0.43	0.66	0.38	0.67	0.62	0.44	0.08	0.11	0.00	0.15	0.19	0.32	0.20	0.13	0.21	0.26	0.29	0.17	0.08	0.10	0.10	0.18	0.19	0.14	0.29	0.09	0.27	0.27	0.27	0.26	0.50	0.25	0.38	1.00				
	Diversified Hedge Funds	4.25	4.52	7.50	4.25	0.07	-0.41	-0.36	0.06	-0.10	-0.08	-0.09	0.22	0.17	0.59	0.64	-0.36	-0.04	-0.30	0.03	0.35	0.38	0.42	-0.06	0.36	0.66	0.68	0.57	0.65	0.60	0.63	0.73	0.73	0.71	0.69	0.66	0.73	0.61	0.73	0.64	0.57	0.59	0.65	0.78	0.41	0.81	0.50	0.50	0.74	0.65	0.32	0.49	0.15	1.00			
	Event Driven Hedge Funds	4.75	5.13	9.00	4.75	-0.02	-0.45	-0.46	0.05	-0.11	-0.06	-0.14	0.27	0.19	0.76	0.76	-0.42	0.02	-0.36	0.10	0.46	0.51	0.57	-0.06	0.37	0.79	0.82	0.75	0.75	0.65	0.68	0.83	0.80	0.81	0.77	0.74	0.84	0.78	0.81	0.77	0.69	0.75	0.78	0.86	0.50	0.81	0.59	0.59	0.75	0.70	0.50	0.43	0.15	0.87	1.00		
	Long Bias Hedge Funds	4.75	5.32	11.00	4.75	-0.01	-0.41	-0.43	0.08	-0.07	-0.02	-0.11	0.30	0.22	0.74	0.66	-0.39	0.11	-0.33	0.19	0.52	0.60	0.60	-0.07	0.28	0.86	0.88	0.80	0.83	0.73	0.81	0.87	0.85	0.89	0.88	0.86	0.93	0.83	0.90	0.84	0.75	0.80	0.85	0.92	0.40	0.83	0.48	0.48	0.72	0.65	0.53	0.52	0.13	0.87	0.93	1.00	
	Relative Value Hedge Funds	4.50	4.73	7.00	4.50	-0.03	-0.40	-0.38	0.16	0.02	0.03	-0.04	0.40	0.30	0.83	0.85	-0.35	0.01	-0.30	0.08	0.55	0.52	0.63	0.07	0.49	0.68	0.71	0.61	0.67	0.62	0.71	0.77	0.74	0.75	0.75	0.72	0.76	0.67	0.71	0.65	0.62	0.67	0.68	0.84	0.42	0.79	0.59	0.59	0.72	0.74	0.43	0.49	0.33	0.84	0.92	0.86	1.00				
	Macro Hedge Funds	3.75	4.06	8.00	3.75	0.16	0.11	0.10	0.26	0.19	0.26	0.19	0.27	0.25	0.17	0.06	0.16	0.31	0.17	0.32	0.23	0.31	0.21	0.10	0.13	0.23	0.22	0.12	0.29	0.25	0.29	0.32	0.24	0.33	0.38	0.35	0.32	0.17	0.28	0.24	0.22	0.21	0.23	0.32	0.13	0.28	-0.09	-0.09	0.20	0.06	0.14	0.25	0.22	0.56	0.30	0.38	0.30	1.00			
	Direct Lending*	7.25	8.14	14.00	7.00	-0.08	0.29	0.37	0.60	0.74	0.54	0.70	0.97	0.91	0.68	0.47	0.39	0.48	0.38	0.46	0.78	0.56	0.81	0.57	0.45	0.31	0.35	0.24	0.38	0.40	0.52	0.42	0.35	0.45	0.48	0.50	0.42	0.31	0.33	0.32	0.38	0.41	0.36	0.52	0.18	0.38	0.35	0.35	0.33	0.56	0.45	0.45	0.93	0.30	0.37	0.38	0.52	0.25	1.00		
	Commodities*	2.25	3.50	16.25	3.75	0.08	-0.11	-0.23	0.27	0.05	0.17	-0.01	0.24	0.17	0.45	0.37	-0.24	0.34	-0.26	0.40	0.37	0.51	0.41	-0.09	0.12	0.44	0.46	0.37	0.47	0.35	0.48	0.59	0.34	0.53	0.60	0.52	0.54	0.40	0.48	0.42	0.36	0.42	0.42	0.47	0.27	0.61	0.41	0.41	0.62	0.62	0.24	0.55	0.13	0.53	0.57	0.61	0.54	0.42	0.26	1.00	
	Gold*	2.50	4.02	18.00	4.00	0.07	0.37	0.27	0.49	0.41	0.41	0.32	0.37	0.30	0.11	-0.08	0.25	0.53	0.19	0.52	0.36	0.40	0.33	0.25	0.10	-0.02	0.00	-0.05	0.07	-0.01	0.23	0.10	-0.13	0.09	0.24	0.19	0.08	-0.04	0.02	0.01	0.02	0.02	0.00	0.09	0.00	0.09	-0.03	-0.03	0.03	0.21	0.05	0.20	0.37	0.11	0.06	0.14	0.09	0.41	0.34	0.45	1.00

Source: J.P. Morgan Asset Management; as of September 30, 2018. Alternative asset classes (including hedge funds, private equity, real estate, direct lending and infrastructure) are unlike other asset categories shown above in that there is no underlying investible index. ** For additional disclosures, please turn to the additional information slide located in the back of the book.

J.P.Morgan
Asset Management

Biographies

Ben Mandel

Benjamin R. Mandel, executive director, is an economist in Multi-Asset Solutions, based in New York. As a member of the Global Multi-Asset Strategy team, he formulates tactical asset allocation views based on analysis of the global economy. He is also currently an adjunct professor at Columbia University's School of International and Public Affairs. Ben began his career as an economist in the International Finance division at the Federal Reserve Board and later moved to the International Research group at the Federal Reserve Bank of New York. Prior to joining J.P. Morgan, he was a member of the Global Economics team at Citi Research. Ben's academic research has been published in leading scholarly journals, including: American Economic Review, American Economic Journal: Macroeconomics, American Economic Journal: Economic Policy, Quantitative Finance and the Journal of Economic Perspectives. He has held adjunct faculty positions at NYU Stern School of Business and Georgetown University, as well as various consultancy roles for the World Bank. Ben holds a Ph.D. in Economics from the University of California, Davis and a B.Sc. in Applied Economics from Cornell University.

Michael Buchenholz

Michael Buchenholz, CFA, FSA, executive director, is Head of U.S. Pension Strategy in the Institutional Solutions Strategy & Analytics team, helping pension funds design and implement asset allocations that achieve their specific objectives. Prior to his current role, Michael was a Client Portfolio Manager in Fixed Income Global LDI Solutions, responsible for combining fixed income views and actuarial and accounting considerations in order to design customized investment strategies for corporate pension plans. An employee since 2013, he previously held roles as an actuary in Mercer's Financial Strategy and Retirement Groups. Michael holds a B.S.B.A. in mathematics (probability and statistics) and finance from Washington University and an M.B.A. in finance and economics from Columbia University. He is a Fellow of the Society of Actuaries (FSA), a Chartered Enterprise Risk Analyst (CERA), and a CFA charterholder.

Lara Clarke

Lara Clarke, managing director, is a Client Advisor within J.P. Morgan Asset Management. Lara oversees client and business development efforts and provides tailored investment solutions serving U.S. institutional investors across public and corporate pension plans. Previously, Lara was Director of Marketing and Business Development for Los Angeles Capital Management, an institutional equity investment manager focused on creating customized solutions to meet client specific needs. She led the firm's marketing strategy for the public pension, corporate plan sponsor, endowment/foundation, and consultant community in the West and Midwest regions. Prior to LA Capital, she was in sales and relationship management with StarMine Corporation, a quantitative equity analytics company and at Thomson Financial (Baseline), she was responsible for client service and business development. Lara is also the Co-Founder and Co-President of Women in Institutional Investments Network (WIIIN), a 501(c)(3) non-profit organization focused on creating a community for women in institutional investments in Southern California through educational and philanthropic events. Lara received a B.S. in Finance and International Business from Pennsylvania State University and M.B.A. from the UCLA Anderson School of Management. She holds the FINRA Series 7, 63 and NFA Series 3 licenses.

J.P.Morgan Asset Management

J.P. Morgan Asset Management – Risks & Disclosures

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Internal Asset Management

Board of Investments Offsite

July 1, 2019

Ted Wright – Principal Investment Officer

Michael Viteri – Senior Pubic Equity Investment Officer, Oregon State Treasury

Rich Eggett – Portfolio Manager, Utah State Retirement Systems

LOS ANGELES COUNTY EMPLOYEES RETIREMENT ASSOCIATION

Review of Findings To Date

Potential Benefits:

- Lower management costs
- Increased transparency/ beneficial ownership rights
- Greater control over investment portfolio
- Enhanced investment culture

Potential Challenges:

- Increased tracking error
- Governance considerations (authority, liability)
- Additional compliance, operations, and reporting requirements
- Up front fixed cost investment
- Headline risk

Conclusions:

- Advantages and disadvantages
- Multiple mandates may reduce costs
- Typical implementation trajectory: simple to complex
- Variety in complexity of architecture
- Considerable infrastructure resident at LACERA
- Continue methodical evaluation

Speaker Biographies

Michael Viteri

Michael Viteri is the Senior Public Equity Investment Officer for Oregon State Treasury (OST). Michael joined OST in 2008 and created the internally managed equity program requiring the acquisition and integration of infrastructure governing portfolio management, order management, trading, settlement, and risk management. Current duties involve leading a staff of investment professionals on the oversight of the $28 billion OPERF Global Equity portfolio, the $2.2 billion Oregon Savings Growth Plan, and the $1.7 billion Common School Fund in addition to directing the management of five internally managed U.S. and global equity portfolios valued at $8 billion.

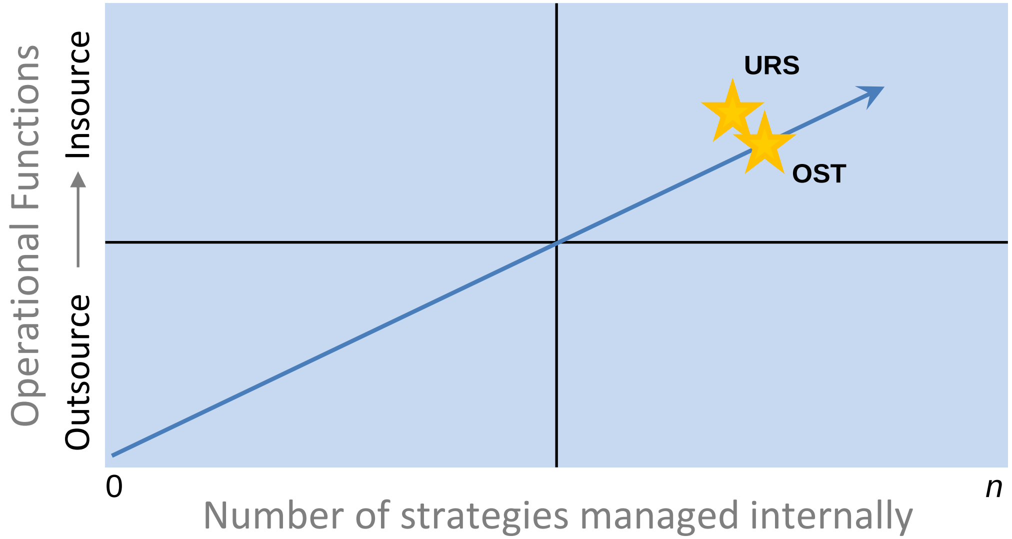
Rich Eggett

Rich Eggett is a Portfolio Manager in Investments for Utah State Retirement Systems (URS). Having joined Utah Retirement Systems in 2006, Rich is currently a portfolio manager with responsibility for long-only equity and absolute return strategies. Within Public Equity, he is responsible for portfolio construction, external manager selection and monitoring, and implementation of internal strategies. Rich is a member of the FTSE Russell Americas Regional Equity Advisory Committee and also part of the working group for Open Protocol Enabling Risk Aggregation. He is a CFA and CAIA charterholder and has served in leadership positions with the CFA Society Salt Lake City.

Discussion Items

- Pros and Cons of Internal Management
- Development and Implementation Considerations – trends exist but one size doesn't fit all

Example: positive correlation between insourcing of operations and number of strategies managed



- Other Benefits and Challenges

Building Capacity – Internal Management

Through benchmarking an aggregation of pension funds across the globe, research shows that internally-managed assets, over the long term, produce cost savings and improved investment returns. Overall staffing levels tend to increase, but the investment management costs are reduced.

-CEM

OST Internally Managed Public Equity

Value Added (period ending 5/30/19)

Period Ending 5/30/19	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
OST 400 Portfolio	**$ 653,001,959.80**	**-7.946%**	**-4.83%**	**9.69%**	**-5.17%**	**8.69%**	**7.59%**	**12.48%**
S&P 400 Index		-7.971%	-4.82%	9.60%	-5.44%	8.37%	7.31%	12.18%
Excess		**0.03%**	**-0.02%**	**0.09%**	**0.26%**	**0.32%**	**0.28%**	**0.30%**
Inception Date of Oct. 1, 2009	**Tracking Error = 30 bps**	**Target Excess Return: 10 bps**						

Period Ending 5/30/19	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
OST 500 Portfolio	**$ 2,445,075,687.98**	**-6.362%**	**-0.64%**	**10.79%**	**3.89%**	**11.78%**	**9.72%**	**12.79%**
S&P 500 Index		-6.355%	-0.67%	10.74%	3.78%	11.72%	9.66%	12.73%
Excess		**-0.01%**	**0.03%**	**0.06%**	**0.11%**	**0.05%**	**0.05%**	**0.06%**
Inception Date of Oct 1, 2009	**Tracking Error = 10 bps**	**Target Excess Return: 5 bps**						

Period Ending 5/30/19	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
RU2000/ S&P 600	**$ 274,989,108.65**	**-8.644%**	**-8.01%**	**6.19%**	**-11.89%**	**8.84%**	**6.62%**	**10.60%**
Russell 2000/S&P 600 Index		-8.728%	-8.35%	5.81%	-11.92%	8.58%	6.03%	9.86%
Excess		**0.08%**	**0.34%**	**0.38%**	**0.02%**	**0.26%**	**0.59%**	**0.74%**
Inception Date of April 1, 2010	**Tracking Error = 50 bps**	**Target Excess Return: 30 bps**						

Period Ending 5/30/19	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
RISK PREMIA	**$ 2,925,860,814.10**	**-6.607%**	**-2.11%**	**9.64%**	**-0.14%**	**12.54%**	**10.64%**	**10.59%**
MSCI Risk Premia Index		*-6.615%*	*-2.14%*	*9.53%*	*-0.32%*	*12.57%*	*10.67%*	*10.61%*
MSCI USA		-6.320%	-0.76%	10.99%	3.71%	11.76%	9.56%	9.76%
Excess		**-0.29%**	**-1.35%**	**-1.35%**	**-3.86%**	**0.78%**	**1.08%**	**0.83%**
Inception Date of Jan 1, 2014	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**						

Period Ending 5/30/19	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
INT'L RISK PREMIA	**$ 769,819,019.32**	**-2.175%**	**0.082%**	**9.79%**	**-3.01%**			**1.81%**
MSCI INT'L Risk Premia Index		*-2.201%*	*-0.160%*	*9.50%*	*-3.36%*			*1.56%*
MSCI WORLD X-US		-4.730%	-1.534%	8.21%	-5.45%			1.16%
Excess		**2.555%**	**1.616%**	**1.578%**	**2.434%**			**0.654%**
Inception Date of Jun 1, 2017	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**						

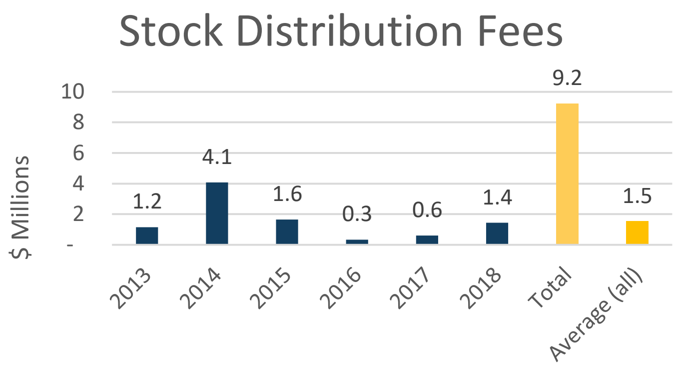
Period Ending 9/30/15	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
TEMS	**$ 180,449,700**	**-3.871%**	**-16.49%**	**-16.55%**	**-22.43%**	**-6.42%**	**-4.08%**	**9.01%**
MSCI EM Index		-3.008%	-17.90%	-15.48%	-19.28%	-5.27%	-3.58%	8.87%
Excess		**-0.86%**	**1.41%**	**-1.07%**	**-3.15%**	**-1.15%**	**-0.51%**	**0.14%**
Inception Date of Feb 1, 2009	**Tracking Error = 400 bps**	**Target Excess Return: 200 bps**	**TERMINATED SEPTEMBER 30, 2015**					

Period Ending 8/31/16	Market Value	Month	3 Months	YTD	1 year	3 years	5 years	Inception
RUSSELL RAFI LC	**$ 1,371,571,346**	**-0.045%**	**4.04%**	**10.27%**	**13.81%**	**11.23%**	**N/A**	**14.65%**
RAFI LC Index		*-0.040%*	*3.97%*	*10.06%*	*13.54%*	*11.21%*	*N/A*	*14.62%*
RUSSELL 1000		**0.133%**	**4.18%**	**7.83%**	**11.69%**	**12.02%**	**N/A**	**14.46%**
Excess		**-0.18%**	**-0.14%**	**2.43%**	**2.11%**	**-0.79%**	**N/A**	**0.19%**
Inception Date of Nov 1, 2011	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**	**TERMINATED AUGUST 31, 2016**					

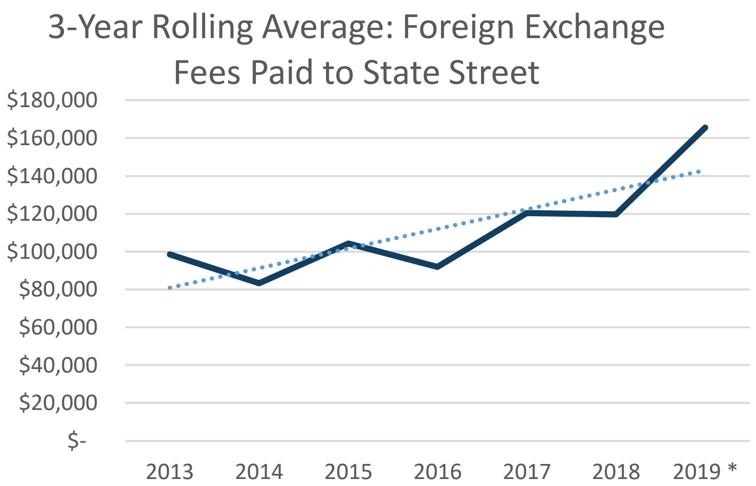
OREGON STATE TREASURY

Bringing Other Equity Related Functions In-House:
-Stock Distributions
-Foreign Exchange

Since 2013, fees for management of stock distributions have ranged from $0.3 million to $4.1 million per year.



While YoY variance is significant, the 3-year rolling average shows a notable upward trend (despite 2016 being a low outlier).



OREGON STATE TREASURY

Los Angeles County Employees Retirement Association

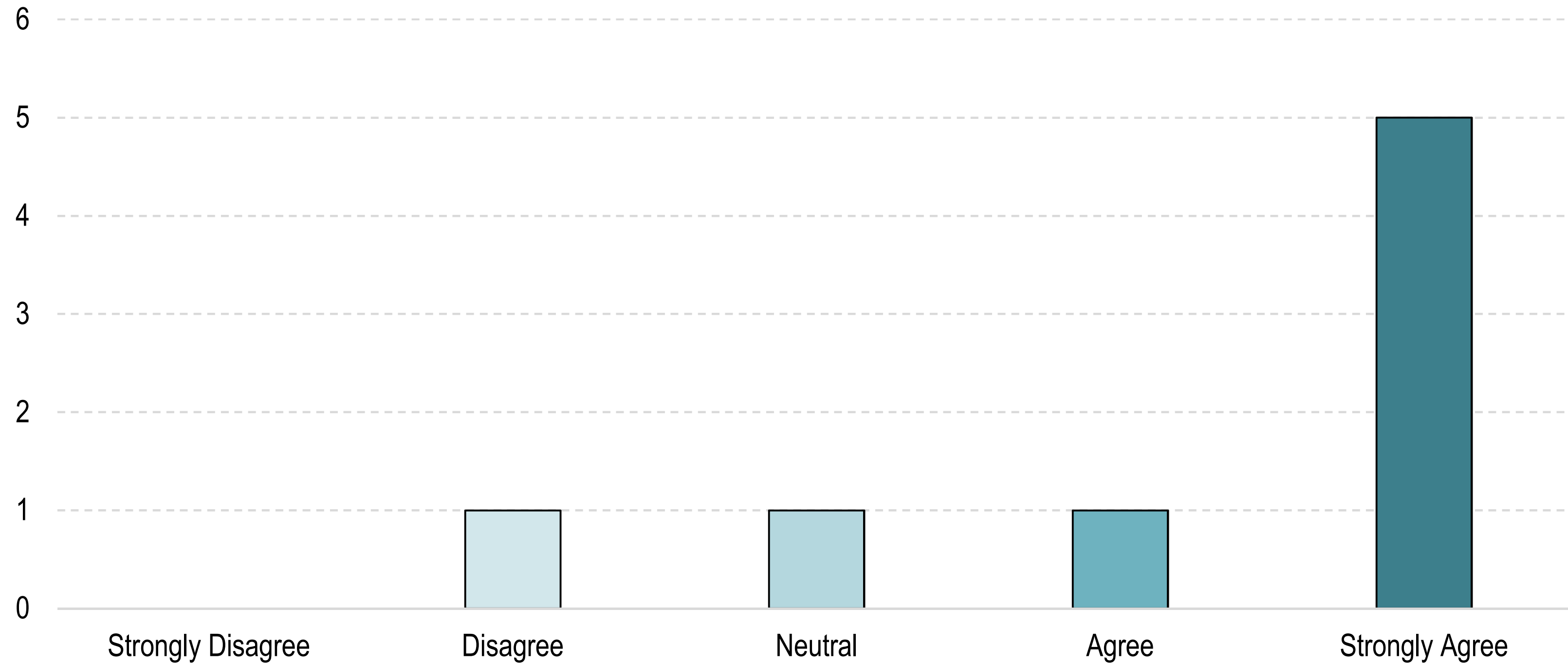
BOI Standing Committee Review
July 2019 Offsite

Leandro A. Festino
Alina Yuan

Background

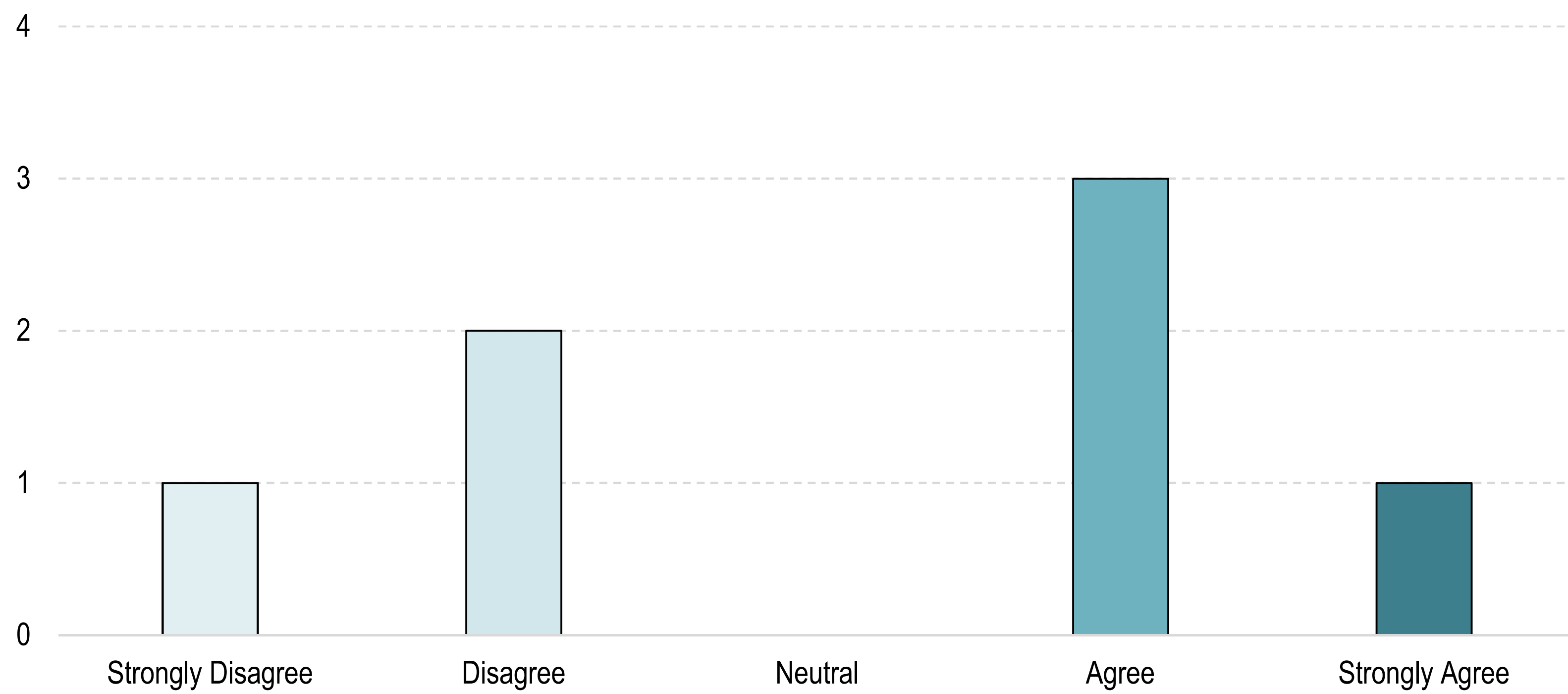
- In May of 2019, the BOI was asked to complete a brief survey.
- The purpose of the survey was to solicit feedback to review and enhance the effectiveness of the BOI Standing Committees.
- The survey focused on BOI-only Committees: (i) Corporate Governance; (ii) Credit and Risk Mitigation; (iii) Equity: Public/Private; and (iv) Real Assets.
- Today, we will review the survey results, and facilitate a discussion regarding the effectiveness, structure, goals, and meeting times of the Standing Committees.
- 8 Trustees participated in the survey.

Q1: Standing Committees Enhance Board Effectiveness



- There is a *strong consensus* that the Standing Committees serve a valuable purpose and are worth maintaining.

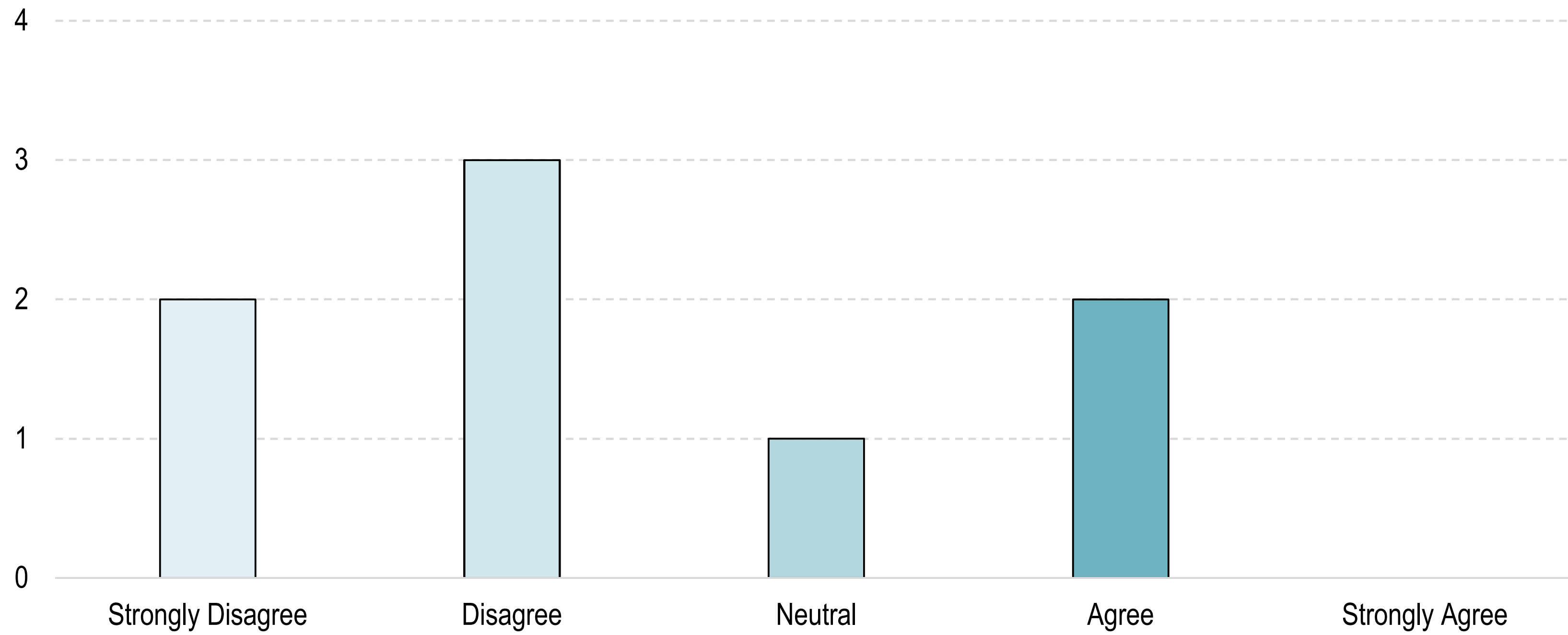
Q2: Standing Committees are Structured Appropriately



- The Board has a fairly mixed view of the Standing Committee structure.

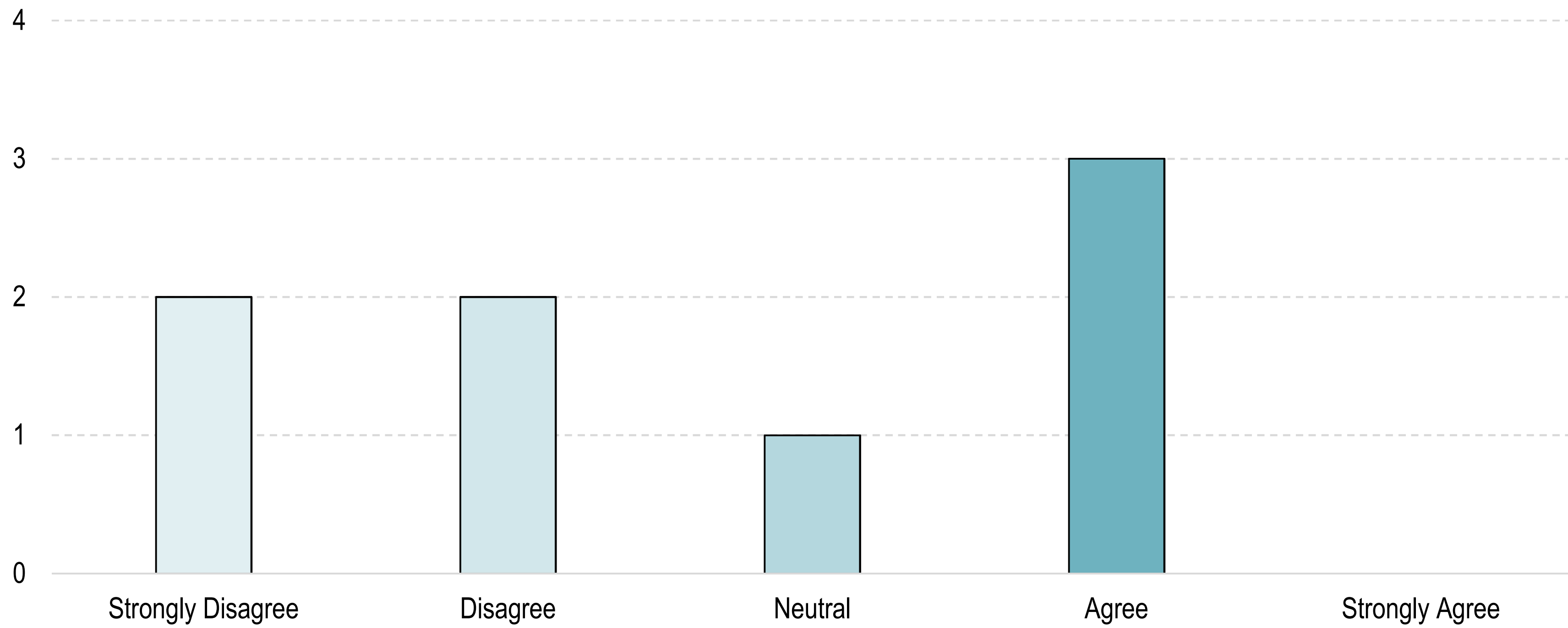
[1] 7 responders answered, 1 responder skipped the question.

Q3: The Primary Goal of the Committee is Special Reports and Education



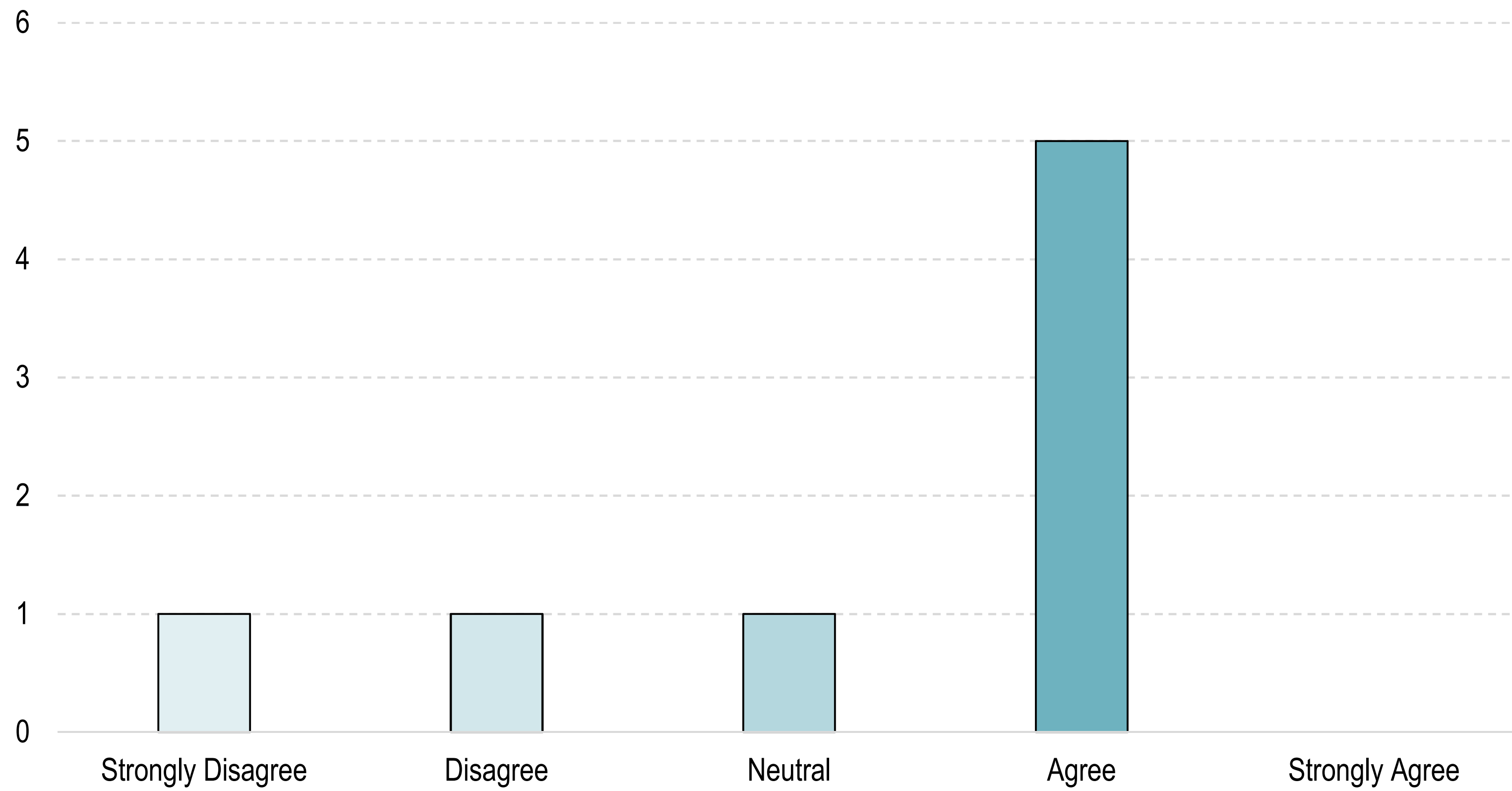
- There is consensus that the primary goal of the Committees stretches beyond special reports and education, including making policy recommendations.

Q4: The Primary Goal of the Committee is RFP/RFI Processes



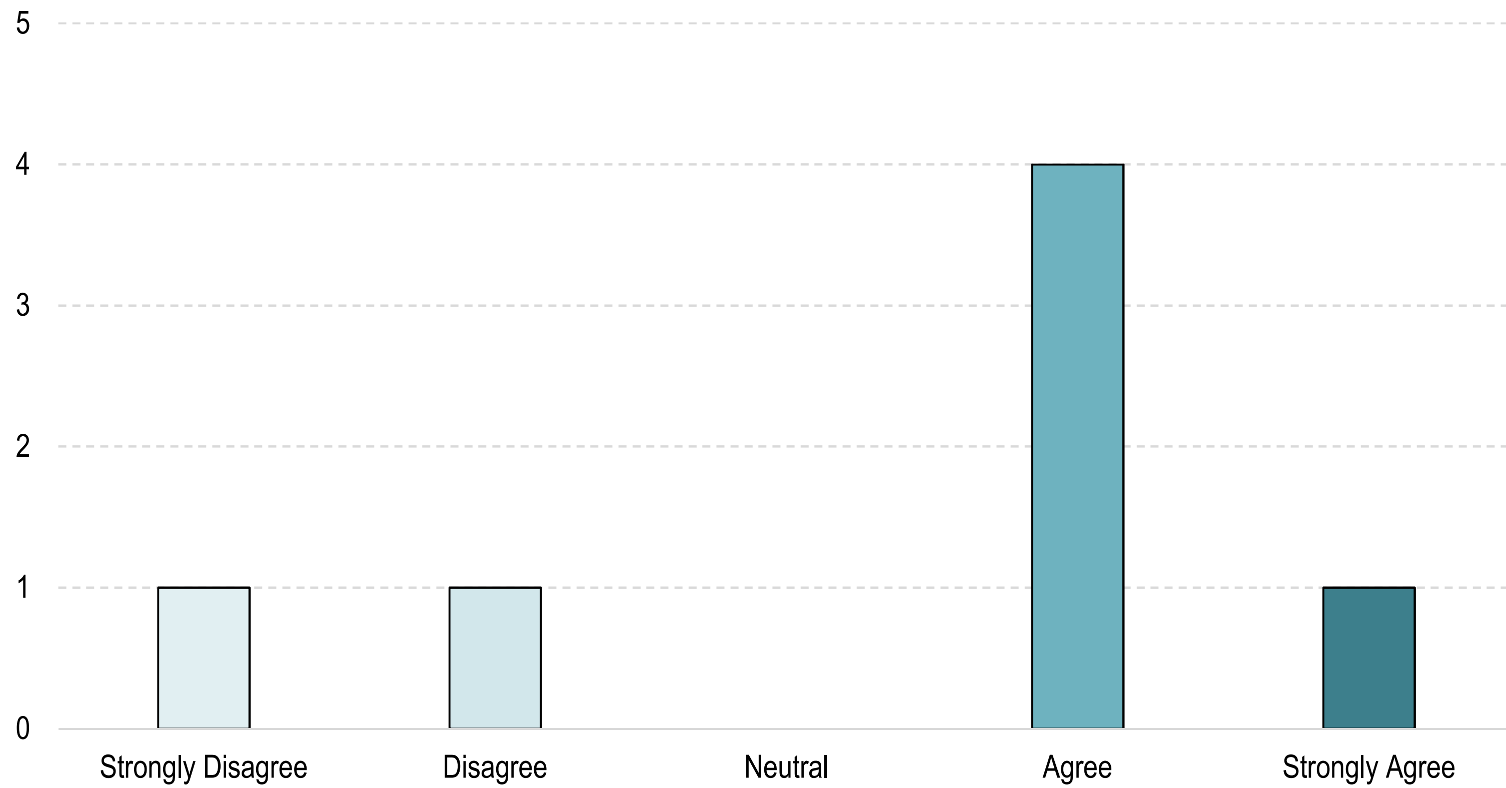
- The Board has a fairly mixed view regarding the primary goal of the Committee being RFP/RFI Processes.

Q5: The Primary Goal of the Committee is Structure and Investment Plan Reviews



- There is a *strong consensus* that the primary goal of the Committee is Structure and Investment Plan reviews.

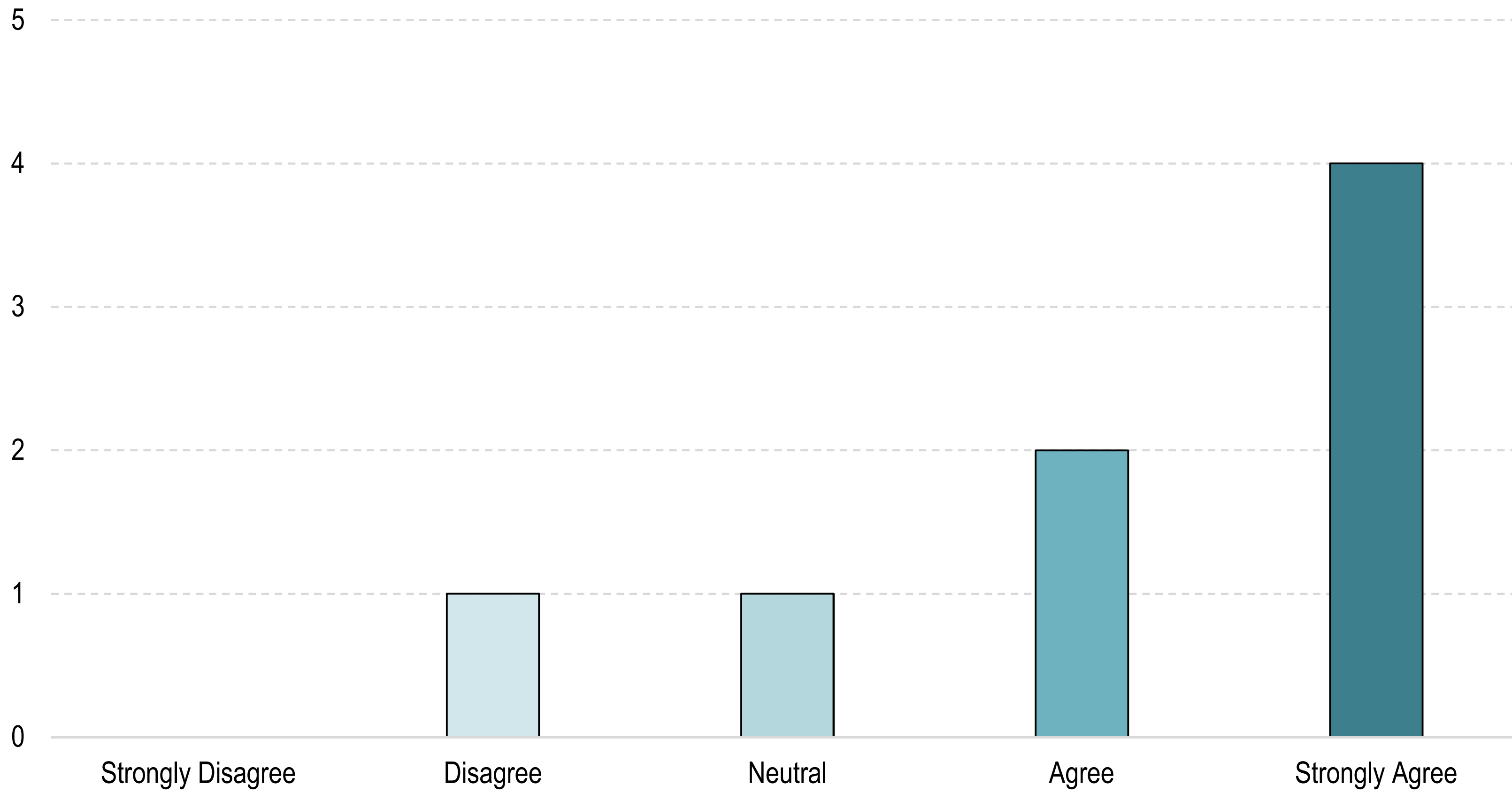
Q6: The Primary Goal of the Committee is Corporate Governance Oversight (Governance Committee)



- Related to the CG Committee, there is a *strong consensus* that the primary goal of the Committee is Corporate Governance oversight.

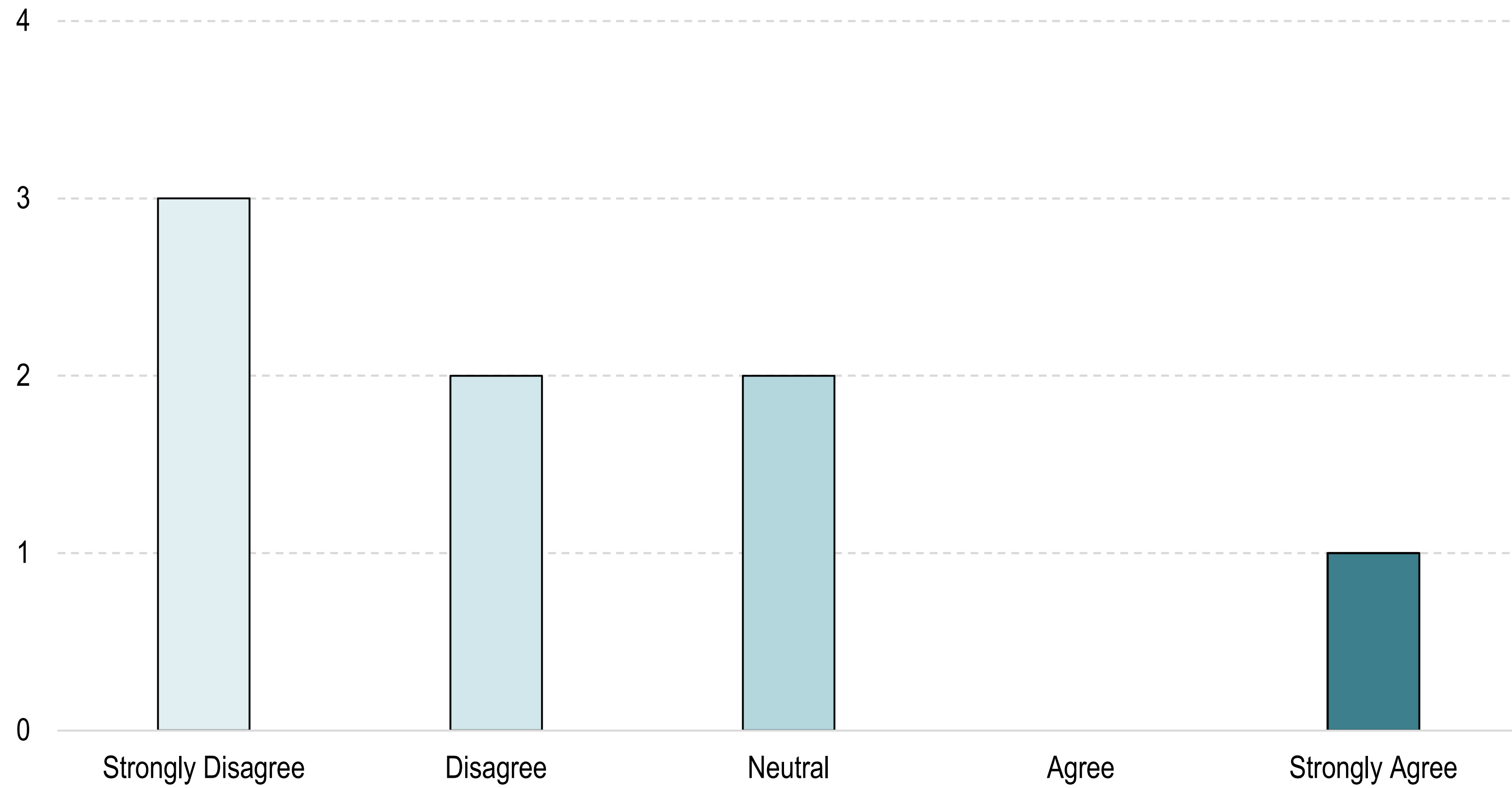
[1] 7 responders answered, 1 responder skipped the question.

Q7: I Prefer Committee Meetings Scheduled Before the Board Meeting



- There is a *strong consensus* that Committee meetings should be scheduled before Board meetings.

Q8: I Prefer Committee Meetings Scheduled After the Board Meeting



- Similarly, there is a *strong consensus* that Committee meetings after Board meetings are undesirable.

Summary

- In conclusion, most Trustees believe the Standing Committees enhance Board effectiveness.
- Furthermore, it is clear that for most Trustees, Committees serve multiple roles, with one of the most important being Policy, Structure, and Plan Reviews.
- Finally, there is strong consensus that Trustees prefer Committee meetings to be scheduled before Board meetings.
- In terms of future work, Trustees' feedback points to addressing, and possibly revising, the Structure of the Standing Committees.

LA County Employees Retirement Association

Board of Investments Offsite

Cybersecurity in Investment Management

July 2019

Cybersecurity Overview

Cybersecurity is not the only Technology / Information Risk

Technology, Operational and Information Risks

- Management & Governance
- High Risk / Major Projects
- Capacity Management
- Information Security
- Business Continuity Planning
- Operations Risk Management
- Vendor Management
- Systems Development

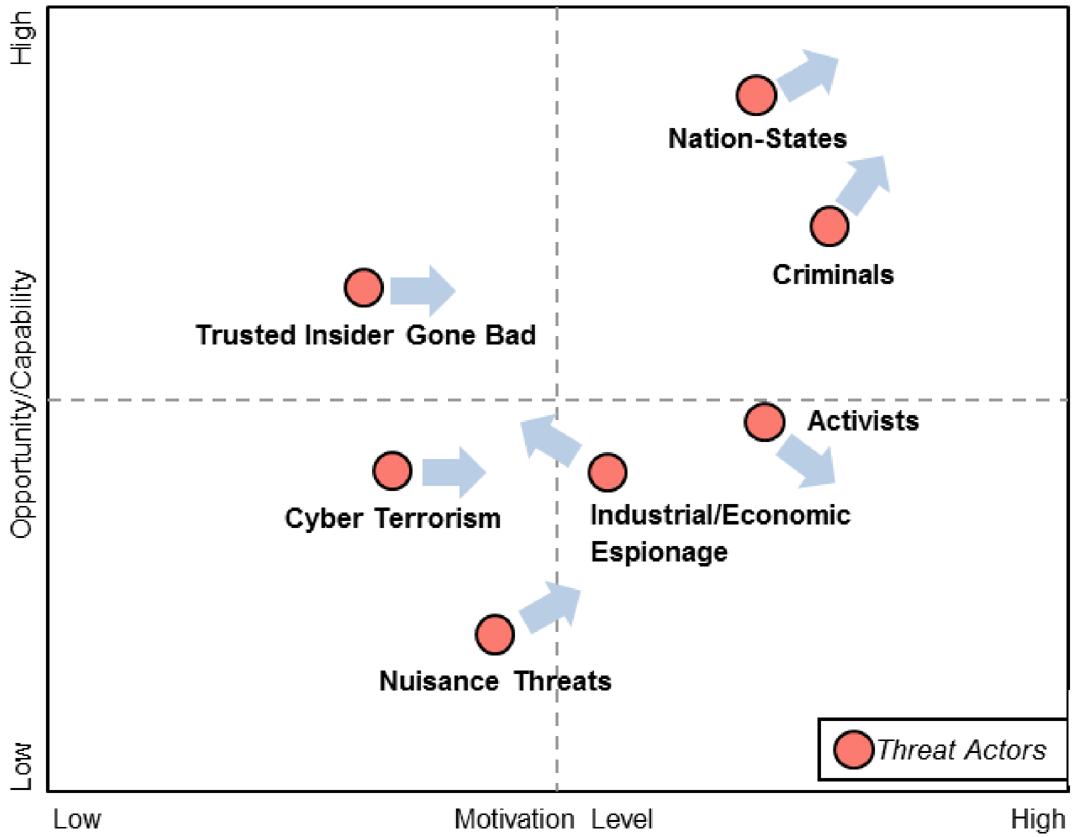
Protecting the confidentiality, integrity, and availability of data, systems, and processing capability against inside / outside threats – in any environment [on premise, vendor or cloud]. Specifically:

- Stopping malicious software and intrusions on our network and systems
- Protecting our infrastructure and Internet/mobile applications from attack
- Locking down our environment to reduce the risk of data theft
- Driving protection on mobile and remote working for employee flexibility
- Implementing controls programs to help business units manage identity, access, and data flow (inside and outside)
- Embedding controls in software, hardware, and processes across the organization and beyond (customers, supply chain, counterparties)
- Analyzing threat intelligence (public, private, and classified) and hunting for and responding to attacks
- Balancing risks and controls to support clients, business goals, and commercial objectives

Cyber Security : subset of Information Security defending against external threats or coerced insider threats

Cyber Threat Landscape

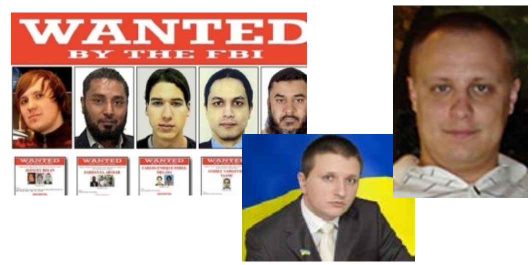
Omnipresent and Increasing Nation-state and Organized Criminal Threats



- **Design controls to defend against a wide array of threats, constantly adjust/upgrade as threats evolve**
- **Hard to defend against sophisticated adversaries targeting organizations uniquely with new attacks or using trusted insiders**
- **Accordingly, work not only to prevent attacks, but also to detect, contain and recover from them**
- **Ongoing militarization of cyber-space represents significant current and future concern – asymmetric geopolitical response of cyber-threats**
- **Inherent risk is increasing all the time as more services and markets are digitized/connected. New technologies are adopted and proliferate ahead of the market's ability to secure them**
- **The boundaries between threats are often blurred as nation-states use criminal groups for capabilities or cover**

Cyber Threat Actors

Attackers Have Bosses and Budgets Too



	Nation State	Organized Crime	Activists
Motivation / Methods	▪ Political and economic espionage using targeted malware / hacking ▪ Disruption and data destruction ▪ State-sponsored financial crime ▪ State-sponsored ransomware	▪ Identity theft, illicit funds transfer, extortion and many forms of financial crime ▪ Multiple methods from ransomware, spyware / hacking to supply chain attack	▪ Political or cause-based ▪ Tactics center around embarrassing targets through hacking or data leakage
Capability Assessment	▪ Huge investments by most nations in cyber offense and defense ▪ Capabilities and activities continue to increase along with capability of collateral damage	▪ Significant levels of R&D in new attacks ▪ Deep and liquid markets for stolen data, credentials and attack code ▪ Mercenaries for nation states	▪ Significantly diminished activity due to law enforcement action but potential for resurgence is always present
Example Events	▪ 200+ companies targeted in multiple espionage actions ▪ Denial of Service attacks against the US financial sector ▪ SWIFT-connected systems breaches / illicit funds transfer	▪ Payments fraud ▪ Identity theft and credit/debit card attacks – phishing and hacking ▪ Bank/broker account hijack ▪ Ransomware ▪ Denial of service extortion	▪ Denial of Service targeting ▪ Constant hunt for personal data and e-mails of potential targets

Perpetual Cybersecurity Mitigation Programs

Constant Vigilance and Broad Business Integration

HARBINGER

Threat Intelligence

Analysis of public, private and classified intelligence to thwart or avoid attacks

HUNTER

Detection & Surveillance

Detecting incidents, hunting for attacks and attackers on the network

STRONGHOLD

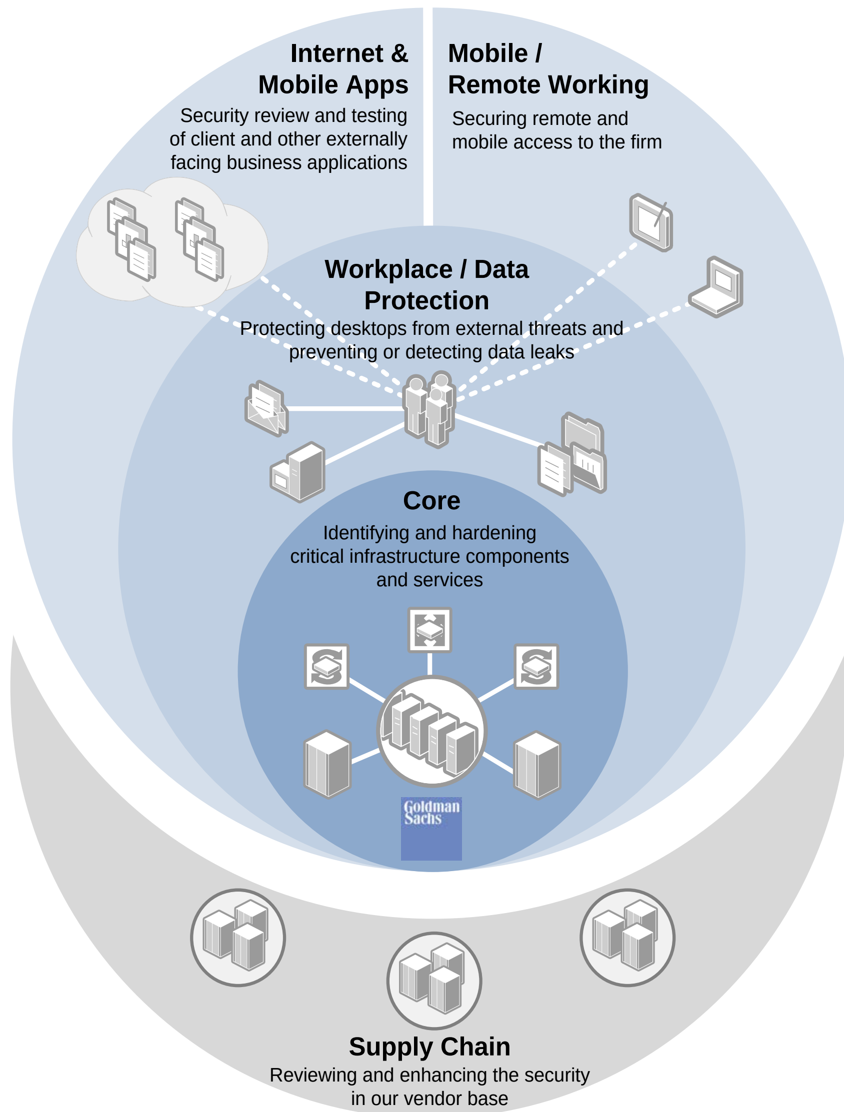
Prevention

Continual increase in defensive controls informed by threat intelligence and events

RADAR

Continuous Assessment

Modeling and continually measuring key risks and controls and identifying potential control incidents



Cybersecurity Mitigation Strategy

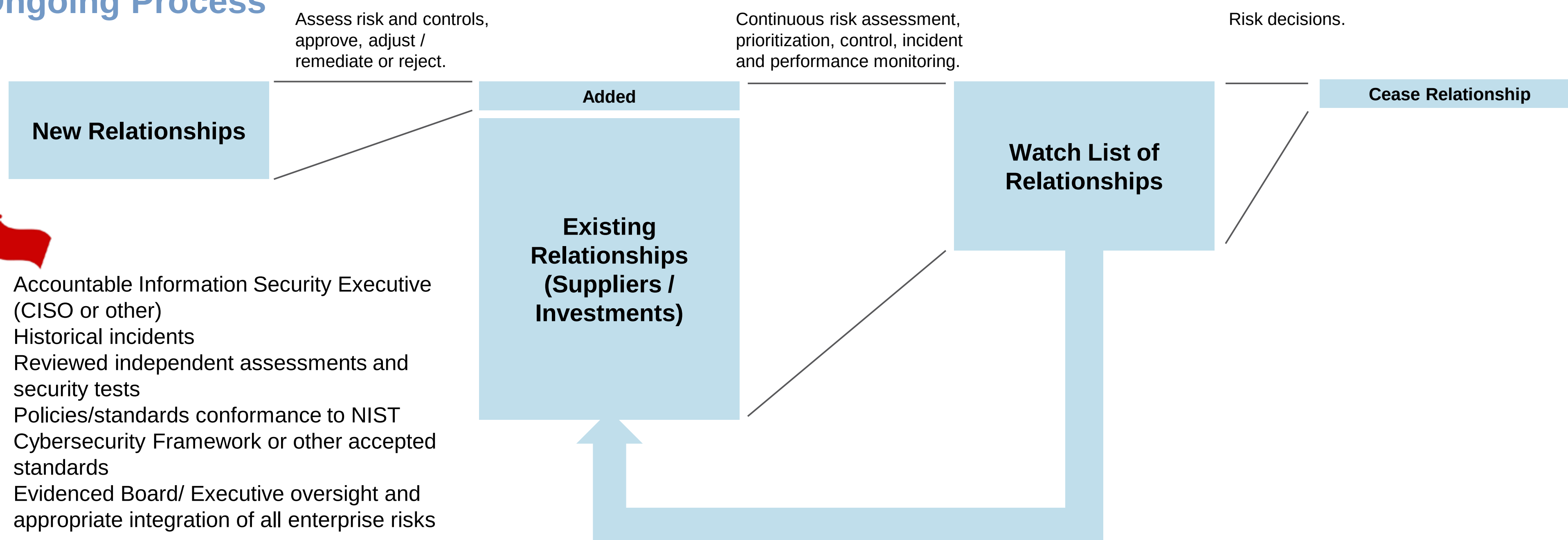
Maximize Safe Use of Digital Assets and Maintain Freedom to Operate

A. Increase Risk Transparency and Accountability	▪ Continuous control monitoring ▪ Inherent risk reduction is as valuable as control risk / residual risk reduction
B. Raise the Baseline by Reducing the Unit Cost of Control	▪ Inventories of hardware, software, services and other assets are systematically validated ▪ Zero trust environment - controls are embedded / enabled by default
C. Create More Defensible and Resilient Architectures	▪ Make no full reliance on the corporate perimeter and minimize all attack surfaces ▪ No one control failure is catastrophic – enclaves, failed closed, defend in depth and limit blast radius
D. Increase Risk Workforce Productivity	▪ Security and usability work together - make the secure path the easiest path ▪ Focus on extended enterprise (clients ←→ firm ←→ supply chain)
E. Operate Threat Intelligence and Large Scale Hunting	▪ Actively hunt adversaries – inside and outside the network ▪ Constantly scale up & speed up the intelligence, hunt and defend loop

Supply Chain and Relationship Assessments

Pre-assessment and Continuous Monitoring

Ongoing Process



- Accountable Information Security Executive (CISO or other)
- Historical incidents
- Reviewed independent assessments and security tests
- Policies/standards conformance to NIST Cybersecurity Framework or other accepted standards
- Evidenced Board/ Executive oversight and appropriate integration of all enterprise risks

Sample Tooling

AICPA SOC 2

SSAE 18 SOC 1 TYPE 2 SOC 2 TYPE 2

BITSIGHT The Standard in SECURITY RATINGS

KY3P Know Your Third Party A fully integrated vendor life cycle tool

NIST National Institute of Standards and Technology U.S. Department of Commerce

SecurityScorecard

External Partnerships

Public / Private Partnership is Critical for Shared Defense

FS-ISAC

FSARC

FSSCC

SHELTERED HARBOR

MS-ISAC®
Multi-State Information Sharing & Analysis Center®

CIS. Center for Internet Security®

NIST National Institute of Standards and Technology
U.S. Department of Commerce

CyberNYC
Catalyzing Innovation. Creating Jobs.

Coupling to Enterprise Risk

Cybersecurity as a 1st Class Business Risk

1. Enterprise Risk Integration

- Embed risk considerations into enterprise governance apparatus : dedicate a risk committee
- Integrate risk considerations into all processes : new products, supply chain/vendors, acquisition, divestment, investment – adopt / use recognized testing approaches, for example: SOC2, NIST standards

2. Technology Integration

- Basic technology / digital business discipline and hygiene can stop many attacks, for example: CIS Top 20 Controls
- Continuous control monitoring and ambient controls

3. Resilience & Recovery : plan for failure and constantly exercise / drill

- Detect early, respond decisively, formalize accountability and test constantly
- Integrate cyber response with enterprise resilience / business continuity approaches – conduct regular drills across all scenarios and all leadership levels to build muscle memory

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