

MINISTERIO DE HACIENDA

Pension Reserve Fund – Asset Allocation Study

June 7, 2017



CONTENTS

1. Introduction	4
2. Study of Other Pension Reserve Funds.....	5
• 2.1 Introduction.....	5
• 2.2 Conclusions	8
3. Investment Objectives.....	10
• 3.1 Introduction.....	10
• 3.2 Possible Approaches.....	11
• 3.3 Real Return Considerations	12
• 3.4 Currency Frame of Reference	14
• 3.5 Liability Cash Flow Considerations	16
• 3.6 Time Horizon	19
• 3.7 Conclusions and Recommended Approach	20
4. Theoretical Framework	24
• 4.1 Introduction.....	24
• 4.2 Asset Classes.....	24
• 4.3 Capital Market Assumptions.....	30
• 4.4 Approach to Modelling the Fund's Cash Flows	40
• 4.5 Modelling Real Returns	47
• 4.6 Approach for Developing the SAA.....	50
• 4.7 Monte Carlo Simulation Approach.....	51
5. Strategic Asset Allocation	52
• 5.1 Introduction.....	52
• 5.2 Current Asset Classes.....	55
• 5.3 All Asset Classes.....	58
• 5.4 Final Candidate Asset Allocations	65
6. Simulations, Back Testing, and Stress Testing - Analysis of Candidate Portfolios ...	67
• 6.1 Introduction.....	67
• 6.2 Modelling the Fund's Cash Flows	67
• 6.3 Analysis of Candidates.....	68
• 6.4 Conclusions and Recommendations	80
7. Portfolio Construction.....	85
• 7.1 Introduction.....	85
• 7.2 Asset Classes.....	85
• 7.3 Current Asset Classes.....	86

• 7.4 Additional Asset Classes	95
• 7.5 Conclusion.....	101
8. Implementation Plan	103
• 8.1 Introduction.....	103
• 8.2 Transition Plan	103
• 8.3 Organizational Framework	105
9. ESG Considerations.....	112
• 9.1 Responsible Investment Overview	112
• 9.2 Responsible Investment in Practice	115
• 9.3 Conclusion.....	126
Appendix A: Scope of Project and Timeline.....	128
Appendix B: Detailed Discussion of Each Fund.....	131
Appendix C: Example of Global Market Portfolio	155
Appendix D: Example of International Purchasing Power Maximization	156
Appendix E: Mercer Stochastic Simulation Model	158
Appendix F: Summary of Capital Market Assumptions as of December 2016	163
Appendix G: Rationale for Steady State Sovereign Yield Curves	170
Appendix H: Rationale for Currency Translation Approach.....	173
Appendix I: Currency Forwards and the Mechanics of Currency Hedged Returns ...	178
Appendix J: Downside Risk Measures	179
Appendix K: Regional Equity Considerations.....	181
Appendix L: Derivation of Candidate Portfolios – Unhedged Asset Classes.....	183
Appendix M: Detailed Output from Scenario Analysis	194
Appendix N: Further information on Denmark ATP	200
Appendix O: CMO Report.....	203
Appendix P: Additional Analysis for Portfolio Construction	249
Appendix Q: An Investment Framework for Sustainable Growth	251
Appendix R: Mercer Investments Beliefs	264

Appendix S: Ignorance isn't bliss...the risks your portfolio may be ignoring	275
Appendix T: Investing in a Time of Climate Change.....	280
Appendix U: Building a Bridge to Sustainable Infrastructure.....	305
Appendix V: Sample ESG Research.....	325
Appendix W: Draft Investment Policy Statement	335

1

Introduction

Assignment - Final Presentation to the Financial Committee

The Ministerio de Hacienda (Ministry of Finance - "MoF") of the Republic of Chile has retained Mercer Investment Consulting, LLC ("Mercer") to provide a comprehensive asset allocation review and study of the Pension Reserve Fund ("PRF"). Implemented in January of 2012, the current investment policy is as follows: 48% in sovereign bonds, 17% in inflation-indexed sovereign bonds, 20% in corporate bonds and 15% in stocks.

This assignment is divided into the provision of certain services provided within a distinct timeline and framework and revolving around three distinct and formal meetings with the Financial Committee ("FC"). The FC is a group of experts hired by the MoF to provide advice on all matters related to the investments of the PRF.

This study was conducted in two stages. The first stage encompassed a review of the experience of other Pension Reserve Funds, similar to the PRF, which assisted in refining and testing the investment objectives for the PRF. Also covered at this stage was the setting of the theoretical framework that would be used for modeling purposes. The second stage involved the recommendation of alternative strategic asset allocations; stress tested using Monte Carlo simulations. In addition, this second stage involved the portfolio construction process and implementation, including the consideration of ESG factors, to execute the recommended strategic asset allocations. For more information as to the scope and timing of this project please refer to Appendix A.

This final report consolidates the material provided in earlier reports and updates the material as relevant to reflect the discussions and communications with the MoF and the FC.

2

Study of Other Pension Reserve Funds

2.1 Introduction

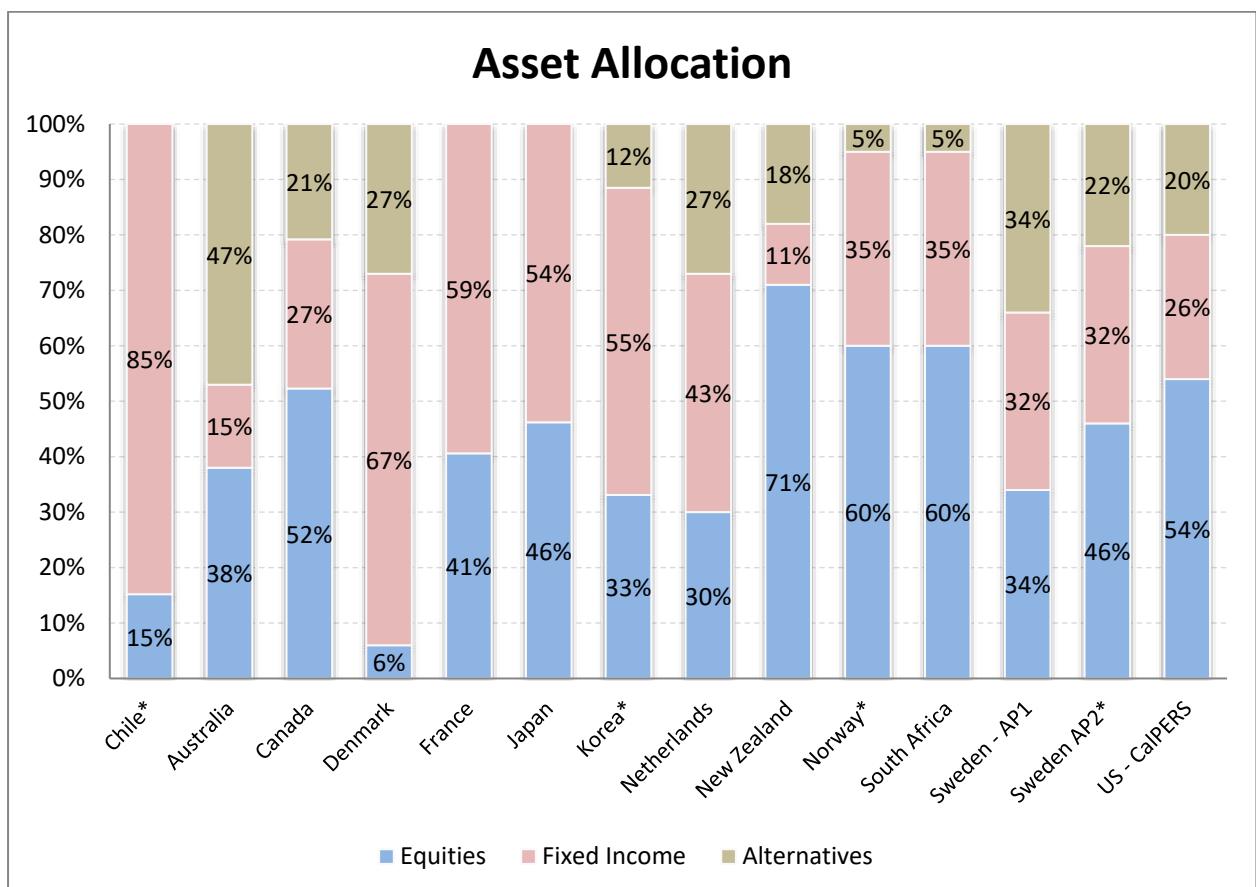
This section has been prepared to provide the MOF with background information on other national pension and wealth funds. The candidates chosen for this analysis were other national funds with pension-focused investment objectives. Availability of data also factored into the choice of candidates, as did asset size. Mineral sovereign wealth funds were excluded as candidates for this comparison as these often have a stabilization function rather than an explicit pension-related role.

In developing our list of funds for this study we have taken a relatively imprecise definition of the term “pension reserve fund”. In the sovereign wealth context, this definition tends to be related to those funds where the government is building up assets to assist in meeting future pension or social security obligations via putting aside either budget surpluses or, as is the case with Chile, a portion of the country’s resource-related wealth. For example, in addition to the Pension Reserve Fund, this definition would include funds such as the New Zealand Superannuation Fund or the French Pension Reserve Fund.

However, many other countries have, in effect, pension reserve funds funded by regular contributions by participants and/or their employers to meet the promised nationwide pension or social security obligations. Some funds which meet this definition include the Canada Pension Plan or the Japanese Government Pension Investment Fund. These funds are not strictly fully funded in the sense that the contribution rates are generally set independent of the promised benefits and, as such, the intention of the contributions is more of a social security tax to partially prefund some of the benefits.

We have included samples of both of these in this study. In addition, to make the study as comprehensive as possible, we have also included some other government-related pension funds. These tend to be funds set up either at a country level (or in the case of the United States at a state level) to meet the pensions of civil servants. These funds do tend to aim for full funding.

The funds we have included in the study are shown in the following chart. The asset allocations shown are shown by broad asset classes and are a mixture of strategic asset allocations and actual asset allocations depending on type of fund and information available. A detailed description of the practices of each of these funds follows the chart. Absolute return targets, where given, are assumed to be nominal unless otherwise stated.



Alternatives exposure includes asset classes other than traditional equities and fixed income such as real estate, private equity, hedge funds, infrastructure, and commodities. An asterisk denotes strategic asset allocation is being shown. For the remaining funds, actual asset allocation is shown for the latest time periods available (range from December 31, 2015 to September 30, 2016).

	Chile	Australia	Canada	Denmark	France	Japan	Korea
Type of fund	PRF	SWF	PRF	PRF	PRF	PRF	PRF
Year Est.	2006	2006	1997	1964	2001	1954	1988
Estimated size (\$USD)	\$9.4 B	\$92 B	\$288 B	\$112 B	\$39 B	\$1,200 B	\$460 B
Inv Objective	Finance future pension liability	Finance future government expenditures	Finance future benefit payments	Finance pension liability	Make future pension payments	Finance benefit payments	Finance benefit payments
Responsible Investment	No	Yes	Yes	Yes	Yes	No	No
% Domestic	0%	6.3%	19%	Yes	37%	63%	76%
% External	35%	Both	Yes	Majority Internal	100%	Yes	35%
% Passive	100%	Both	0%	Mostly active	40%	Yes	30%
Inv Horizon	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term
Liquidity	Highly important	Limited	None	Yes	Yes	Yes	Yes
Contributions	Yes	No	Yes	Yes	Not until 2020	Yes	Yes
Withdrawals	Yes	None until 2020	No	Yes	Yes, until 2024	Yes	Yes
Type of benchmarks used	Weighted asset class index	CPI plus 4.5-5.5% annualized	Reference Portfolio Real return of 4%	Absolute return objective	Excess of the cost of French public debt	Real Return of 1.7%	Weighted asset class index

	Netherlands	New Zealand	Norway	South Africa	Sweden –AP1	Sweden– AP2	US-CalPERS
Type of fund	PRF	PRF	SWF	PRF	PRF (Buffer)	PRF (Buffer)	PRF
Year Est.	~100 yrs	2001	1990	1996	2001	2001	1932
Estimated size (\$USD)	\$398.4B	\$23.4 B	\$873 B	\$11.3 B	\$31.7 B	\$32.8 B	\$300 B
Inv Objective	Finance pension liability	Make future pension payments	Finance future government expenditure	Finance pension liability	Pay out benefits if requested	Pay out benefits if requested	Finance pension liability
Responsible Investment	Yes	Yes	Yes	Yes	Yes	Yes	Yes
% Domestic	14%	14%	0%	85%	12%	10%	9.3% (CA)
% External	Both	57%	4%	Majority Internal	31%	17%	Majority Internal
% Passive	0%	67%	85%	Predominantly Passive	5%	90%	Mostly Active
Inv Horizon	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term
Liquidity	Yes	Limited Need	Limited	Yes	Limited	Limited	Yes, has liquidity sleeve of 2%
Contributions	Yes	Forecast to re-start in 2020/21	Depending on petroleum revenues	Yes	Yes	Yes	Yes
Withdrawals	Yes	None prior to 1 July 2020	Depending on petroleum revenues	Yes	Yes	Yes	Yes
Type of benchmarks used	(1) Return of 5% annualized (2) Strategic Portfolio	(1) Reference Portfolio (2) Cost of Government debt	Reference Portfolio Real return of 4%	Reference Portfolio	Annualized net return of 4.0% over rolling periods	Weighted asset class index (not always market cap)	Reference Portfolio

Detailed information on each of these funds is included in Appendix B.

2.2 Conclusions

There are a couple of takeaways and key issues to consider from this survey in relation to the PRF, including:

- The majority of funds have more exposure to equities, and thus are set up for longer-term growth and have determined that the risk and volatility is tolerable given their mandates and objectives;

- A few funds are managed to very clear and easily measureable objectives and benchmarks (absolute return or a premium over inflation/CPI), with these expressed relative to domestic indicators;
- While passive investing is very established, there appears to be some strategies/asset classes where active management should be considered;
- On the surface, the majority of Funds appear to maintain ample liquidity given their short- to mid-term liability profile;
- With the exception of a few Funds, most were created post-1980, and thus have only been in existence in a period of falling interest rates (in the developed world). With historically low interest rates in the developed world, this has potential investment implications.

These are very high level observations and the implications of these, along with many other factors, are covered in the next sections, where the investment objectives considerations and the theoretical framework specific to the PRF are covered.

3

Investment Objectives

3.1 Introduction

In this section of the report, we analyze alternative approaches for defining the investment objectives for the Pension Reserve Fund (PRF).

Mercer's view is that investment objectives should take into account the following factors:

- Nature of and source of funds
- Investment time frame
- Stakeholders' expectations
- Factors that influence risk tolerance.

Mercer advocates MOF adopt a 'SMART' framework in developing objectives that are goal orientated, quantifiable and verifiable. SMART objectives are: Specific; Measurable; Achievable; Realistic; and Time-bound. To put this in an investment context, the objective must clearly state a quantifiable return target that is both attainable and measurable over a specified time period. Specification of the investment objectives will typically take the following form:

- Primary objective (such as a specific target return over a specific time),
- Secondary objectives (incorporating organizational specific objectives not covered by primary objectives),
- Risk tolerance (specifying risk parameters in terms of volatility or chance of negative returns),
- Specified timeframes.

Return objectives are often expressed as a margin over the rate of inflation, typically measured by changes in the Consumer Price Index (CPI). Inflation is used as a base by the majority of long term investors because they are usually focused on growing their long term wealth in real terms; that is, they are seeking a return in excess of inflation. On this basis, return objectives relative to inflation are usually suitable for investors with a medium term horizon, say, of five years or more. As their investment horizon and risk appetite increases, so can the target margin over CPI.

Risk tolerance can be readily expressed as volatility or the probability of a negative return in any one year or some level of tolerance for downside risk. It is important to understand that the minimum time horizon, risk tolerance and the appropriate performance objective are all interrelated, and ultimately, they determine the appropriate mix of assets, such as the portfolio's growth/defensive split.

3.2 Possible Approaches

We consider that the primary approaches available for assisting in the framing of objectives are as follows:

- **Establish a tolerance for downside risk in the short-term:** under this approach, a tolerance for downside risk in the short-term (such as a year) is established and then the objective is then simply to maximise expected return consistent with that risk tolerance. This has the merit of simplicity but begs the question “what is the appropriate tolerance for downside risk?” We note in the previous study conducted in 2007/8 that the potential risk parameters provided by the MOF for the PRF were for maximum losses of 2%, 5% and 10% of the Fund in USD terms in any given year at the 95th percentile. The adopted approach was to have a 95% probability that the Fund would not lose more than 10% of its value in USD terms in a given year.
- **Set a real return target:** for example, an objective of achieving a real return of 3% pa over rolling 5 years. This has the merit of simplicity but begs the question “why 3% and not something else?”
- **Focus on the sustainability of the fund:** for employer-based pension funds, there is generally a requirement to focus on full funding. However, this requirement for full funding is not the case with social security-related funds either where these are established to pre-fund future drawdowns from contributions (as in the case of the Canada Pension Plan, for example) or where they act as a pension buffer fund from budget surpluses (as is the case with the New Zealand Superannuation Fund). In some projects we have undertaken for social security-related funds, we have focused on seeking to determine the level of expected real return that might achieve a degree of sustainability for the fund. We discuss this further in Section 3.4.
- **Identify the underlying liabilities:** this is a mechanism we have used with some SWFs to anchor the possible real return target where the liabilities may not be explicitly defined unlike the situation with the PRF. For example, one approach we have used is to model the target incomes per capita based on different levels of returns from the SWF together with future payments to the fund from the natural resource store (in the ground). This approach has the merit that it adds some rationale to the required rate of return but the required return is sensitive to a number of parameters (discount rates, oil prices) and the analysis needs to capture risk considerations.
- **Representative investor:** an alternative approach for a large investor such as a SWF is to focus on the capture of global GDP (as a proxy for capture of global real return). The basic rationale for this approach is that international purchasing power might be best safeguarded through broad ownership of the production of goods and services, which effectively translates into the ownership of a “market portfolio”. In effect, this is the approach used in Norway. Under this approach, the starting point is to take the Global Market Portfolio¹ as a starting point and adjust this based in a number of SWF-specific considerations, including,

¹ The Global Market Portfolio represents the broad opportunity set of potential investments on a market capitalization basis. An example of this is included in Appendix C.

for example, an overweight to equities on risk capacity grounds and an underweight to hedge funds on capacity and cost grounds.

A brief discussion of the pros and cons of these is as follows:

Approach	Pros	Cons
Establish Risk Tolerance	<ul style="list-style-type: none"> Simple and easy to measure This is the current approach so no change/transition needed 	<ul style="list-style-type: none"> May focus too much emphasis on the short-term at the expense of the longer-term health of the fund Establishing correct risk tolerance is problematic
Real Return/Sustainability Focus	<ul style="list-style-type: none"> Simple and easy to measure 	<ul style="list-style-type: none"> What return is appropriate? Experience will differ from ambition in short run so open to criticism Success may require to be more dynamic What about risk tolerance?
Liability-Driven	<ul style="list-style-type: none"> Strong link to ultimate purpose Sets out an objective measure Helps formulate risk and return boundaries 	<ul style="list-style-type: none"> Does require making a series of assumptions More work in setting and managing expectations?
Representative Investor-Led	<ul style="list-style-type: none"> Simple as return is an outcome 	<ul style="list-style-type: none"> What about risk tolerance? Tilts become subjective Market Portfolio may not capture full opportunity set, especially for private markets

3.3 Real Return Considerations

One important consideration when thinking about real returns is what inflation basis to use for deflating nominal returns into real returns. The definition of what constitutes the basis for real returns is critical, as this can also be considered to be a definition of wealth maximization in real terms.

Most investors will define wealth maximization in their home currency. However, SWFs often face the constraint that they must be invested in foreign currency denominated assets, and

thereby, act as a source of foreign wealth that can be drawn upon by the country at some future date, including meeting unforeseen crises. In practice, therefore, the investment objective will tend to be defined in foreign currency terms, in a manner that best fits the definition of wealth maximization, as interpreted by investors, the government or the sponsor of the fund.

There are three broad options available, for the investor/government/sponsor, on how to define wealth maximization:

- 1) In domestic terms – that is, the focus will be on preserving real value in domestic terms
- 2) In purely US dollars as the world's dominant traded currency
- 3) In terms of a basket of currencies - in which case, the performance of the fund is either referenced in this currency basket or alternatively might still be referenced in US dollars

As indicated, most institutional investors will view maintaining real value (or purchasing power) in terms of domestic inflation.

Sovereign pension funds (such as Canada Pension Plan or the Government Pension Investment Fund in Japan that we have mentioned in Section 2) have a responsibility for meeting domestic pension liabilities, and therefore, any focus on maintaining real value will be considered from a domestic inflation perspective. For example, the Canada Pension Plan aims to achieve a 4% long-term real return. In this respect, while they invest globally, the Fund's performance is assessed in Canadian currency (CAD) and Canadian inflation is used to deflate the nominal returns into real returns.

However, in the case of Norway's Government Pension Fund – Global, nominal returns achieved by the Fund are reported in "the fund's currency basket", which is effectively based on the local currency exposures in the benchmark indices used by this Fund. These nominal returns are then deflated into real returns using an inflation rate consistent with the country weights in the benchmark indices. Norway's main rationale for its approach is:

"The objective of the greatest possible long-term international purchasing power is best served by broad ownership of the production of goods and services. The Fund's geographical distribution should depart from market weights only if such a composition of the Fund helps reduce risk or increase expected returns"

Norway's definition of "global" inflation is essentially based on country (and currency) weights derived from:

- 60% MSCI All Countries World Index (with some customization on permissible emerging markets)
- 28% Barclays Global Treasuries GDP-Weighted Index (with some customization on markets)
- 12% Barclays Global Corporate Index

In effect, Norway uses the same approach for determining "global" inflation as they use for performance reporting purposes. This is similar to the situation with the Canada Pension Plan, although this uses Canadian inflation for these purposes rather than a "global" inflation measure.

Performance reporting is generally undertaken on a nominal return basis. If a “global” inflation deflator is used to convert nominal returns into real returns, then it needs to be recognized that the resulting real returns may be difficult to interpret. This is a consequence of the fact that the reporting currency for the nominal returns is different from the currency basket inherent in the “global” inflation deflator.

The cash flows projections we have been provided for the PRF over the next 20 years are in real terms and in CLP terms. In this context, it could be argued that the focus of real returns for the PRF should also be in CLP terms – that is, relative to Chilean inflation.

3.4 Currency Frame of Reference

Following discussions of the pros and cons of adopting alternative frames of reference in terms of currency, including the CLP or a trade-weighted, consumption-weighted, or other basket of foreign currencies, the MOF ultimately directed Mercer to perform the previous study in US dollar (USD) terms.

The basic objective of some SWFs is to invest their capital such that the international purchasing power is as high as possible, in particular when it is likely that capital will be drawn upon, taking into account an acceptable risk exposure. While SWFs in this situation may have some element of stabilization in that there may be regular withdrawals for budgetary purposes, the primary focus is on wealth accumulation. However, there may be no specific purpose that these funds aim to meet, unlike the situation with those SWFs that serve as pension reserve funds. That is, these funds have no defined liabilities. Examples of these funds include Singapore’s GIC Pte Ltd or the Kuwait Investment Authority.

From an asset-liability perspective, the theoretical “least risk” position in this case would be to hold a portfolio of inflation-linked bonds, weighted in accordance with the expected import pattern, with duration equivalent to that of the Fund². Of course, in reality such a portfolio will not exist since such bonds will not exist for all trading partners and the duration of the Fund will be unknown. In addition, the weights should ideally reflect future trading partners (which obviously are unknown) rather than present trading partners. As above, this might argue for some trade-weighted currency basket as the currency frame of reference or simplifying this by just using the USD as the main currency in which global trade is conducted. For other SWFs (such as the Economic and Social Stabilization Fund), the function is to stabilize the local economy against fluctuations in the price of an important natural resource or commodity, which also means that a foreign currency frame of reference is appropriate.

However, as we understand it, the role of the PRF is not to serve these functions. Instead, the PRF’s stated purpose is “to complement the financing of fiscal liabilities in the area of pension and social welfare. Specifically, the fund backs the state guarantee for old-age and disability solidarity pension benefits, as well as solidarity pension contributions, as established under the pension reform of 2008”. As such, the liabilities of the PRF are effectively denominated in CLP terms rather than in foreign currency terms as they would be if the purpose was to be a source of funds to meet the future cost of imports.

² An example of the workings of such a fund to illustrate these points is included in Appendix D.

If we examine this issue in respect of the funds included in Section 2, with the exception of the Norway's Government Pension Fund – Global, the funds use their home currency as the currency frame of reference in recognition of the fact that their liabilities are in their local currency. In Norway's case, although the Fund has the word "pension" in its name, it does serve a much broader macroeconomic function within the Norwegian budget, which to some degree explains its use of a global currency frame of reference.

The inflows to the PRF are dependent on the fiscal surplus in that the minimum annual contribution to the PRF of 0.2% of the previous year's GDP can be increased up to a maximum of 0.5% depending upon the amount of any fiscal surplus. As such, the investment of the assets of the PRF should be invested in a way that diversifies against local economic results. That is, when the local economy is not performing well and contributions to the PRF are at their minimum, it may be expected that the translation of foreign currency returns into a depreciated CLP will assist the overall financial performance of the PRF. It would be conversely the case when the local economy is performing well and the CLP is appreciating.

We consider this issue might argue for leaving foreign currency exposures unhedged (as indeed is the case at present) more so than arguing against the CLP being the currency frame of reference for the PRF given its CLP-denominated liabilities.

In this regard, it is interesting to consider the currency hedging practices of two of the peers discussed in Section 2 – the Canada Pension Plan and the New Zealand Superannuation Fund. While both of these funds are global investors, they do hold some domestic assets, in contrast to the PRF.

The Canada Pension Plan believes extensive hedging of foreign investments is not appropriate for the following reasons:

1. For a Canadian investor, hedging foreign equity returns reinforces their inherent risk. This reflects the Canadian dollar's status as a commodity currency that tends to strengthen when global equity markets are rising but weaken when they are falling. It also reflects the status of certain currencies including the U.S. dollar to act as a safe haven during times of crisis.
2. The cost of hedging currencies of many developing countries is prohibitively high. And if these countries increase productivity and economic growth, their currencies will tend to strengthen³.
3. When the Canadian dollar strengthens against other currencies as a result of higher commodity prices, especially oil, the Canadian economy is likely also stronger. That in turn means increased earnings for CPP contributors. As earnings rise, so do contributions to the CPP. This represents a natural hedge, reducing the need for explicit currency hedging of the Fund's foreign investments. This is the same argument as discussed above in the case of inflows to the PRF.

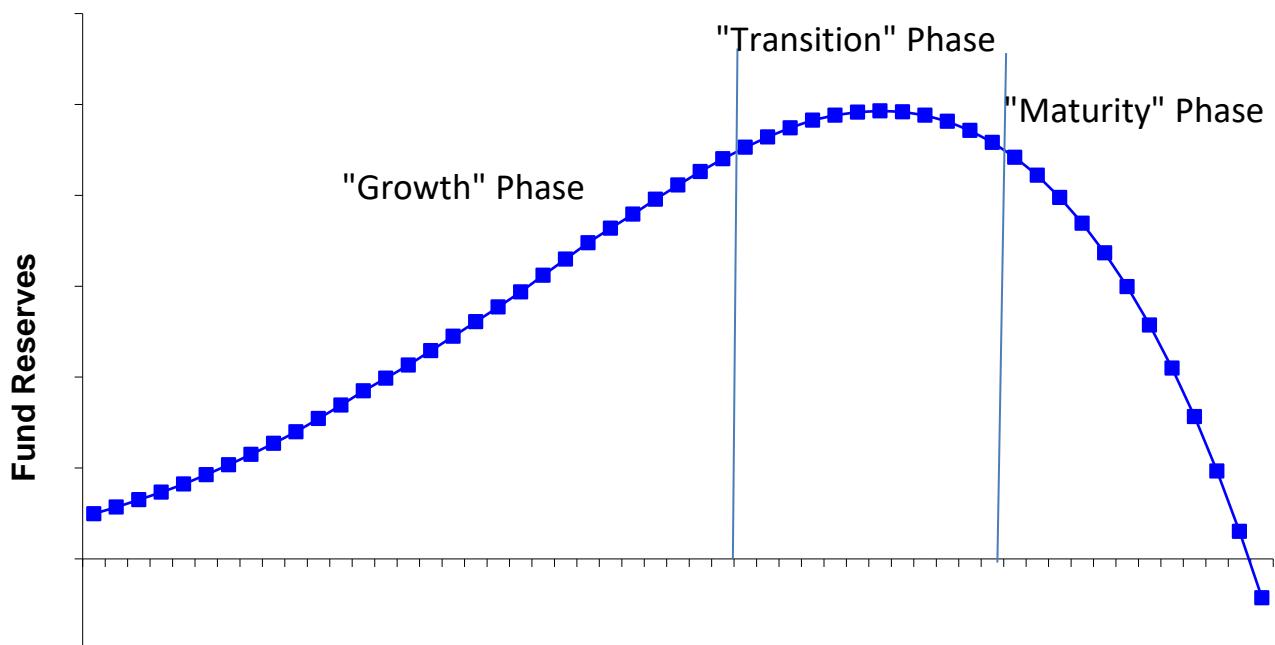
³ This tendency for currencies of less developed currencies to appreciate in real terms over time is generally known as the Balassa-Samuelson relationship after separate papers produced by 1964; namely: "*The Purchasing Power Parity Doctrine: A Reappraisal*", by Béla Balassa, *The Journal of Political Economics* and "*Theoretical Notes on Trade Problems*", by Paul A. Samuelson, *Review of Economics and Statistics*. We discuss this relationship further in Section 4.3.6.

As such, the Reference Portfolio for the Canada Pension Plan is fully unhedged. In contrast, the Reference Portfolio adopted for the New Zealand Superannuation Fund is fully hedged. This reflects their view that there is a systematic risk premium associated with hedging into the NZ dollar⁴.

3.5 Liability Cash Flow Considerations

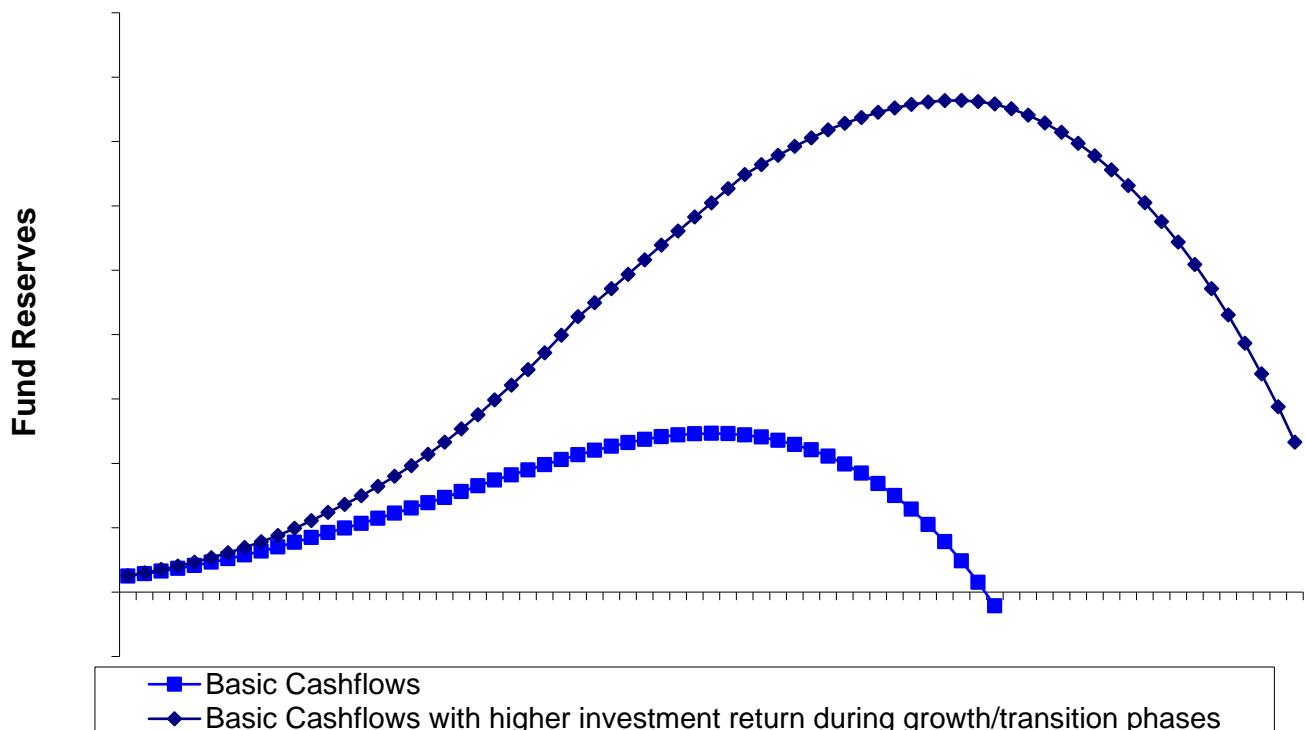
The basic approach to considering the assets and liabilities of the PRF that was undertaken in our 2007/8 study was based around the use of a liability proxy. That is, we sought to proxy the liabilities with a government bond of equivalent duration and then to consider candidate portfolios relative to that proxy. This is an approach often used with fully funded pension funds. While we could adopt this approach in this review, we consider the alternative approaches we have outlined below are preferable as these can directly take the liabilities into account rather than reducing them to a proxy.

With government pension funds and social security funds that do not aim for full funding and often do not regularly discount the liability cash flows into present values, another approach is to just focus on the cash flows and the sustainability of those cash flows (rather than their present values). As such, one approach we have adopted is to use the cash flow projections to assess the future growth in the reserves and where in the evolution and draw-down these fall, as shown below:



⁴ For further information, please refer to the "2015 Reference Portfolio Review", dated July 2015 that is available on the New Zealand Superannuation Fund's website.

That is, there could be considered to be three distinct phases in relation to the Fund which potentially have different implications for the investment policy. For example, if a more aggressive investment policy were undertaken during the growth phase such that a higher return is achieved during that period, then this could have the result that the peak Fund reserve value is extended and the longevity of Fund reserves is extended, as shown in the example below:



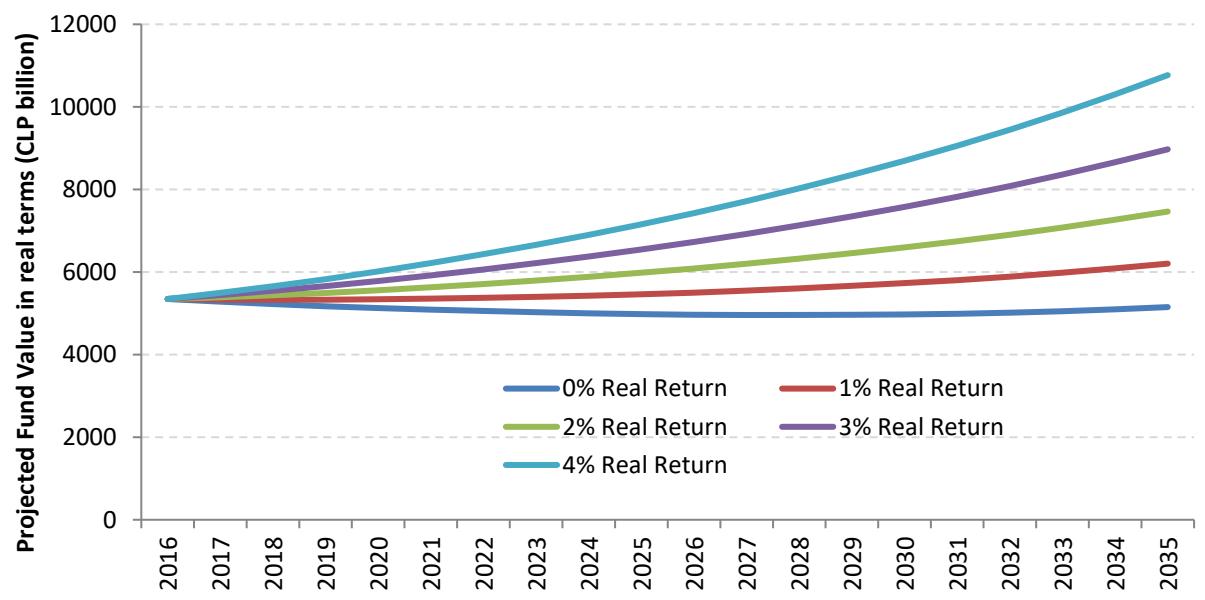
Some of the approaches we have used to express our clients' risk tolerances are as follows:

- A focus on seeking to maximize the expected value at the end of the "growth" phase subject to an acceptable degree of downside risk in the short-term
- A focus on seeking to minimize the probability of reserves being diminished by a particular date, again subject to an acceptable degree of downside risk in the short-term

The second approach that we suggest, which we have also used with pension reserve funds, is to consider the relationship between the existing value of the Fund's assets and the present value of the expected future inflows to the Fund relative to the present value of the expected pension outflows from the Fund. In most instances since the pension reserve fund is not aiming for full funding of the liabilities, there will be a deficit in this relationship. As such, the asset-liability focus might be on seeking to minimize the expected deficit through the derivation of the target return, subject to an acceptable degree of downside risk in the short-term. Under this approach, it is necessary to agree on the basis for the discount rate to be used to determine the present values.

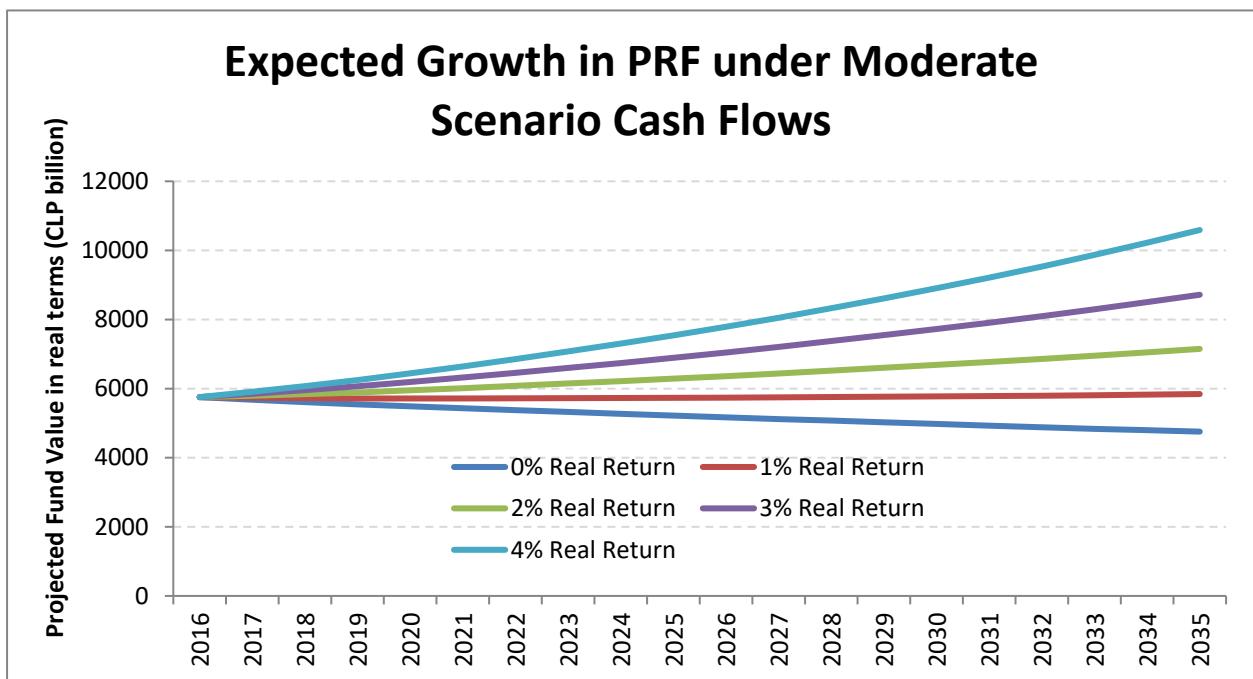
The following chart shows the expected growth in the PRF in real terms based on the cash flow information we have been provided with under the central scenario together with assumed real returns of 0% per annum, 1% per annum, 2% per annum, 3% per annum and 4% per annum:

Expected Growth in PRF under Central Scenario Cash Flows



This chart shows that, even with no real return being assumed, the projected Fund value remains relatively stable over the 20-year projection period.

Even in the most negative cash flow scenario provided (the “Moderate Scenario”), the projections show the Fund value remaining relatively stable over the 20-year projection period with a 1% assumed real return.



As such, unless a longer time horizon for the cash flow projections than 20 years is available and can be incorporated, then it could be concluded that the focus of investment objectives might be on continuing to grow the fund's capital in real term by the end of 20 years in the event that there is an expectation the pace of withdrawals might increase more significantly after the 20 year period.

One option to extend the withdrawals would be to assume a constant liability growth rate from 2035 onwards. For example, the cash flow projections have been undertaken in real terms. For the central scenario, the average real liability growth rate in the last 5 years of the projection is 1.8% per annum and therefore a possible assumption might be for the withdrawals after 2035 to grow at 2% to 3% per annum.

3.6 Time Horizon

The illustrative projections outlined in the above charts indicate that, under the central scenario, the projected outflow is expected to be met, on average, from the projected inflow. This suggests that a longer time horizon can be considered than is implied by the current strategy since its unlikely that fund capital will be drawn upon to meet outflow over the next 20 years other than in the event of a sustained decline in Chilean GDP (thus leading to lower inflows) or sustained low real investment returns.

We propose a 10-year time horizon be considered for the current review on the basis that this is sufficiently long for planning purposes. However, we will also examine a shorter time horizon of 5 years and a longer time horizon of 20 years in line with the proposed projection period.

3.7 Conclusions and Recommended Approach

Where they are explicitly stated, the return objectives for the sample pension reserve funds either target a certain level of real rate of return or seek to deliver returns in excess of the cost of the country's government debt.

Fund	Objective
Australia – Future Fund	4.5% - 5.5% real return
Canada Pension Plan	4% real return
France – Pension Reserve Fund	Exceed cost of French public debt
Japan – Government Pension Investment Fund	1.7% real return (although real return relative to wage inflation rather than price inflation)
New Zealand Superannuation Fund	Exceed cost of New Zealand government debt by achieving a return of 90-day NZ Treasury Bills + 2.7%

These are among the sample funds that we would categorize as being the most direct peers to the PRF as pension reserve funds. While all these funds have a global investment focus, all express their investment objectives relative to domestic variables.

At present, the investment objective for the PRF is expressed in terms of the “acceptable” level of downside risk in USD terms over a one-year time horizon, with there being no explicit return objective – instead, the implicit return objective is to maximize returns consistent with the risk tolerance.

Given that the liabilities of the PRF are pension-related payments in CLP terms, we recommend that the currency frame of reference for the PRF should be the CLP rather than the USD. A foreign currency frame of reference will be the most appropriate for those SWFs focused on international purchasing power (where liabilities can be regarded as being denominated in foreign currency). Given the CLP-denominated liabilities, a focus and approach that seeks to maximize wealth in USD terms, entails an implicit currency bet that could potentially lose money in the long term. As discussed above in relation to the Canada Pension Plan’s currency hedging approach, one view often expressed is that as emerging market economies ‘catch up’ in their levels of productivity and economic development, their currencies, all other things being equal, are likely to experience real appreciation. However, the currency could still depreciate in nominal terms if inflation in the emerging economy is systematically higher than in other markets.

Therefore, we recommend that the basis for the investment objectives of the PRF be changed to be framed as a target real rate of return, with this being considered from the perspective of Chilean inflation. In line with the above analysis, we would propose, subject to discussion with the MOF, to focus on potential real return targets of 1%, 2%, 3% and 4%.

From a risk perspective, we will also consider this from the perspective of maximum losses in CLP terms in any given year at the 95th percentile and also from the perspective of the likelihood of the fund value falling below various thresholds at various times within the 20-year projection period. For example, we will examine the probability of the projected portfolio values falling

below the initial starting value threshold after 5 years, 10 years and 20 years, being the proposed time horizons discussed above.

It is important to note that, by recommending that the CLP be regarded as the reference currency, we are not proposing that the PRF should start to invest domestically, nor are we necessarily proposing that the foreign currency exposure should be hedged into CLP.

However, one potential issue with this approach is that the risk statistics could potentially be high when viewed from a CLP perspective. That is, since the PRF is invested globally on an unhedged basis (which theoretically should provide the best overall diversification to the PRF between the investment returns and the inflows), when viewed in isolation, the annual downside risk from a CLP perspective could be quite high. We exam this issue in the table below where we show the historical annual returns for global bonds (based on the Bloomberg Barclays Global Aggregate Index) and global equities (based on the MSCI All Countries World Index) – the returns are shown in both USD and CLP terms:

	Global Bonds		Global Equities	
	USD	CLP	USD	CLP
1992	5.8%	8.0%	-4.2%	3.1%
1993	11.1%	24.5%	24.9%	41.3%
1994	0.2%	-5.7%	5.0%	-4.4%
1995	19.7%	20.9%	19.5%	20.0%
1996	4.9%	9.5%	13.2%	21.8%
1997	3.8%	7.4%	15.0%	26.6%
1998	13.7%	22.3%	22.0%	27.9%
1999	-5.2%	6.1%	26.8%	45.3%
2000	3.2%	11.9%	-13.9%	-3.0%
2001	1.6%	17.0%	-15.9%	0.3%
2002	16.5%	26.9%	-19.0%	-16.2%
2003	12.5%	-7.4%	34.6%	4.0%
2004	9.3%	2.4%	15.8%	5.1%
2005	-4.5%	-12.0%	11.4%	8.2%
2006	6.6%	11.1%	21.5%	21.9%
2007	9.5%	2.2%	12.2%	0.5%
2008	4.8%	34.1%	-41.8%	-22.1%
2009	6.9%	-14.9%	35.4%	3.5%
2010	5.5%	-2.7%	13.2%	2.4%
2011	5.6%	17.3%	-6.9%	4.4%
2012	4.3%	-3.9%	16.8%	7.4%
2013	-2.6%	6.9%	23.4%	38.5%
2014	0.6%	16.2%	4.7%	26.9%
2015	-3.2%	13.1%	-1.8%	18.9%
2016	2.1%	-3.4%	8.5%	3.8%
Volatility	6.3%	12.5%	18.1%	17.0%

The volatility figures at the bottom of the table relate to the full 25-year period. As can be seen, the volatility of global bond returns in unhedged CLP terms has been approximately double the volatility in unhedged USD terms. However, the volatility of global equity returns in unhedged CLP terms has been lower than those in USD terms. This is a function of the fact that the movements in the CLP relative to the MSCI ACWI currency basket have tended to be negatively correlated to equity returns. Conversely, the movements in the CLP relative to the Bloomberg Barclays Global Aggregate Index currency basket have tended to be positively correlated to bond returns.

A consequence of these relationships is that, depending on the actual asset allocation, the risk statistics on an unhedged to CLP basis may not differ significantly from those on an unhedged to USD basis as at present. This is shown in the table below where we examine the annual historical returns associated with different allocations between global equities and global bonds. For example, 15/85 denotes a portfolio with 15% in global equities and 85% in global bonds, while 65/35 denotes a portfolio with 65% in global equities and 35% in global bonds.

	15/85		25/75		35/65		45/55		55/45		65/35	
	USD	CLP	USD	CLP	USD	CLP	USD	CLP	USD	CLP	USD	CLP
1992	4.3%	6.5%	3.3%	5.4%	2.3%	4.4%	1.3%	3.4%	0.3%	2.4%	-0.7%	1.4%
1993	13.1%	26.8%	14.5%	28.4%	15.9%	29.9%	17.3%	31.4%	18.7%	33.0%	20.1%	34.5%
1994	1.0%	-5.1%	1.4%	-4.6%	1.9%	-4.2%	2.4%	-3.7%	2.9%	-3.3%	3.3%	-2.8%
1995	19.6%	20.9%	19.6%	20.9%	19.6%	20.8%	19.6%	20.8%	19.6%	20.8%	19.5%	20.8%
1996	6.1%	10.8%	7.0%	11.6%	7.8%	12.5%	8.6%	13.4%	9.5%	14.2%	10.3%	15.1%
1997	5.5%	9.1%	6.6%	10.3%	7.7%	11.5%	8.8%	12.6%	10.0%	13.8%	11.1%	14.9%
1998	14.9%	23.7%	15.8%	24.5%	16.6%	25.4%	17.4%	26.3%	18.3%	27.2%	19.1%	28.1%
1999	-0.4%	11.5%	2.8%	15.1%	6.0%	18.6%	9.2%	22.2%	12.4%	25.8%	15.6%	29.4%
2000	0.6%	9.1%	-1.1%	7.2%	-2.8%	5.4%	-4.5%	3.5%	-6.2%	1.7%	-7.9%	-0.2%
2001	-1.1%	14.0%	-2.8%	12.0%	-4.5%	10.0%	-6.3%	8.0%	-8.0%	6.0%	-9.8%	3.9%
2002	11.2%	21.1%	7.7%	17.3%	4.1%	13.4%	0.5%	9.5%	-3.0%	5.7%	-6.6%	1.8%
2003	15.8%	-4.7%	18.0%	-2.9%	20.3%	-1.0%	22.5%	0.8%	24.7%	2.6%	26.9%	4.4%
2004	10.2%	3.4%	10.9%	4.0%	11.5%	4.6%	12.2%	5.2%	12.8%	5.8%	13.5%	6.4%
2005	-2.1%	-9.8%	-0.5%	-8.4%	1.1%	-6.9%	2.7%	-5.4%	4.2%	-4.0%	5.8%	-2.5%
2006	8.9%	13.4%	10.4%	15.0%	11.9%	16.5%	13.3%	18.1%	14.8%	19.6%	16.3%	21.2%
2007	9.9%	2.6%	10.2%	2.8%	10.4%	3.1%	10.7%	3.3%	11.0%	3.6%	11.2%	3.8%
2008	-2.2%	25.2%	-6.9%	19.2%	-11.5%	13.2%	-16.2%	7.2%	-20.9%	1.3%	-25.5%	-4.7%
2009	11.2%	-11.4%	14.0%	-9.2%	16.9%	-6.9%	19.7%	-4.6%	22.6%	-2.4%	25.4%	-0.1%
2010	6.7%	-1.6%	7.5%	-0.9%	8.2%	-0.2%	9.0%	0.5%	9.8%	1.2%	10.5%	1.9%
2011	3.8%	15.2%	2.5%	13.8%	1.3%	12.4%	0.0%	11.0%	-1.2%	9.6%	-2.5%	8.2%
2012	6.2%	-2.1%	7.4%	-1.0%	8.7%	0.2%	9.9%	1.3%	11.2%	2.5%	12.4%	3.6%
2013	1.3%	11.2%	3.9%	14.1%	6.5%	16.9%	9.1%	19.8%	11.7%	22.6%	14.3%	25.5%
2014	1.2%	16.9%	1.6%	17.4%	2.0%	17.8%	2.4%	18.3%	2.9%	18.8%	3.3%	19.3%
2015	-3.0%	13.3%	-2.8%	13.5%	-2.7%	13.6%	-2.6%	13.8%	-2.4%	13.9%	-2.3%	14.1%
2016	3.0%	-2.5%	3.7%	-1.9%	4.3%	-1.3%	5.0%	-0.7%	5.6%	-0.1%	6.2%	0.5%
Volatility	6.2%	10.9%	6.8%	10.2%	7.9%	9.9%	9.2%	10.0%	10.6%	10.6%	12.2%	11.4%
"Worst Case" Return	-2.2%	-8.9%	-2.8%	-7.6%	-4.2%	-6.3%	-5.9%	-4.5%	-7.7%	-3.1%	-9.4%	-2.8%

In the event that the PRF's asset allocation remains mainly invested in bonds, there is likely to be a significant difference in the risk statistics depending on whether the CLP or the USD is used as the reference currency. For example, with the 25/75 portfolio, the historical volatility has been 6.8% when viewed from a USD perspective and 10.2% when viewed from a CLP perspective. The "worst case" return⁵ was -2.8% from a USD perspective and -7.6% from a CLP

⁵ The "worst case" return is defined as the bottom 5th percentile of the return distribution.

perspective. On the other hand, for the 65/35 portfolio, the risk statistics have actually been worse when viewed from a USD perspective.

We believe that another factor to consider is the potential impact on the overall financial position of the PRF. In the event that the asset class returns in CLP terms are severely negative as a result of CLP appreciation, then this is likely to be an environment when the Chilean economy is performing strongly such that inflows into the PRF might be towards their maximum levels. These are similar arguments to those presented earlier for the rationale that the Canada Pension Plan uses to support leaving its currency exposures unhedged. While the CLP may be more volatile than the CAD⁶, the CLP has not been significantly more volatile notwithstanding that the Canada Pension Plan does have Canadian domestic assets.

We believe this analysis provides support to the use of the CLP as the reference currency and for the investment objective to be expressed in real terms from a Chilean inflation perspective in recognition of the CLP-denominated liabilities. We propose that consideration also be given to potential currency hedging of the foreign fixed income exposure.

⁶ For example, the annualized volatility of the CLP relative to the USD has been 9.7% over the period since the beginning of 1988, while the annualized volatility of the CAD was 7.7% over that period

4

Theoretical Framework

4.1 Introduction

In this section of the report, we describe the theoretical framework that will be used to develop the Strategic Asset Allocation (“SAA”) for the PRF; specifically the approaches that will be used to:

- i. forecast the expected returns, volatility and correlations between the different asset classes and other variables in the long-term;
- ii. model future contributions and liabilities of the fund;
- iii. obtain the SAA using mean-variance and/or surplus optimization; and
- iv. simulate using Monte Carlo for multi-asset returns.

Before addressing these points, we first discuss the potential asset classes to be considered for the review.

4.2 Asset Classes

The current Strategic Asset Allocation for the PRF is as follows:

Asset Class	Percentage	Benchmark
Sovereign and government-related bonds	48	Bloomberg Barclays Global Aggregate Treasury Index (unhedged) + Bloomberg Barclays Global Aggregate Government-Related Index (unhedged)
Inflation-linked sovereign bonds	17	Bloomberg Barclays Global Inflation-Linked Index (unhedged)
Corporate bonds	20	Bloomberg Barclays Global Aggregate Corporate Bond Index (unhedged)
Equities	15	MSCI All Country World Index ex Chile (unhedged)
Total	100	

The assets are invested in broad global fixed income and global equity asset classes. In this section, we discuss the potential asset classes that could be considered for this review. As an input to that discussion we reference the results of the survey of members of the Financial Committee that was conducted regarding their individual views on potential additional asset classes.

Another input that we have used is the reference portfolios that Mercer has developed as a means of illustrating our best views on global multi-asset portfolio construction and the asset classes and strategies that we are proposing to our clients. We have developed a series of global reference portfolios across the risk/return spectrum and also, for each of these, we have constructed constrained and unconstrained versions. These constraints mainly refer to clients that may have either liquidity constraints or constraints on the complexity of their portfolios. The reference portfolios are shown below:

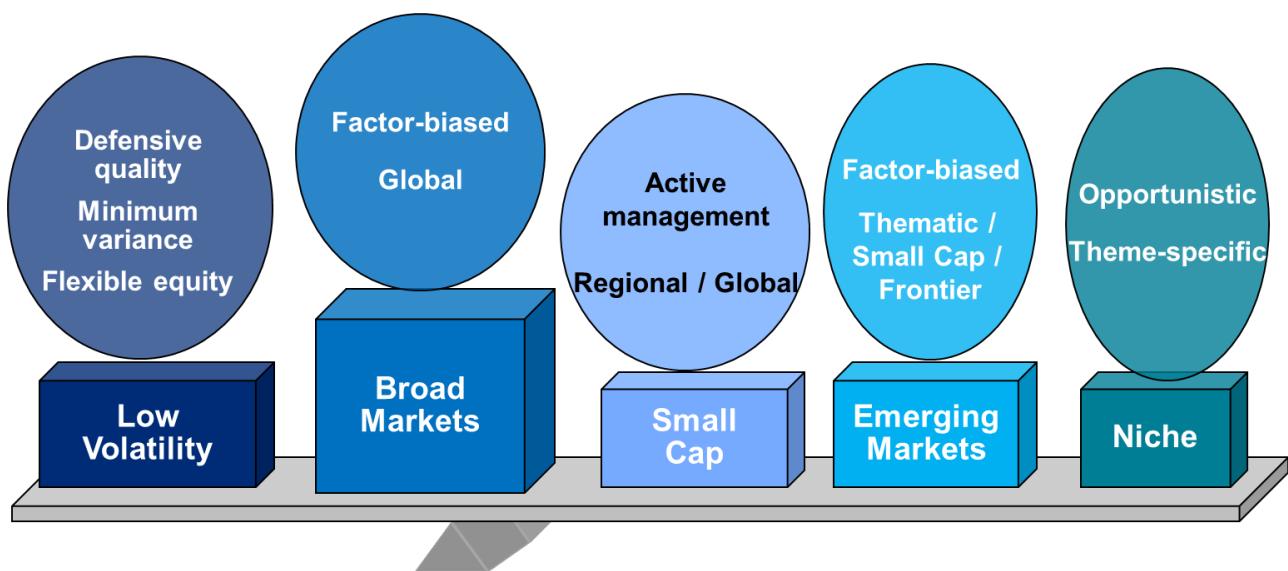
		Capital Stable (Constrained)	Capital Stable (Unconstrained)	Balanced (Constrained)	Balanced (Unconstrained)	Growth (Constrained)	Growth (Unconstrained)	All Growth (Constrained)	All Growth (Unconstrained)
Public Equity	Broad Market Equity (inc EM)		5.0%	10.0%	10.0%	25.0%	15.0%	30.0%	22.5%
	Low Volatility	20.0%	10.0%	7.5%	5.0%	10.0%	5.0%	12.5%	10.0%
	Emerging Markets (Specialist)			7.5%	2.5%	7.5%	2.5%	10.0%	7.5%
	Global Small Cap			5.0%	2.5%	7.5%	5.0%	12.5%	5.0%
		20.0%	15.0%	30.0%	20.0%	50.0%	27.5%	65.0%	45.0%
Private Equity				5.0%			7.5%		15.0%
Real Assets	Infrastructure - Listed			2.5%		2.5%		2.5%	
	Real Estate - Listed			2.5%		2.5%		2.5%	
	Infrastructure - Unlisted		5.0%	2.5%	5.0%	2.5%	5.0%	5.0%	2.5%
	Real Estate - Unlisted		5.0%	2.5%	7.5%	2.5%	7.5%	5.0%	7.5%
	Natural Resources				5.0%		5.0%		5.0%
		0.0%	10.0%	10.0%	17.5%	10.0%	17.5%	15.0%	15.0%
Hedge Funds and Others	Hedge Funds - Defensive	5.0%	15.0%	5.0%	17.5%				
	Hedge Funds - Moderate Risk					5.0%	20.0%	5.0%	15.0%
	Multi-Asset Funds (idiosyncratic)		5.0%		5.0%		5.0%		5.0%
		10.0%	15.0%	10.0%	17.5%	10.0%	20.0%	10.0%	15.0%
Growth Fixed Income	Emerging Market Debt (LC)	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
	Multi-Asset Credit	7.5%	2.5%	7.5%	2.5%	7.5%	2.5%	7.5%	2.5%
	Private Debt		5.0%		5.0%		5.0%		5.0%
	Unconstrained Bonds (Growth)						2.5%		
		10.0%	10.0%	10.0%	10.0%	10.0%	12.5%	10.0%	10.0%
Defensive Fixed Income	Sovereign Bonds (Nominal)	15.0%	10.0%	15.0%	10.0%	10.0%	10.0%	5.0%	
	Inflation-Linked (Sovereign)	15.0%	10.0%	7.5%	5.0%	5.0%	5.0%		
	Investment Grade Credit	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%		
	Absolute Return Bonds (Defensive)	10.0%	15.0%	7.5%	5.0%		5.0%		
	Cash	10.0%	10.0%	5.0%	5.0%				
		60.0%	50.0%	40.0%	30.0%	20.0%	15.0%	0.0%	0.0%

It should be noted that these have only been included for illustration purposes and to assist in the discussion of potential asset classes.

4.2.1 Equity Asset Classes

As indicated above, the equity exposure for the PRF is currently achieved through broad global equity mandates.

While we will seek to develop this more when we subsequently discuss portfolio construction principles, the following graphic summarizes Mercer's house view on portfolio construction for global equities – the public equity allocations in the illustrative reference portfolios are consistent with this approach:



This structure aims to deliver enhanced risk-adjusted returns relative to the MSCI ACWI. In this respect, “Broad Markets” is intended to include Emerging Markets, as is the case with the PRF’s existing approach. The separate Emerging Market allocation in the above is intended to be additional specialist Emerging Market exposures, which could include Frontier Markets.

We note that the survey conducted of Financial Committee members focused on Small Caps and Frontier Markets, with all members in favor of Small Caps and about half in favor of Frontier Markets.

The above structure seeks to enhance risk-adjusted returns by taking exposures to non-benchmark areas such as Small Caps and Frontier Markets, which tend to be higher returning, more volatile exposures while at the same time counterbalancing this volatility with dedicated exposure to Low Volatility equities.

This graphic is meant to illustrate our view of an optimal global equity portfolio without taking into account any constraints, which could include governance budget and bandwidth, available staff to monitor, amongst other factors. It also serves as a starting point and guide to help us evaluate the risk and constraints of our clients in our discussions on how to optimally structure a global equity portfolio.

We have been requested to consider the possibility of breaking down the global equity asset class, by region or degree of development to see if some subsets could provide hedging benefits (from a CLP perspective). The results of that analysis are included in full in Appendix K.

The current weighting to emerging markets in the MSCI All Countries World Index is around 10%. While an increased allocation to emerging markets would marginally increase the diversification benefits with a marginal increase in volatility, it will also marginally increase the complexity due to either:

- A need to utilize a customized benchmark comprising a higher weighting to emerging markets; or

- To have an additional mandate to manage the additional emerging markets exposure

For the purposes of the SAA, we propose to restrict the analysis to broad market global equities and to defer any sub-allocation decisions within global equities to the portfolio construction discussions in Section 7 of this report.

4.2.2 Fixed Income Asset Classes

The following table provides a summary of the breakdown of the global fixed income market, based on the various components within the Bloomberg Barclays Multiverse Index:

Global Aggregate

Treasuries	55.3%
Agencies/ Local Authorities	6.0%
Non-Corporate Credit	6.3%
Corporate Credit	18.0%
US MBS	11.1%
Other Mortgages	3.1%
ABS	0.2%
Total	100.0% 94.0%

Global High Yield

US High Yield	56.4%
Pan European High Yield	16.1%
Emerging Market High Yield	25.3%
Other	2.2%
Total	100.0% 4.6%
EMD Local Currency ex Global Agg	1.1%
Euro Treasury High Yield	0.3%
Total	100.0%

As indicated previously, the PRF already has exposures to the government and corporate-related sections of the Global Aggregate portion, which represents over 85% of the fixed income universe. The remainder of the universe is made up of the securitized sector (primarily US Mortgage-Backed Securities) and High Yield, or those securities rated below investment grade.

We note from the survey conducted of Financial Committee members that members were unanimous that High Yield should be considered as a potential asset class, while there was a majority in favor of also extending the universe to include Agency Residential MBS. In conjunction with the current fixed income asset classes, these would cover the vast majority of the market summarized in the above table.

With reference to the reference portfolios shown earlier, the potential gaps are:

- Local currency Emerging Market Debt – in effect this is captured above in that those emerging market countries rated investment grade or above or already in the Barclays

Global Treasury index, albeit lowly weighted given the index is weighted in accordance with outstanding debt. Those countries rated below investment grade could be captured within a broad definition of high yield.

- Also within the Growth Fixed Income categorization, we include Multi-Asset Credit which in effect is an active management strategy that seeks to rotate among the various credit opportunities as their relative attractiveness varies.
- Within the unconstrained portfolios, we include Private Debt as a potential asset class. While this was not a favorable asset class in the survey conducted of Financial Committee members (only one member supported it), we consider that could be considered as a potential asset class provided that the associated illiquidity of the asset class can be tolerated as can the resulting greater complexity of overseeing a private debt program as compared to public debt investments. Again, this is inherently an active management strategy given the inability to passively manage an exposure.
- Within the Defensive Fixed Income categorization, we include Absolute Return bonds, which again is an active management strategy that seeks to manage investment grade oriented portfolios from an absolute return perspective without a conventional benchmark index serving as an anchor.

We note that ex-ante tracking errors for the existing fixed income portfolios are capped at 50 basis points, consistent with the adoption of a largely passive approach to implementing the PRF. The discussion of the pros and cons of active and passive management is to be covered under item vi) of the scope of this study and therefore we recommend that any potential considerations of actively managed fixed income strategies be deferred to then. Similarly, any decision to take a strategic overweight to emerging market bonds can be considered at that time.

As such, for the purposes of the SAA review, we propose to use the existing fixed income asset classes but to extend the candidate asset classes to include Global High Yield and Agency Residential MBS.

4.2.3 Alternative Asset Classes

From our review of the survey of Financial Committee members, the alternative assets classes that received potential support from 50% or more of members were as follows:

- Real estate – 83% of the members appeared to be in favor of “real estate-related equity” and 67% to REITs being considered, while only 33% were in favor of “commingled real estate funds”. Our belief from this assessment is the outcome can be regarded as favoring a listed approach to gaining real estate exposure. In terms of our reference portfolios mentioned earlier, within the constrained portfolios, we favor a combined listed and unlisted real estate approach given the high correlation in the short-term between public equities and REITs. Within the unconstrained portfolios, we favor a fully unlisted approach as these portfolios do not require the liquidity that is implied in the constrained portfolios and an unlisted approach

provides a potentially better capture of the risk factors inherent in real estate investment⁷. However, we recognize the greater complexity associated with overseeing an unlisted portfolio.

- Infrastructure – 67% of members were in favor of “infrastructure-related equity”, 67% in favor of ETFs and 83% in favor of “listed infrastructure funds”, but only 17% were in favor of “unlisted infrastructure funds”. Again, we consider the outcome to be that the Financial Committee favors a listed approach to any infrastructure exposure. The situation in respect of our reference portfolios is similar as discussed in the previous paragraph in relation to real estate. That is, we considered an unlisted approach provides a better capture of the risk factors inherent in infrastructure investment.
- Commodities – 50% of members were in favor of Commodities ETFs, although there were comments referring to Chile’s existing long exposure to commodities as a reason against such an exposure as was the potential desire for the PRF to hedge against copper price movements. In addition, the only comment in favor of the exposure stated that this should only be the case if the ETFs invest primarily in the shares of companies that are producers of commodities, and not the commodities themselves. While we include allocations to Natural Resources in the unconstrained reference portfolios, the relevance is less in this situation given the influence that commodity prices (albeit copper) have on the PRF’s overall financial position. On balance, we would not recommend any exposure be considered as part of this review.

With reference to our reference portfolios outlined earlier, the only exposures not discussed to date have been private equities and hedge funds or multi-asset funds. Hedge funds were examined in the survey of Financial Committee members and these were viewed negatively, with only one member expressing a preference for them to be considered. Given the current focus on largely passive management, this view on hedge funds is not surprising.

4.2.4 Conclusions

One other consideration that we have discussed with the MoF and the Financial Committee is the potential need for a minimum cash allocation to be included given the increased need for liquidity given the PRF is now facing cash outflows. Given any need for such liquidity would be to meet CLP-denominated liabilities, this suggests that any cash requirement should be Chilean cash, which would be counter to the current approach for the PRF to invest offshore. Given that the assets in which the PRF is currently investing are liquid (and are likely to remain so), we consider that, in the near term, there is no need to introduce a strategic exposure to cash.

With reference to the classification of broad asset classes outlined for the Mercer reference portfolios, we recommended that the following be considered as potential candidate asset classes in this SAA review:

Broad Asset Class	Asset Class
Public Equity	Broad Market Equity (inc EM)
Real Assets	Infrastructure Real Estate

⁷ For a discussion of the risk factors inherent in real estate investment please refer to Section 4.3.5.

Hedge Funds and Others	n/a
Growth Fixed Income	Global High Yield
Defensive Fixed Income	Sovereign Bonds (Nominal) Inflation-Linked (Sovereign) Investment Grade Corporates Agency Residential MBS

This recommendation was accepted by the Financial Committee.

4.3 Capital Market Assumptions

In this sub-section of the report we discuss Mercer's approach to establishing capital market assumptions.

4.3.1 Overview of General Approach

Two sets of capital market assumptions are produced by Mercer globally. These are summarized as follows:

- **Steady State** - Assumptions that are set independently of (and unconditionally upon) current market valuations. For fixed income asset classes, assumptions are derived with reference to yield curves that are considered consistent with future 'steady state' growth and inflation expectations. For equity asset classes, assumptions are derived with reference to inputs consistent with 'steady state' growth and inflation expectations. As above, no allowance is made for current market valuations.
- **Market Aware** - Assumptions that are conditional upon current market valuations and acknowledge that short term asset valuations can vary, sometimes significantly, from longer-term expectations. Market Aware assumptions include the effect of such short-term fluctuations disappearing over time as initial conditions gradually revert to the steady state conditions inherent in the Steady State assumptions.

Our steady state assumptions are reviewed annually. Market aware assumptions are updated quarterly.

We have used our 20-year Market Aware assumptions as the basis for this review for the PRF.

4.3.2 Economic Variables

Consensus Economics⁸ long-term forecasts are the starting point for our 'steady state' inflation assumptions and economic growth forecasts – specifically, the average of the second five years of their ten-year forecasts, which at present, is the period 2022-2026. For countries not covered

⁸ Consensus Economics is a London-headquartered company that surveys more than 700 economists each month to obtain their forecasts and views. While most of their forecasts are focused on the next one to two years, every quarter they undertake surveys of estimates over the next ten years. It is these longer-term forecasts that we reference.

by Consensus Economics, reference is made to average of any other long-term forecasts that might be available for these countries.

In the case of inflation, reference is also made to either explicit inflation targets or mid-point of explicit target ranges. These are used to cross-check the forecasts from Consensus Economics as part of our consideration on whether to deviate from their forecasts for the purposes of our assumptions.

In the case of economic growth, it is also necessary to have assumptions for long-run labor force and productivity growth. For labor-force growth, reference is made to UN population projections in the working age group and any other sources of such projections. Productivity growth is established as the difference between the overall growth assumption and the labor-force assumption.

For emerging markets, our 'steady state' growth estimates are based on the average over the ten year period covered by Consensus Economics, combined with our assessment of the level of economic growth likely at the end of 20 years.

The breakdown of the current 'steady state' inflation and economic growth forecasts for the major developed and emerging market countries/regions is shown in Appendix F.

In relation to our Market Aware assumptions, allowance is made for initial conditions to move towards our assumed 'steady state' estimates. The proxy for the initial conditions uses a 50/50 combination of the most recent annual inflation/growth figures and the current 1 year inflation/growth forecasts from Consensus Economics. A ten year period has been assumed for reversion.

4.3.3 Equity Returns

Equity return assumptions are built using the Gordon Growth model⁹, which involves the determination of the expected return using the following building blocks:

Expected Real Return = Dividend Yield
x Expected Real Growth of Earnings/Dividends
x Changes to Price/Earnings Multiples

To derive the proportion of returns assumed to come from dividends, we establish an assumption for the assumed payout ratio for each market, which is then applied to our assumed 'steady state' earnings yield. The payout ratios are determined with reference to historical ratios and assessed future trends.

Over the long-run, growth in dividends will equal earnings growth, if the payout ratio remains constant, and in turn, earnings growth will be in line with GDP growth, if company profits account

⁹ The Gordon Growth model is named after Myron J. Gordon formerly of the University of Toronto and referenced in two papers: "Capital Equipment Analysis: The Required Rate of Profit," by M.J. Gordon and Eli Shapiro, Management Science, 3,(1) (October 1956) 102-110 and "Dividends, Earnings and Stock Prices", by Myron J. Gordon, Review of Economics and Statistics, The MIT Press. 41 (2): 99–105, 1959.

for a stable proportion of GDP. However, earnings have grown less than GDP due the following reasons:

Dilution from new share issuance, although consideration also needs to be given to the impact of share buy-backs:

- GDP includes faster growing unlisted companies.
- Equity market may not have been fully representative of economy, and therefore, the drivers of economic growth
- Conflicts of interest cause managers to retain too much earnings and over-invest
- Impact of foreign sourced earnings

These factors are considered in deriving our earnings growth assumptions.

Finally, we incorporate an allowance for changes in the P/E ratio, when the initial ratio is outside our assessed fair value range for that market. The ratio is determined with reference to normalized earnings as opposed to actual trailing earnings, with normalized earnings being derived with reference to an adjusted Shiller¹⁰ P/E approach of looking at rolling ten-year real earnings. The adjustment to the usual Shiller approach seeks to make allowance for the fact that the 10-year average of a series that grows over time will systematically underestimate its current value. As such, we adjust the usual Shiller average real earnings for the trend growth rate in earnings.

These returns are then converted to nominal returns using our inflation assumptions.

4.3.4 Fixed Income Returns

For each market, we derive an estimate for the ‘steady state’ yield curve. The assumed long-dated yields are established with reference to our growth forecasts. Specifically, the 10-year nominal ‘steady state’ sovereign yield is set equal to 90% of the assumed nominal ‘steady state’ economic growth¹¹. In the case of emerging markets, we base the ‘steady state’ 10-year sovereign yield on the assumed ‘ending point’ nominal growth forecasts for each market – i.e., at the end of the 20 year period.

The short-end of the yield curve is determined based on an assumed term premium deemed applicable for the relevant market. The term premium is then apportioned along the yield curve.

Real sovereign yields are then determined by deducting the assumption for expected inflation and the assumed inflation risk premium for the relevant maturity from the nominal yield.

Our Market Aware assumptions make an allowance for initial yields to move to the assumed ‘steady state’ yields. From a basic principle, for developed markets, we aim for a 10 year period for reversion with implied forward rates being used for the initial 3 years of the reversion period.

¹⁰ The Shiller P/E approach is attributable to Robert Shiller, an economics professor at Yale University. It is also known as the cyclically adjusted price-to-earnings ratio (“CAPE”) and is a smoothed version of the P/E ratio. It is derived by dividing the current price by the inflation-adjusted average of the last ten years of earnings.

¹¹ Mercer’s analysis supporting this relationship is summarized in Appendix G of this report.

We then proceed to calculate the returns expected in each year associated with the assumed transition in the yield curve:

- Returns are derived with reference to the current maturity structure of the relevant market and assume a constant maturity profile is maintained.
- The returns make allowance for the expected price impact of the movement in yields during each year (including the impact of roll-down associated with maintaining a constant maturity profile) together with the income associated with the running yield.

In the case of local currency Emerging Market Debt, ‘market aware’ assumptions incorporate a 20 year period for reversion to occur from initial yields to ‘steady state’ yields.

A similar approach is used for non-government bonds (and lower grade sovereign) reflecting required credit quality. We make assumptions for ‘steady state’ spreads based on historical long-term spreads for the relevant market as well our assessment of future trends. As with sovereign bonds, we make an allowance for reversion from current spreads to our assumed ‘steady state’ spreads. Assumptions are also made for probabilities of default and recovery ratios, derived with reference to the studies published by the rating agencies. These assumptions are used to adjust the expected returns for the impact of expected defaults, net of expected recoveries. This approach is also used for hard currency Emerging Market Debt, where the spread is derived with reference to US treasury yields.

Our expected returns for MBS are modelled as an option-adjusted spread over the 10-year sovereign yield. As above, we make assumptions for the ‘steady state’ spread based on historical data as well our assessment of future trends and incorporate an allowance for reversion from current spreads to our assumed ‘steady state’ spreads.

4.3.5 Approach for Alternative Assets

Typically, in setting expected returns for asset classes, we assume passive index funds or extremely low cost vehicles that allow diversified exposure to the asset classes. For most publicly traded asset classes, this is certainly true, as dozens, if not hundreds of index funds, enhanced index funds, and ETFs exist. The hallmarks of these funds are very low tracking error risk and high liquidity. However, for a few categories, most notably the alternative investments—hedge funds, private equity, and private real estate—this is untrue. There is no way of gaining passive exposure. Instead, investors planning a strategic asset allocation must utilize active management and pay active management fees.

Our approach for modelling alternative asset classes incorporates a risk factor model, based on Fung and Hsieh (2002)¹²; namely:

$$R_{i,t} - RFR_t = \beta_1 + \sum \beta_j \times F_{j,t} + \varepsilon_{i,t}$$

where $R_{i,t}$ is the expected return for asset class i , RFR_t is the expected risk-free rate, β_1 is any asset class unique premium, $F_{j,t}$ is risk factor j , β_j is the sensitivity or beta of the asset class returns to risk factor j and $\varepsilon_{i,t}$ is an error term.

¹² “Asset-Based Style Factors for Hedge Funds”, by W. Fung and D.A. Hsieh, Financial Analysts Journal, September/October 2002, pp. 16-27

The risk factors that are incorporated into our model are:

Risk Factor	Description
Equity Risk Premium	The premium expected from investing in developed large cap equities above the risk-free rate, which is assumed to be treasury bills
Small Cap Premium	The additional return expected from investing in small cap equities relative to large cap equities
Emerging Market Premium	The additional return expected from investing in emerging market equities relative to developed market equities
Term Premium	The premium expected from investing in government bonds relative to the risk-free rate
Credit Spread Premium	The premium expected from investing in high yield bonds relative to government bonds
Non-Corporate GDP Growth	Returns on assets such as real estate will be partially explained by the economic cycle and GDP growth not directly linked to the corporate sector, which is captured in the Equity Risk Premium
Unexpected Inflation	The difference between the long term average expected inflation and short term modelled unexpected inflation outbreaks
Illiquidity	Investors expect higher rates of return to compensate for the disadvantages of holding “difficult to market” or “expensive to trade” assets
Value	The premium expected from investing in value strategies
Momentum	The premium expected from investing in momentum strategies
Carry	Additional return expected from holding the investment
Currency	The premium expected in investing in foreign currencies
Alpha	The additional return expected from active management of the underlying assets
Other	Any other potential return driver that may arise with a particular asset class

When looking at the beta exposure we use a mixture of historical analysis based on regression of the asset class return series against the risk factor return series, as well as forward looking assumptions.

The returns for real estate within our factor model are driven by economic growth given the significant impact that GDP growth has on underlying rental and property price growth. We also assume that real estate is impacted by the overall level of interest rates and credit conditions given the use of the debt. Real estate is also assumed to have some underlying equity beta. For private real estate, we incorporate alpha assumptions reflecting what we think Mercer's A-rated managers can return net of all fees and an allowance for an illiquidity premium.

We differentiate between REITs (or public forms of real estate) and private forms of real estate for two key reasons. First, REITs are able to employ leverage and can also be managed on a passive basis. Additionally, REITs have the ability to grow by using additional public offerings of stock or debt.

A similar approach is adopted for infrastructure, although the beta exposures are slightly different.

Our private equity assumptions begin with cash rates and then add high equity beta exposure. Equity beta exposure ranges from 0.85 for mezzanine funds to 1.50 for venture capital funds. We also add in beta to other equity factors such as value and size. Additionally, for mezzanine funds we also add in beta exposure to credit. We also assume an illiquidity premium given the long life of the typical fund and the benefits associated with being a long-term holder of capital. The net alpha assumptions for private equity are based on what we think Mercer A-rated manager can earn.

Our hedge fund risk and return assumptions assume beta exposures to market factors such as equities, credit and duration as well as style factors such as value, carry and momentum. We also assume an illiquidity premium based on the assumption that hedge funds can access opportunities not available to strategies offering daily or monthly liquidity, thus boosting returns. The net alpha assumptions for hedge funds are based on what we think Mercer A-rated manager can earn.

4.3.6 *Currency Translation*

Assumptions for unhedged asset classes are based on the local currency returns adjusted for the expected change in the various currencies over the forecast horizon.

The impact of currency is assumed to follow purchasing power parity (“PPP”) for developed markets¹³ and PPP adjusted for productivity differentials for emerging markets. We use separate approaches because of the lower stability of interest rates in emerging countries, higher inflation and higher productivity growth. Under PPP, the impact of currency is the difference between assumed interest rates, with a higher inflation rate in a foreign country leading to a decline in that currency’s value. For Market Aware assumptions, an adjustment will be made based on the current exchange rate relative to the historic average ratio of spot exchange rate to absolute PPP level.

For the PPP currency impact in emerging markets, the currency return is assumed to be comprised of two parts. The difference between the assumed inflation rates is the first part, which is standard PPP. We add to this 1/3rd of the productivity differential between the emerging and developed home country (this is the Balassa-Samuelson effect¹⁴). Productivity differentials capture the appreciation in real terms of an emerging country. Allowance is made for real exchange rates to move towards ‘fair value’ level implied by the Balassa-Samuelson relationship, although consideration is also given to the extent of any persistent current account

¹³ The concept of Purchasing Power Parity is discussed in numerous academic papers. In Appendix H we reference the study done by Dimson, Marsh & Staunton of the London Business School.

¹⁴ Please refer to Section 3.4 for a discussion on this relationship. Further discussion is included in Appendix H.

deficits such that these deficits might be expected to preclude a currency from appreciating in real terms to the extent implied by the Balassa-Samuelson relationship.

Assumptions for hedged asset classes are based on the local currency returns adjusted for interest rate differentials. This is based on average cash return differentials over the horizon period of interest. This is a function of the arbitrage principle of covered interest rate parity that is inherent in the pricing of forward exchange contracts¹⁵. As a result, the expected return for hedged global equities can be expressed as:

$$ER(GEH) = \sum w_i \times (r_i + fp_{USD,i}) \quad (1)$$

where w_i = weight in country i
 r_i = expected equity return in country i in that currency
 $fp_{USD,i}$ = expected forward premium between USD and currency i

The forward premium can be approximated as the interest rate differential between USD and the foreign currency over the term of the forward exchange contract – that is:

$$Fp_{USD,i} \approx DC - FC_i \quad (2)$$

where FC_i = expected cash return in currency i

This excludes the impact of any transaction costs associated with rolling over forward exchange contracts.

4.3.7 Standard Deviation and Correlation Assumptions

Standard deviation and correlation assumptions are based on historical data adjusted at Mercer's discretion and in its professional judgment. Differences between historical and assumed volatility and correlations reflect the need for judgment because of:

- Limited historical data for an underlying benchmark
- Related to this point, since we are seeking to forecast the volatility of annual returns, the annual return history will be limited for many asset classes. Monthly or quarterly returns are often used to overcome the lack of annual returns. However, if the returns over these shorter periods exhibit serial correlation, then volatility estimates derived from such returns can underestimate annual volatility
- Adjustments to eliminate the effects of abnormal periods that are not expected to be repeated over the forecast horizon
- Adjustments to capture structural changes

Our approach for deriving covariances is to initially derive a covariance matrix for major asset classes based on the historical correlations over the period, since 1988, through an approach

¹⁵ Forward contracts will be priced so that, after taking the costs and credit risks associated with hedging into account, the interest rate the investor earns by investing in the short-term money market in a foreign currency will be equal to the interest rate the investor could earn by investing in its domestic short-term money market. This equality is known as the **covered interest rate parity theorem**. If this relationship did not hold, then risk free arbitrage opportunities would arise from borrowing in one currency and investing in another. Further information is included in Appendix I.

based on Stambaugh¹⁶ to deal with different lengths of historical data. This method strives to combine the information available in longest history data with that of shorter history assets.

For instance, suppose that we have two assets, A and B, A having a longer history than B. The movements of asset B are estimated through a linear regression, the magnitude of this extra information being defined by the sensitivity (beta factor) of asset B relative to asset A movements over their common history sample. The missing data of the longest incomplete time series is estimated first and we then successively measure the sensitivity of each shorter series against the longer ones with a multiple linear regression and estimate their historical behavior. The modeling of missing data thus allows us to calculate a covariance matrix, which includes the information present in the longest history series. Consideration is also given to the longer history of those asset classes with longer return series than 1988.

As discussed above, judgment may then be used to adjust the historical covariance matrix, where we consider future relationships are likely to differ from those in the past.

For example, Mercer's large cap equity standard deviation is 18.1%, lower than the S&P 500 standard deviation of 20.5% since 1929, but higher than has been experienced in recent years.

For fixed income, we primarily concentrate on the period from 1970 onward. Interest rates were completely deregulated in the mid-1970s through early 1980s (for example, Regulation Q, which set a maximum for interest offered by banks and savings and loans, was repealed in the 1970s). Additionally, flexible exchange rates, the elimination of the gold standard, and the advent of financial futures also occurred during that period.

Historically, we have seen a wide discrepancy between actual and expected inflation. For instance, during the period from the late 1970s through the mid-1990s, as inflation rose in the early part of this period, the market factored in high inflation expectations. Even when inflation came in lower than expected in the late 1980s and early 1990s, the market was cautious and kept nominal interest rates quite high relative to actual inflation. (Some analysts cite the 1980s as a period of high real returns, but that does not necessarily mean that real yields were high.) Consequently, we have seen a much weaker relationship between inflation and many asset classes than commonly assumed. Another problem is in adjusting for the difference between actual inflation, which is a backward measure, and yield, which is forward looking. Finally, the market is pricing in expected inflation and reacts to unexpected changes in inflation only when they are deemed permanent.

Our assumptions for alternative assets are a function of the risk factor model that we use to model these asset classes. Estimating the volatility of unlisted asset classes can be difficult given that most underlying net asset values are updated only quarterly. As such, there can be difference between underlying economic volatility and visible realized pricing volatility. The visible realized unlisted returns are very smoothed and do not have much mark to market pricing. For example, on a fundamental basis we do believe that if a private equity portfolio were marked to market, at a market price for the underlying holdings, it would have higher levels of volatility than those observed. We realize that this is not how private equity funds are operated and private equity investors do not think in these terms, however this type of analysis does capture the appropriate long term risks, translated to mean variance statistics. Because

¹⁶ "Analyzing Investments Whose Histories Differ In Length", Robert F. Stambaugh, NBER, February 1997

one-period annual volatility is needed, the volatility number used for private equity may seem to be higher than the numbers investors are used to seeing. A similar principle applies to other unlisted asset classes, such as real estate and infrastructure.

4.3.8 Conclusion

The following table summarizes our expected return and volatility assumptions from a CLP perspective in ***nominal*** terms – these are shown for the asset classes outlined in Section 4.2.4:

	Expected		
	Nominal Geometric Return	Standard Deviation	Risk/Return Ratio
Broad Market Equities	7.1%	15.1%	0.47
Real Estate - Listed	6.5%	20.0%	0.33
Real Estate - Core (u)	7.6%	14.3%	0.53
Real Estate - Core (h)	8.6%	14.7%	0.58
Infra - Listed	6.3%	14.9%	0.42
Infra - Core (u)	7.8%	17.7%	0.44
Infra - Core (h)	8.4%	18.4%	0.46
Sov. Bonds (Nom) (u)	2.4%	10.4%	0.23
Sov. Bonds (Nom) (h)	3.7%	5.0%	0.74
Investment Grade Corporates (u)	3.5%	10.8%	0.33
Investment Grade Corporates (h)	4.8%	5.8%	0.84
Inflation-Linked Sovereigns (u)	2.3%	10.2%	0.22
Inflation-Linked Sovereigns (h)	3.6%	4.5%	0.81
Global High Yield (u)	4.6%	12.7%	0.36
Global High Yield (h)	5.8%	10.2%	0.56
Agency MBS (u)	3.3%	11.6%	0.28
Agency MBS (h)	4.6%	3.3%	1.41
Chile Inflation	3.0%	3.0%	

For the real assets (real estate and infrastructure), we have included assumptions for both listed and private (or unlisted) forms. The private forms of these asset classes come with different risk/return characteristics – for example, in the case of real estate, institutional investors might target exposures in the following:

- **Core** - high quality assets; minimal vacancy; secure leases conservatively geared (below 35% Loan to Value ratio ('LTV')) and asset turnover is low. Open ended structures for pooled vehicles
- **Core Plus** - some lower quality assets; higher income yield; may include higher vacancy risk with asset refurbishment and/or repositioning; gearing in the 40% to 50% LTV range. Either open or closed ended structures for pooled vehicles

- **Value Add** - higher risk profile; lower allocation to core holdings, (circa 30%-50% of the portfolio); gearing > 50%. Focus mainly on asset refurbishment. Returns are back-ended like private equity. Typical fund life is 5 to 7 years via close ended structures.
- **Opportunistic** – typically development in emerging or frontier markets; gearing > 65%; returns are back ended like private equity. Fund life typically 5 to 7 years via close ended structures.

For both private real estate and infrastructure, we have assumed a core approach would be the most appropriate for the PRF and our modelling has been conducted on this basis. This assumption of a core approach is consistent with the approaches that we see from institutional investors in relation to their initial investments in these asset classes. That is, the focus is on the stable cashflows, with some potential inflation adjustments with a relatively lower risk approach as compared to the other approaches which bring more risk and complexity.

As discussed in Section 3, any consideration of currency hedging should be focused on potentially hedging the currency exposures associated with global bonds. As shown in the table on Page 21, the historical volatility of global bond returns in unhedged CLP terms has been more than double the volatility in unhedged USD terms and this has also been the case for the shorter period for which we have been able to estimate hedged to CLP returns. This is a reflection of the fact that movements in the CLP relative to the Bloomberg Barclays Global Aggregate Index currency basket have tended to be **positively** correlated to bond returns.

In contrast, the volatility of global equity returns in unhedged CLP terms has been lower than those in USD terms and this has also been the case for the shorter period we have estimate hedged to CLP returns. This is a function of the fact that the movements in the CLP relative to the MSCI ACWI currency basket have tended to be **negatively** correlated to equity returns. It is for this reason that we have not considered Broad Market Equities on a hedged to CLP basis, which by extension, we have also applied for listed real estate or infrastructure.

It will be noted that the reduction in volatility is not as significant for core real estate or core infrastructure since these asset classes do not tend to exhibit the same degree of positive correlation as exists with the fixed income asset classes

The correlation matrix for nominal returns is as follows:

	Broad Market equities	Real Estate - Listed	Real Estate - Core (u)	Real Estate - Core (h)	Infra - Listed	Infra - Core (u)	Infra - Core (h)	Sov. Bonds (Nom) (u)	Sov. Bonds (Nom) (h)	Investment Grade Corporates (u)	Investment Grade Corporates (h)	Inflation-Linked Sovereigns (u)	Inflation-Linked Sovereigns (h)	Global High Yield (u)	Global High Yield (h)	Agency MBS (u)	Agency MBS (h)	Chile Inflation
Broad Market Equities	1.0	0.8	0.9	0.8	0.9	0.9	0.8	0.0	-0.3	0.1	0.1	-0.1	0.4	0.5	0.0	-0.1	-0.1	
Real Estate - Listed		1.0	0.8	1.0	0.9	0.8	0.0	-0.2	0.2	0.2	0.0	-0.2	0.4	0.4	0.1	0.0	-0.1	
Real Estate - Core (u)			1.0	0.8	0.9	0.9	0.7	0.2	-0.1	0.3	0.2	0.2	-0.2	0.5	0.4	0.2	0.0	-0.2
Real Estate - Core (h)				1.0	0.8	0.7	0.9	-0.4	-0.2	-0.2	0.2	-0.4	-0.2	0.1	0.5	-0.4	0.0	0.1
Infra - Listed					1.0	0.9	0.8	0.1	-0.2	0.3	0.1	0.1	-0.2	0.5	0.4	0.2	0.0	-0.2
Infra - Core (u)						1.0	0.8	0.1	-0.2	0.3	0.1	0.1	-0.2	0.5	0.4	-0.2	-0.1	-0.2
Infra - Core (h)							1.0	-0.4	-0.2	-0.2	0.2	-0.3	-0.1	0.1	0.5	-0.4	-0.1	0.1
Sov. Bonds (Nom) (u)								1.0	0.5	0.9	0.3	0.8	0.1	0.6	-0.1	0.8	0.3	-0.5
Sov. Bonds (Nom) (h)									1.0	0.5	0.8	0.1	0.2	0.2	0.2	0.3	0.7	-0.1
Investment Grade Corporates (u)										1.0	0.5	0.7	0.0	0.8	0.2	0.9	0.3	-0.5
Investment Grade Corporates (h)											1.0	0.0	0.1	0.5	0.8	0.1	0.6	-0.1
Inflation-Linked Sovereigns (u)												1.0	0.4	0.5	-0.2	0.8	0.1	-0.3
Inflation-Linked Sovereigns (h)													1.0	-0.1	0.0	0.0	0.2	0.4
Global High Yield (u)														1.0	0.6	0.7	0.2	-0.4
Global High Yield (h)															1.0	-0.1	0.3	0.0
Agency MBS (u)																1.0	0.4	-0.5
Agency MBS (h)																	1.0	0.1
Chile Inflation																		1.0

Further details on the derivation of the expected nominal geometric returns are included in Appendix F. Mercer's full Capital Market Outlook Report is in Appendix O.

4.4 Approach to Modelling the Fund's Cash Flows

In this sub-section of the report, we outline our approach to modelling the Fund's future cash flows. Given our recommendation for the investment objectives to be focused on attaining a yet-to-be-established real rate of return, it could be argued that an asset-only approach to this study could be undertaken in which case there might be no need to model the Fund's cash flows.

However, we still propose to do so for two main reasons:

- Modelling the cash flows will enable us to projected the future growth of the fund; and
- Modelling the inflows will also enable us to consider the extent to which the investment of the assets can provide overall diversification to the PRF's financial position, although this could also be achieved by assessing the correlation of investment returns to Chilean GDP, since this is the key driver of the inflows

4.4.1 Modelling Inflows

The following table summarizes the historical contributions to the PRF and the relationships to other variables:

	Contribution (US\$ million)	% of GDP prev. year	Prev. year real GDP	Prior Year Copper Price		Prior Year Effective Fiscal Balance (% of GDP)
				Movement USD	Movement CLP	
2006	604.5	0.5	5.1%	39.2%	28.2%	4.1%
2007	736.4	0.5	6.3%	38.9%	44.7%	7.5%
2008	909.1	0.5	4.4%	5.3%	-1.7%	8.0%
2009	836.7	0.5	-0.1%	-54.2%	-41.4%	4.0%
2010	337.3	0.2	2.4%	141.4%	92.2%	-4.1%
2011	443.3	0.2	6.5%	31.4%	21.2%	-0.3%
2012	1197.4	0.5	5.5%	-21.3%	-12.7%	1.6%
2013	1376.8	0.5	5.0%	4.2%	-4.0%	1.2%
2014	498.9	0.2	3.0%	-6.7%	2.4%	-0.2%
2015	463.9	0.2	1.7%	-13.7%	-0.3%	-2.0%
2016	462.3	0.2	1.4%	-26.1%	-13.7%	-2.1%

Source: "Annual Report Sovereign Wealth Funds Ministry of Finance; 2015", Fund website, Datastream.

In the previous study that Mercer undertook for the MOF, our analysis concluded that, in the case of the period from 1994 to 2006, there had been a low correlation between copper prices and Chilean GDP growth, irrespective of whether coincide or lagging correlation time-periods were assumed. We have undertaken an update of that analysis and the results are summarized below:

Correlations of Chilean GDP to USD Copper Prices: June 1996 - September 2016

Basis for Correlation	Quarterly Data	Rolling Annual Data	Annual Data
	[1]	[2]	
Without Lag	0.16	0.38	0.52
1 Period Lag	0.18	0.52	0.48
2 Period Lag	0.31	n/a	n/a
3 Period Lag	0.21	n/a	n/a
4 Period Lag	0.11	n/a	n/a

Correlations of Chilean GDP to CLP Copper Prices: June 1996 - September 2016

Basis for Correlation	Quarterly Data	Rolling Annual Data	Annual Data
	[1]	[2]	
Without Lag	0.08	0.32	0.35
1 Period Lag	0.18	0.50	0.37
2 Period Lag	0.24	n/a	n/a
3 Period Lag	0.18	n/a	n/a
4 Period Lag	0.07	n/a	n/a

[1] Correlation of quarterly year-over-year results

[2] Correlation of data for 12 month periods ended 30 September. These are shown for reference purposes, although the short period (19 or 20 observations) means that these results are not statistically significant

If annual data is used, there is a reasonably strong correlation although, as indicated, the limited number of distinct 12-month periods in the analysis means that the results are not statistically significant and the use of rolling annual data involves some degree of serial correlation due to the overlapping time periods.

However, the key relationship as it affects inflows is the effective fiscal balance position since this is what influences the magnitude of the inflow. As such, we have also analyzed the relationship between copper prices and the change in the effective fiscal balance position from one year to the next. We are able to analyze the relationship over the period from 1991 to 2016, although that still only gives us 25 observations.

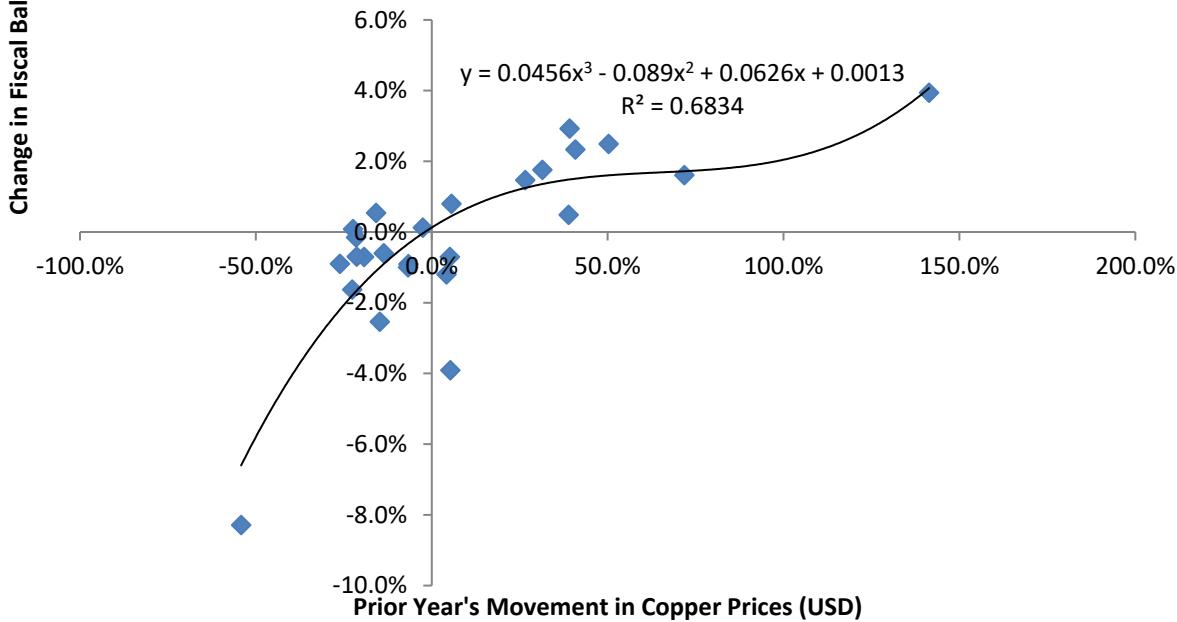
Correlations of Change in Fiscal Position to Copper Prices: 1991 - 2016

Basis for Correlation	USD Copper	
	Prices	CLP Copper Prices
Without Lag	-0.19	-0.15
1 Period Lag	0.73	0.75

Notwithstanding the relatively small number of observations, this analysis shows a high correlation between the copper price movement in one year and the change in the effective fiscal position in the next year. The relationship is similar irrespective of whether USD or CLP copper prices are considered.

The relationship is also examined below from a regression perspective. As such, we consider that a reasonable approach for estimating the effective fiscal balance for a particular year will be to take the fiscal balance at the end of the previous year and to use the regression relationship to simulate the exchange change in the fiscal balance during that year based on the previous year's simulated change in copper prices.

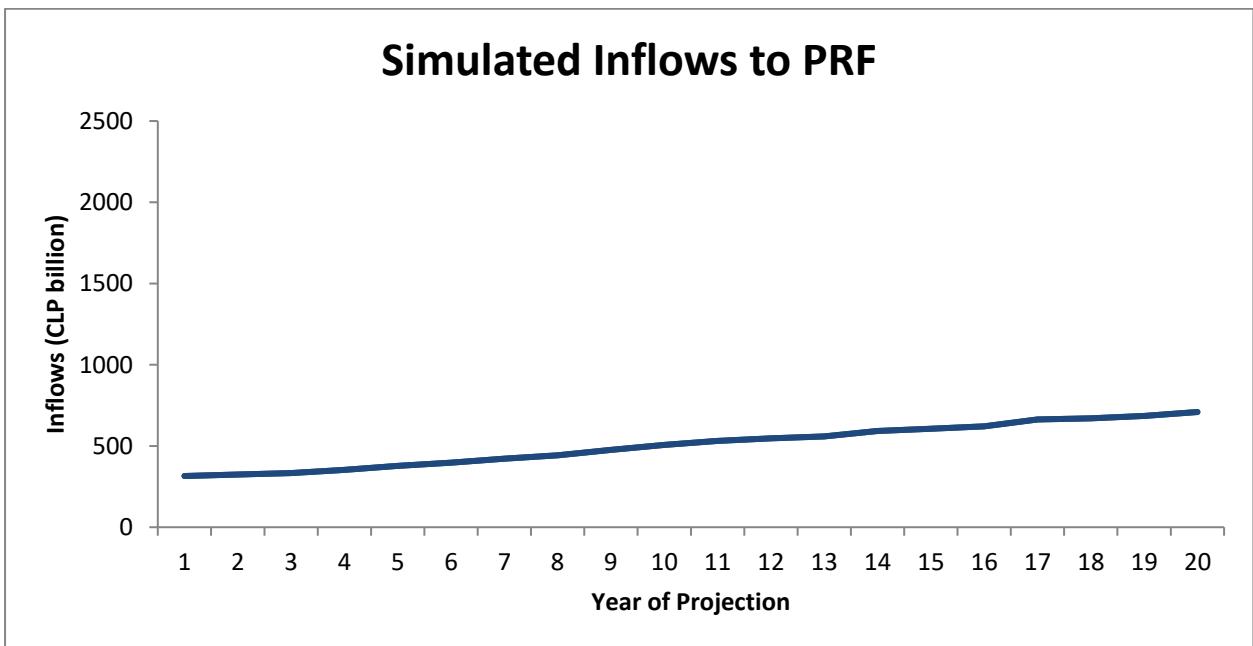
Relationship between Copper Price Movements and Change in Fiscal Balance



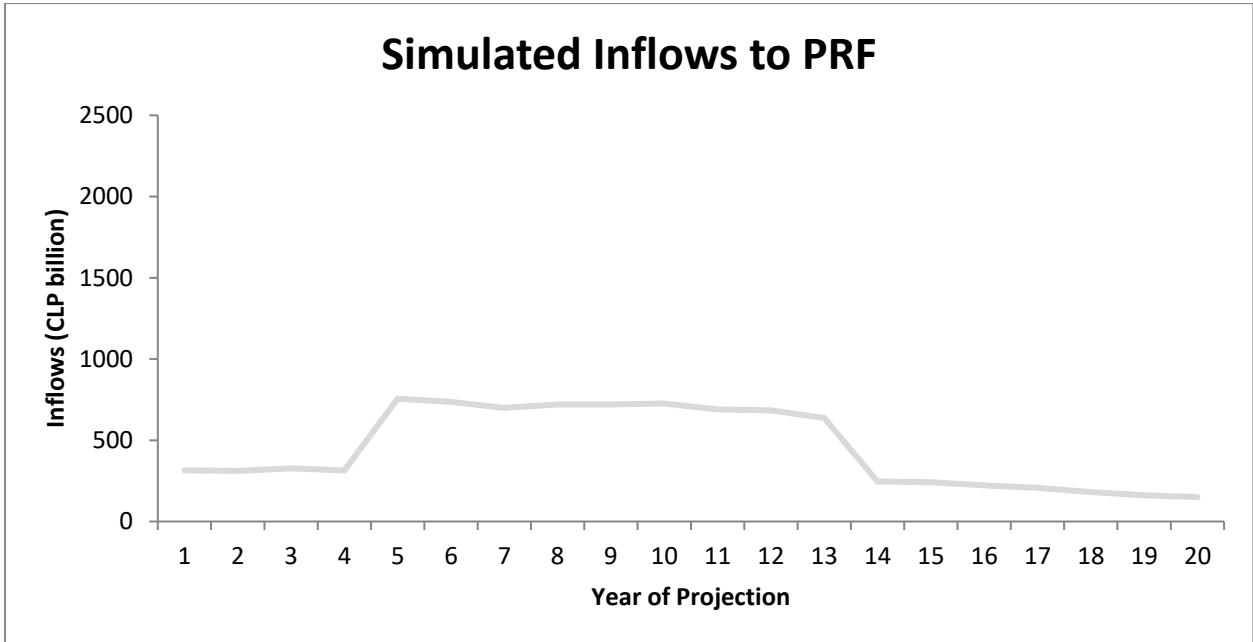
As such, our approach for estimating the effective fiscal balance for a particular year will be to take the fiscal balance at the end of the previous year and to use the above regression relationship to simulate the change in the fiscal balance during that year based on the previous year's simulated change in copper prices.

Therefore, in those simulations that result in an effective fiscal deficit for the previous year, we would assume the minimum contribution of 0.2% of the previous year's GDP. However, for those simulations that result in an effective fiscal surplus position, we will assume an increased percentage as the basis for the contribution up to the maximum contribution of 0.5%.

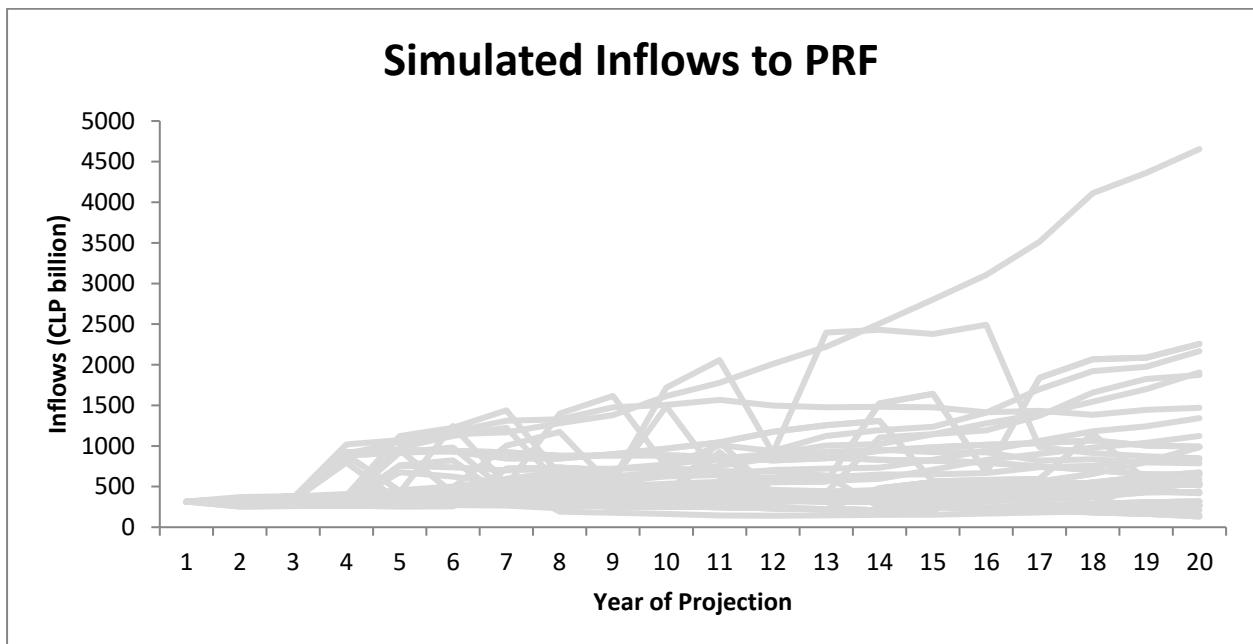
Our model uses *Monte Carlo* techniques to generate plausible observations from the probability distribution of potential outcomes for the future inflows. The rationale behind carrying out stochastic modelling of potential results is that, while the "long term" expected inflows on the basis of our assumptions might look like this...



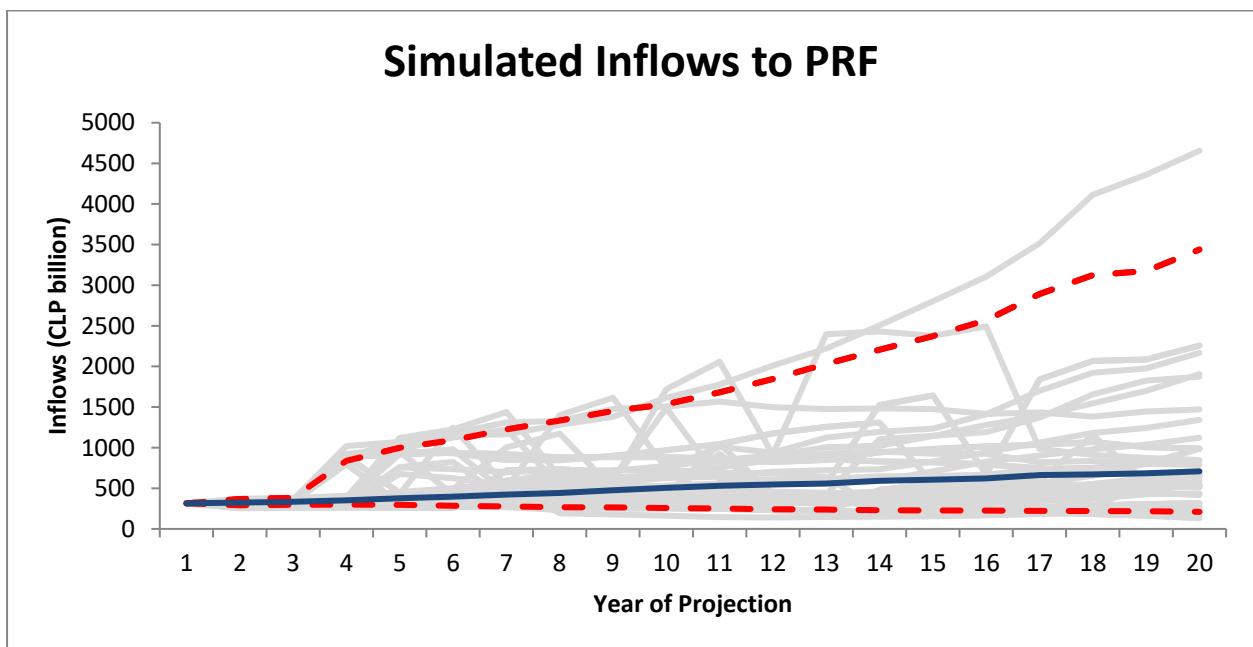
...however in reality, the next 20 years could be significantly different from the long term expected level, and the results of our projection could then well look like this:



The results of 50 simulations of different 20-year periods might therefore look like this:



Our model produces 1,000 simulations of projected inflows over the next 20 years. To make sense of the pattern of potential outcomes, rather than plot all the simulations on a single chart, we will consider the median result, as well as the 5th and 95th percentile cases. Ninety percent of all simulated projections lie between these upper and lower percentile lines, and no more than 5% of observations fall below the lower 5th percentile line. These percentile lines are marked in red on the following chart.



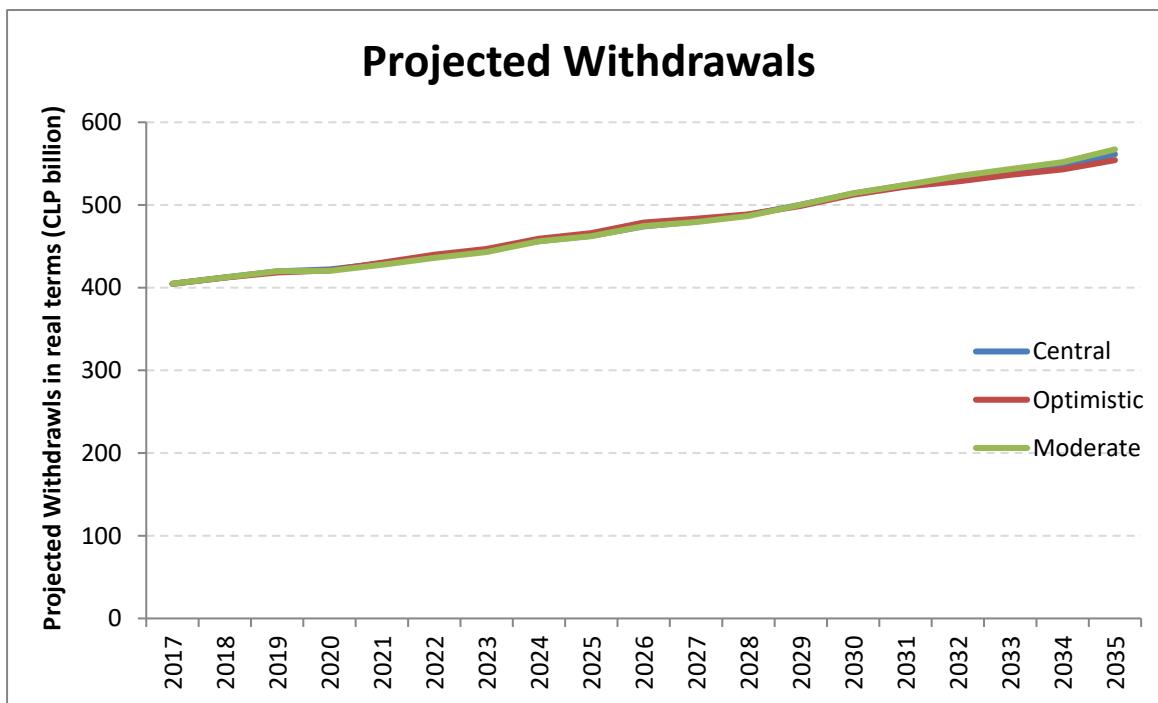
What is of interest is not just the median result (shown in blue in the above chart), but in particular the lower 5th percentile result since this provides a good indication of the plausible worst case outcome.

4.4.2 Modelling Outflows

In similar studies where we have been incorporating government pension projections into our analysis, we have sought to understand the key assumptions underpinning those projections, especially in regards to the inflation and, where relevant, real wage growth assumptions. We have then requested that those projections be also generated under assumptions that are higher and lower than the central assumptions that underpin the initial projections so that we can assess the sensitivities.

Based on this assessment, we will adjust the deterministic withdrawal projections we have been provided with to reflect the simulations from our asset model and the calibrated simulations such that the median of the distribution of our simulated liability projections approximately coincides with the deterministic projections.

In this case, the withdrawals have been projected in real terms and therefore differences in inflation simulations will not need to be taken into account. The withdrawals we have been provided with are undertaken under three different scenarios. These are shown below.



As can be seen, the withdrawals are not that sensitive to the underlying economic assumptions within each of the scenarios. On this basis, an approach based on using the deterministic withdrawals without seeking to establish an inter-relationship with the stochastically projected economic variables is likely to be sufficient.

4.4.3 Conclusions

In relation to modelling the cash flows in and out of the PRF we propose an approach that seeks to stochastically model the inflows but to deterministically model the outflows on the basis that the withdrawals do not appear sensitive to different economic regimes.

4.5 Modelling Real Returns

The Financial Committee has requested that our analysis for determining and analyzing the candidate portfolios for the Strategic Asset Allocation be undertaken in real terms.

Mercer's understanding is that pensions in Chile are effectively denominated in UFs (Unidad de Fomentos) rather than CLP. That is, the pension might be 100 UFs per month, which means that the value in CLP will automatically be adjusted upwards (or potentially downwards) to reflect inflation movements. This outcome would be the same as if pensions were denominated in CLP terms and then adjusted from time to time for inflation, as would be what is done in other countries where pensions are subject to periodic inflation adjustments.

While theoretically we could project the investment returns in real terms, this does not appropriately pick up the differences between nominal bonds and inflation-linked bonds. Therefore, it is preferable to do the investment return projections initially in nominal terms.

This is mainly a function of the operation of our stochastic model and the use of an optimization approach based on those simulations. As can be seen from the diagram of the workings of our model that is included in Appendix E, the simulation of inflation is an integral part of our stochastic model.

If we were to attempt to just generate the simulations in real terms, then we would effectively need to assume zero inflation for all regions being simulated. We would then need to express the nominal yields in real terms, which would mean that they are going to essentially be the same as the yields used for inflation-linked bonds. Therefore, we consider it better to simulate returns in nominal terms first and then deflate those based on the simulated Chilean inflation in order to generate the real returns to be used within our optimization model.

This approach is analogous to what would be followed in the event that a mean-variance optimization (MVO) approach was to be pursued. For example, let us assume for illustration purposes that the covariance matrix used for the MVO analysis were to be based on historical returns over some appropriate period. If we were doing this from a CLP perspective, it would be first necessary to convert the historical nominal returns into CLP. The nominal covariance matrix would then be derived from the historical nominal returns. The real covariance matrix would be derived from the historical nominal returns deflated by historical Chilean inflation.

The historical covariance matrix might then be adjusted to reflect forward-looking expectations but the key point is that deflated nominal returns are used. This is what we will be doing for the optimization approach from a real return perspective, albeit based on our simulated returns.

As indicated above, our stochastic model starts with a generation of inflation, which is correlated across regions. In particular, the model simulates inflation for the major developed markets, for emerging markets in aggregate and for Chile. We have included further details of the approach used to simulate inflation in Appendix E of this report. In relation to our assumption for the error terms for the Chilean inflation simulations, we base this on the historical volatility and how we assess this will vary going forward. From a historical perspective, we have calculated the

standard deviation of the annual inflation figures for the past 25 years to be 3.4% and we assume a lower figure of 3% will be applicable going forward.

We then simulate real GDP growth, which again is correlated across regions – the correlations need not be the same as those used for inflation. Next we generate various yields and again these are correlated across regions. The returns are then generated with reference to the changes in the simulated yields during each year. Therefore, we are using a variety of different correlations in generating the simulations. The end result will be nominal returns in CLP terms. As such, we can then generate a forward-looking covariance matrix from these simulated returns either by using the nominal returns or by deflating those returns by the simulated Chilean inflation. As mentioned above, this is analogous to what was outlined above for how a MVO analysis from a real return perspective with a historical covariance matrix would operate.

Therefore, the optimization process we are proposing would be based on the simulated real returns and accordingly the inherent covariance matrix will be real in nature.

We will also project forward the growth in the fund value of the PRF over the next 20 years in real terms.

As discussed in Section 4.4.2, Mercer has been provided with the withdrawal projections in real terms and therefore these will be used for the outflows. The information provided also includes the projected expenses, again in real terms.

In relation to the inflows to the PRF, then our approach is as follows:

- Projecting forward Chilean GDP – this can be done in nominal or real terms since our model generates both.
- Projecting forward the fiscal balance – that is, we have the position at the start of the year and then we will be generating the change in the year based on the simulated movement in the previous year's copper price. This will effectively be undertaken in nominal terms since we would be simulating the copper price in nominal terms and the fiscal balance is expressed in nominal terms. We will then deflate the inflows calculated in this manner based on the simulated inflation.

The investment income that the fund achieves each year will be based on the simulated real return for the relevant asset allocation.

As such, the modelling approach has been undertaken in real terms as requested by the Financial Committee.

The following table summarizes our assumptions from a CLP perspective in **real** terms. The figures have been derived from our simulated nominal returns in CLP deflated by our simulations for Chilean inflation. That is, for each trial and each year, the nominal returns are divided by the simulated Chilean inflation associated with that trial and year in order to establish the real returns. The expected real geometric returns are then derived as the average cumulative annualized real return across the trials. The standard deviations are derived in a

similar manner and the correlations are derived based on the correlations of the simulated real returns.

	Expected Real Geometric Return	Standard Deviation	Risk/Return Ratio
Broad Market Equities	3.9%	15.5%	0.25
Real Estate - Listed	3.4%	20.3%	0.17
Real Estate - Core (u)	4.5%	15.0%	0.30
Real Estate - Core (h)	5.4%	14.4%	0.37
Infra - Listed	3.2%	15.6%	0.21
Infra - Core (u)	4.6%	18.3%	0.25
Infra - Core (h)	5.2%	18.0%	0.29
Sov. Bonds (Nom) (u)	-0.6%	11.9%	-0.05
Sov. Bonds (Nom) (h)	0.7%	6.0%	0.12
Investment Grade Corporates (u)	0.5%	12.3%	0.04
Investment Grade Corporates (h)	1.8%	6.6%	0.27
Inflation-Linked Sovereigns (u)	-0.7%	11.3%	-0.06
Inflation-Linked Sovereigns (h)	0.6%	4.4%	0.14
Global High Yield (u)	1.6%	13.9%	0.11
Global High Yield (h)	2.7%	10.4%	0.26
Agency MBS (u)	0.2%	13.0%	0.02
Agency MBS (h)	1.5%	4.8%	0.32

	Broad Market Equities	Real Estate - Listed	Real Estate - Core (u)	Real Estate - Core (h)	Infra - Listed	Infra - Core (u)	Infra - Core (h)	Sov. Bonds (Nom) (u)	Sov. Bonds (Nom) (h)	Investment Grade Corporates (u)	Investment Grade Corporates (h)	Inflation-Linked Sovereigns (u)	Inflation-Linked Sovereigns (h)	Global High Yield (u)	Global High Yield (h)	Agency MBS (u)	Agency MBS (h)
Broad Market Equities	1.0	0.9	0.9	0.8	0.9	0.9	0.8	0.1	0.0	0.3	0.3	0.2	0.0	0.5	0.5	0.2	0.1
Real Estate - Listed		1.0	0.9	0.9	1.0	0.9	0.8	0.1	0.0	0.3	0.3	0.1	-0.1	0.5	0.5	0.2	
Real Estate - Core (u)			1.0	0.8	1.0	0.9	0.7	0.3	0.1	0.4	0.3	0.3	0.0	0.6	0.5	0.3	0.2
Real Estate - Core (h)				1.0	0.8	0.7	0.9	-0.2	-0.1	0.0	0.3	-0.2	-0.2	0.2	0.5	-0.2	0.0
Infra - Listed					1.0	0.9	0.8	0.3	0.1	0.4	0.3	0.3	0.0	0.6	0.5	0.4	0.2
Infra - Core (u)						1.0	0.8	0.2	0.1	0.4	0.3	0.3	0.0	0.6	0.5	0.3	0.2
Infra - Core (h)							1.0	-0.2	-0.1	-0.1	0.2	-0.2	-0.1	0.2	0.5	-0.2	0.0
Sov. Bonds (Nom) (u)								1.0	0.7	0.9	0.5	0.9	0.4	0.7	0.1	0.9	0.6
Sov. Bonds (Nom) (h)									1.0	0.7	0.8	0.4	0.4	0.5	0.3	0.6	0.8
Investment Grade Corporates (u)										1.0	0.7	0.8	0.4	0.9	0.4	0.9	0.7
Investment Grade Corporates (h)											1.0	0.2	0.3	0.7	0.8	0.4	0.7
Inflation-Linked Sovereigns (u)												1.0	0.7	0.6	0.0	0.8	0.4
Inflation-Linked Sovereigns (h)													1.0	0.3	0.1	0.4	0.4
Global High Yield (u)														1.0	0.7	0.7	0.5
Global High Yield (h)															1.0	0.1	0.4
Agency MBS (u)																1.0	0.7
Agency MBS (h)																	1.0

Real returns exhibit higher volatility than the nominal returns. This is a function of the negative correlation between Chilean inflation and the nominal asset class returns in CLP terms. Normally, a negative correlation would result in a reduction in volatility but in those instances,

the variables are being multiplied together. However, in this case, the nominal returns are being deflated and hence the negative correlation serves to increase volatility.

4.6 Approach for Developing the SAA

Our approach will start with developing candidate asset allocations comprising the agreed potential asset classes.

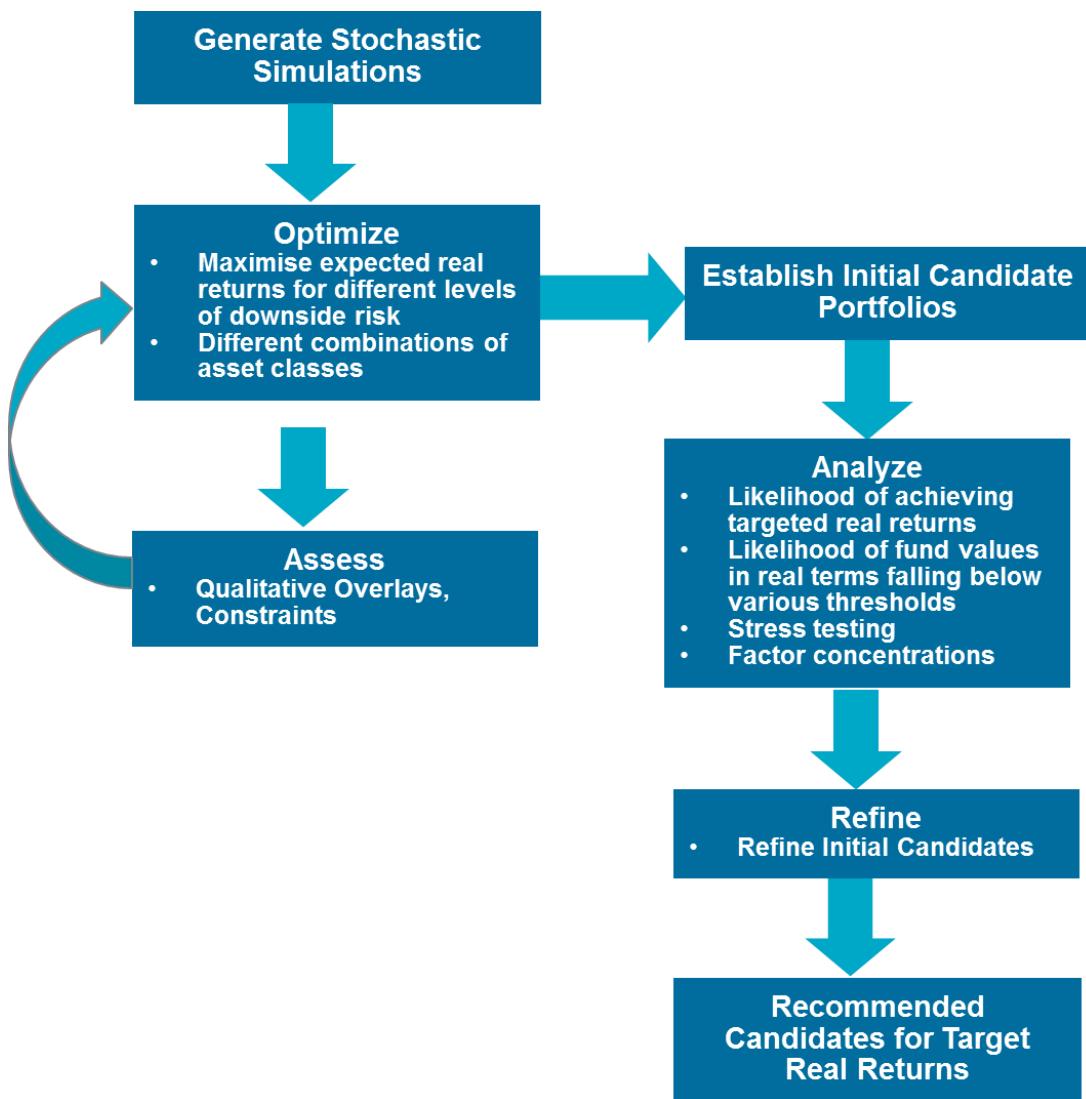
Rather than using mean-variance or surplus optimization, we propose to utilize an internally-developed optimization approach that uses the outputs from our simulation model, discussed below. This approach addresses the inherent limitations in mean-variance optimization (MVO); namely:

- MVO assumes independence of returns across time periods
- MVO assumes asset class returns are distributed normally and variance as a single risk measure
- MVO assumes constant correlations between asset classes

Our model is set up in a way that it can solve for different risk measures rather than just the variance of returns as under MVO. The purpose of such an analysis is to include the fat tails and non-normal outcomes that are captured by Mercer's stochastic capital markets model but which are not reflected in mean variance optimization. In this approach, variations in the asset allocation are repeatedly run through the stochastic trials and tested against target objectives (real return, etc.) and risk measures (VaR, drawdown, etc.). This approach is more computationally intensive than MVO but the additional risk and return measures that can be captured may be important in some situations.

While the outputs from the model will be the starting point for the derivation of our candidate portfolios, we will also consider potential variations to these to enhance diversification. An input to this process is our Global Portfolio Toolkit ("GPT"), which identifies "looks-through" exposures to specific risk factors embedded within different strategies. This enables us to consider diversification beyond just asset classes to include diversification across the risk factors that drive the returns and risks of those asset classes. That is, GPT enables us to analyze a portfolio in terms of its exposures to the risk factors outlined above in Section 4.3.5 and to consider how diversification could be enhanced through adjusting the risk factor allocations.

As such, the approach used to derive the recommended SAAs is outlined in the following graphic:



4.7 Monte Carlo Simulation Approach

Mercer's Capital Market Simulator model (CMS) has been utilized as the basis for our Monte Carlo simulation approach. We have included an overview of the workings of CMS in Appendix E.

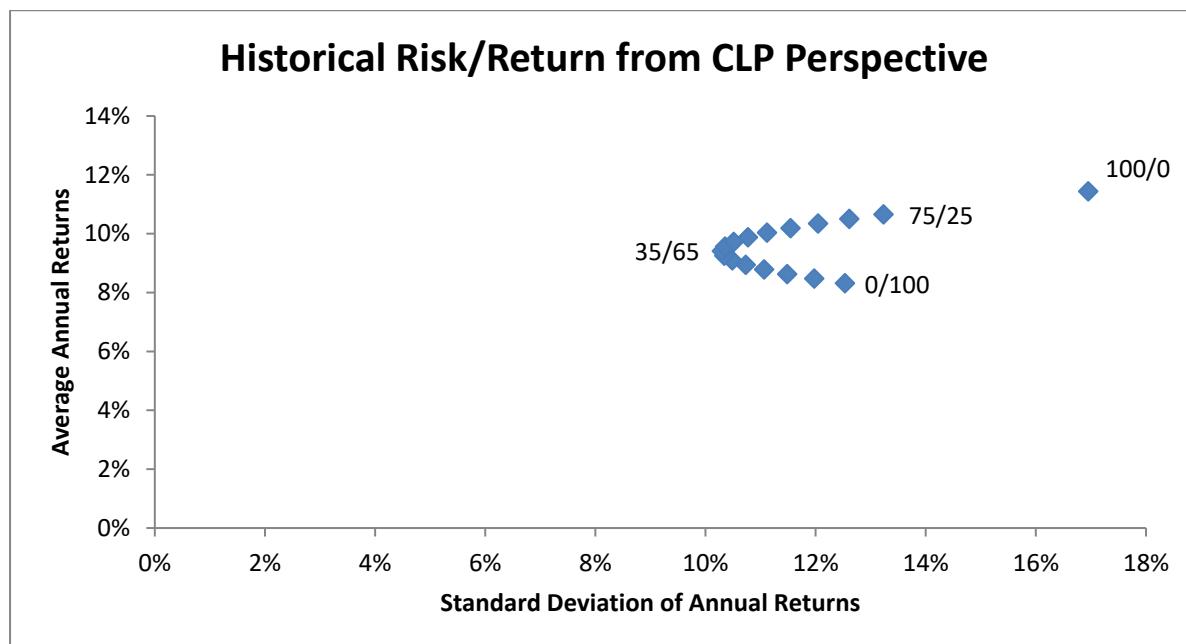
5

Strategic Asset Allocation

5.1 Introduction

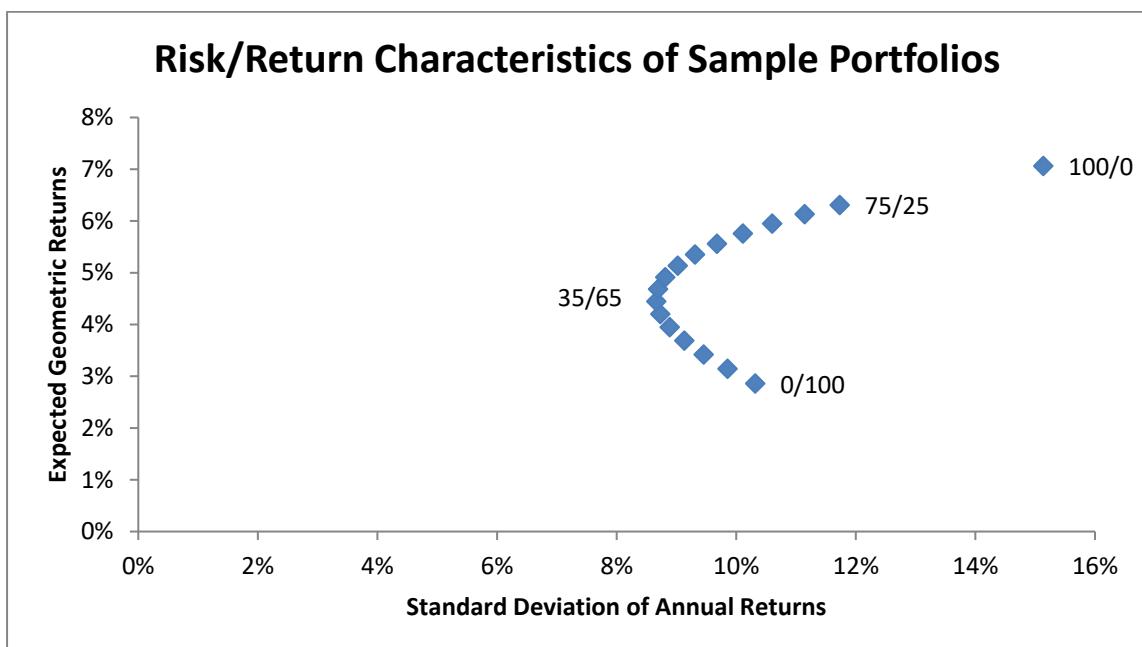
As indicated in Section 3, one potential issue with the move to a CLP currency frame of reference is that the risk statistics could potentially be high when viewed from a CLP perspective. That is, if the PRF continues to be invested globally on an unhedged basis (which should provide the best overall diversification to the PRF between the investment returns and the inflows), when viewed in isolation, the annual downside risk from a CLP perspective could be quite high.

The following chart illustrates the historical returns and volatilities associated with various combinations of the two asset classes maintained throughout the 25 year period – 0/100 refers to 0% global equities and 100% global bonds, while 100/0 refers to 100% global equities and 0% global bonds.

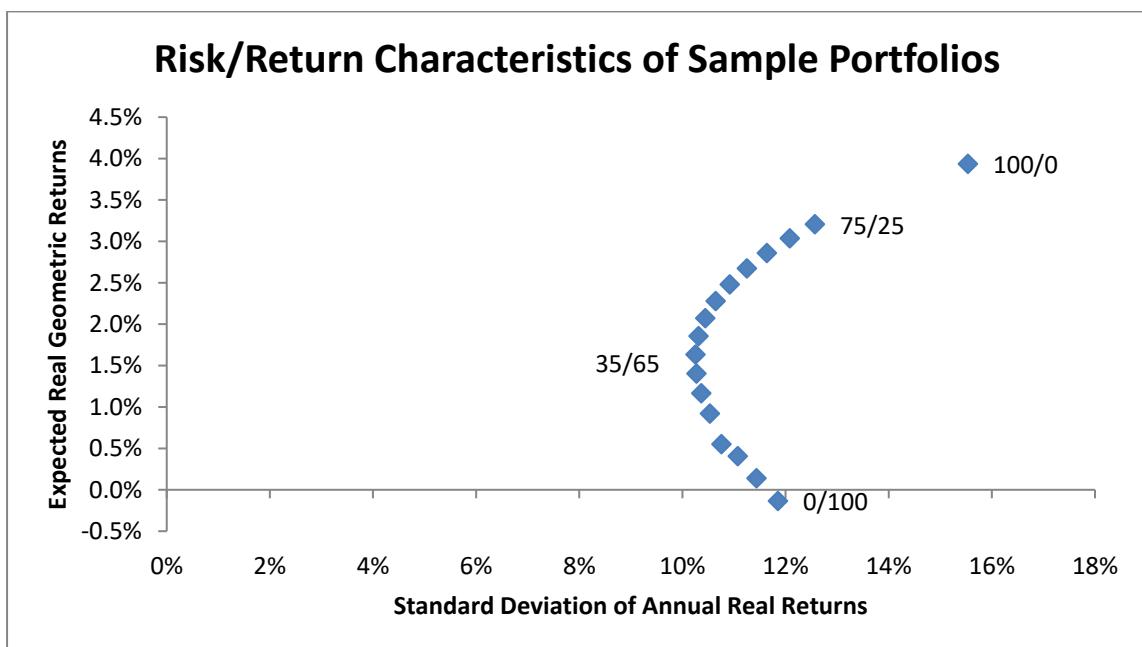


This chart illustrates that, historically, the minimum volatility portfolio from a CLP perspective would have come from a portfolio that maintained an allocation of 35% in global equities and 65% in global bonds.

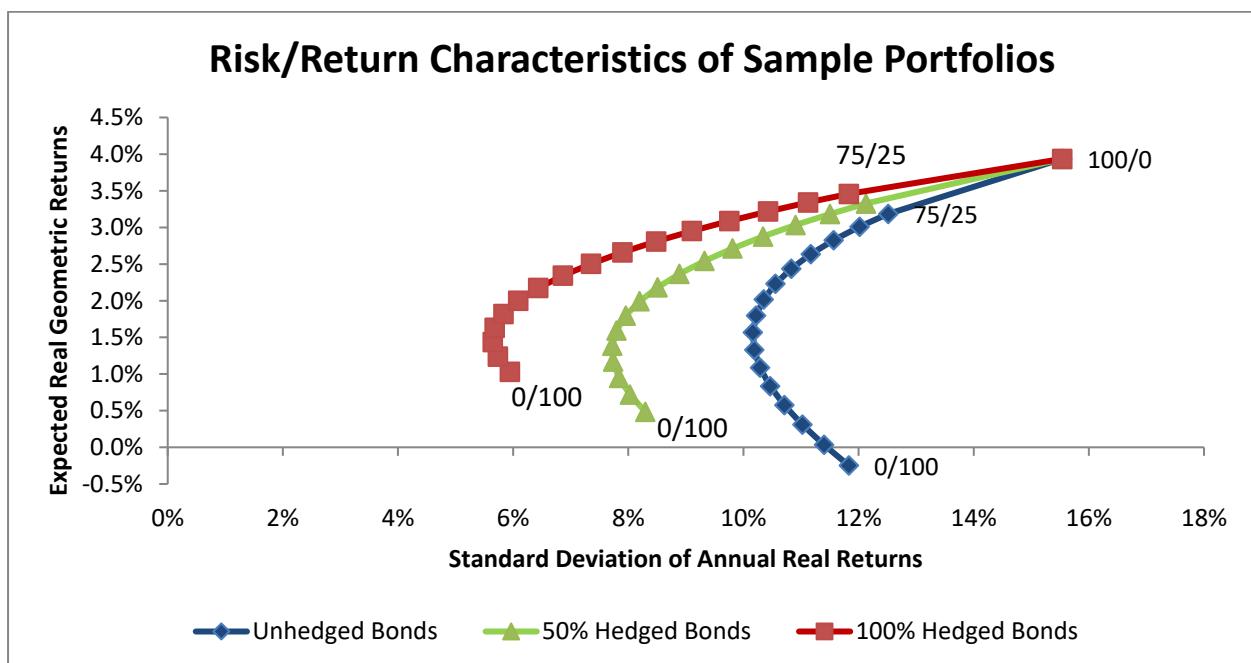
The following chart is similar, but is based on the simulated nominal returns from our Capital Market Simulator:



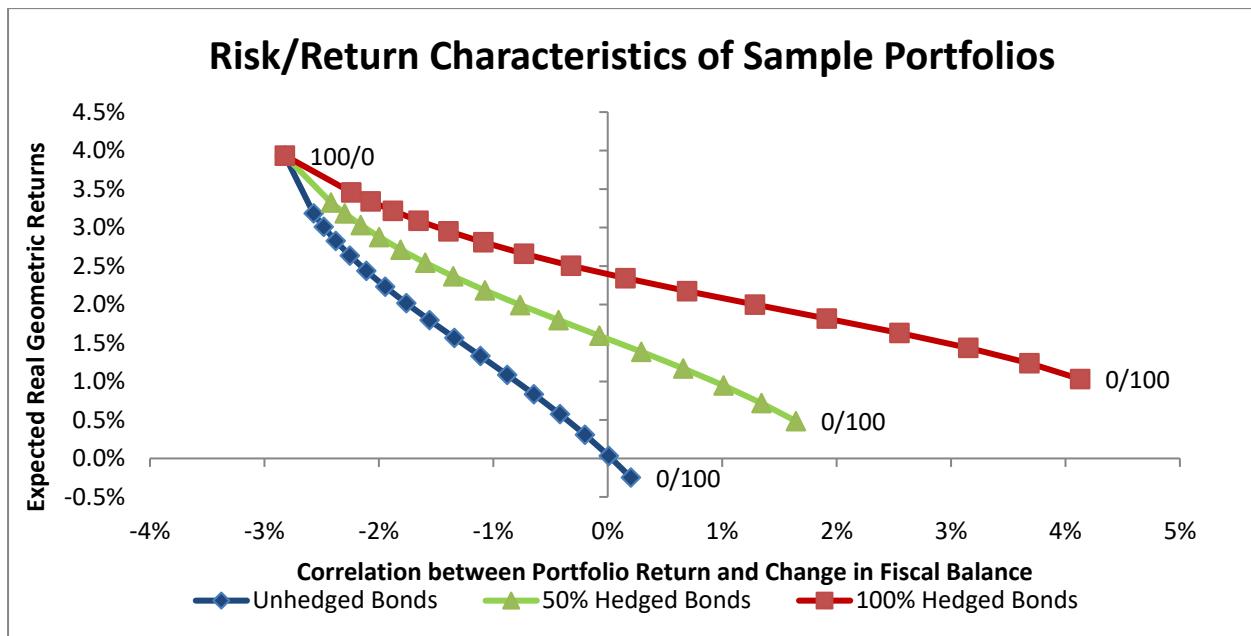
Coincidentally, the minimum volatility portfolio in this case would also have 35% in global equities and 65% in global bonds. The situation is similar if we are to consider the use of simulated real returns rather than simulated nominal returns, as shown in the following chart.



The following chart is similar to that shown earlier, but also shows the results assuming bonds are 100% hedged to CLP (the red line) and 50% hedged to CLP (the green line). Again, 0/100 refers to 0% global equities and 100% global bonds, while 100/0 refers to 100% global equities and 0% global bonds.



As can be seen, hedging the global bonds provides a much superior risk/return outcome as compared to an unhedged position. However, the following chart shows how the correlation of the portfolio real return to the change in fiscal balance is impacted by hedging the global bond exposures.



Hedging global bonds marginally reduces the diversification benefits to the PRF, where the correlation is being used as a proxy for this diversification. This is illustrated by the correlation becoming marginally more positive as the hedging percentage is increased.

The remainder of this section assumes that consideration will be given to hedging some or all of the currency exposures associated with global bond assets. For completeness, we have included the details of our initial analysis, which had assumed that all asset classes would continue to be managed on an unhedged basis. This analysis can be found in Appendix L.

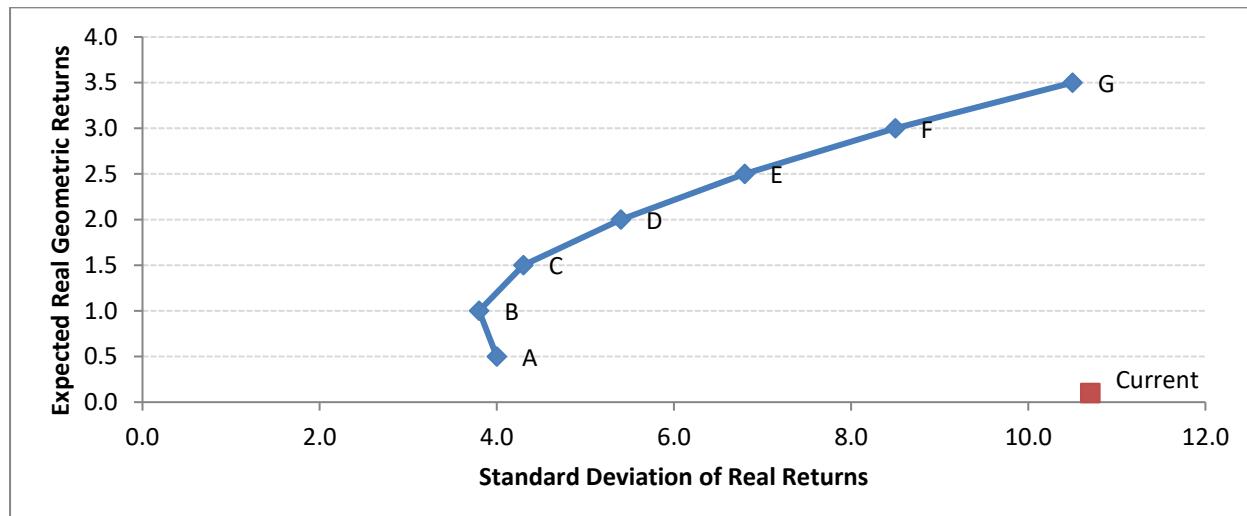
5.2 Current Asset Classes

Option 1 has been constructed using only the asset classes that the PRF is currently investing in. That is, global equities, global government bonds, global corporate bonds and global inflation-linked bonds.

The optimization process has been extended to include the global bond asset classes on a hedged to CLP basis as well as on an unhedged basis. This has been generated using real returns without any constraints to guide the optimization process. It should be noted that unlike MVO where volatility is the risk measure that is optimized, our model uses Conditional Value-at-Risk (CVaR)¹⁷ at a 5% level - that is, for a particular level of target expected return, the optimizer generates the portfolio with the best CVaR.

Portfolios have been generated for target geometric real returns from 0.5%pa to 3.5%pa in 0.5% increments.

'Efficient' Frontier – Option 1



As can be seen the current SAA (highlighted in the red box on the graph) is not “optimal”, which is consistent with the analysis presented in the previous sub-section. The over-riding reason for this non-optimality is that the current SAA was derived as a result of an analysis being conducted from a USD base currency perspective.

¹⁷ For a discussion on CVaR and VaR, please refer to Appendix J.

The main impact in this regards is the substantially higher volatility of global bonds on an unhedged to CLP basis, as has been illustrated in the table on Page 21. In contrast, there is much greater degree of differentiation between global bonds and global equities on an unhedged to USD basis as compared to that on an unhedged to CLP basis.

We would expect that if the current analysis had been undertaken on an unhedged to USD basis, then the current SAA would be much closer to any efficient frontier.

We have indicated on the above chart various candidate portfolios corresponding with various target geometric real returns – it should be noted that the vertical scale in the chart shows expected real geometric returns. The portfolios corresponding to the points on the efficient frontier are as follows:

Asset Class	Asset Allocation							
	Current %	A %	B %	C %	D %	E %	F %	G %
Broad Market Equities	15.0	-	7.7	13.1	23.5	32.8	43.9	59.3
Sovereign Bonds (Nominal) - U	48.0	1.2	-	-	-	-	-	-
Sovereign Bonds (Nominal) - H	-	37.6	23.9	0.4	-	-	-	-
Investment Grade Corporates - U	20.0	-	-	-	-	-	-	-
Investment Grade Corporates - H	-	-	8.5	30.5	32.8	42.2	47.5	40.7
Inflation-Linked (Sovereigns) - U	17.0	0.3	-	-	-	-	-	-
Inflation-Linked (Sovereigns) - H	-	60.9	59.9	56.0	43.7	25.0	8.6	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	4.0	3.8	4.3	5.4	6.8	8.5	10.5
VaR @ 5% confidence	-15.5	-6.1	-5.6	-5.8	-6.7	-8.3	-10.3	-12.9
CVaR @ 5% confidence	-19.3	-7.5	-7.1	-7.6	-8.9	-10.9	-13.5	-17.0

Table 1: Optimal Portfolios – Unconstrained Current Asset Classes

Hedged global bonds are strongly preferred relative to unhedged global bonds, which is not surprising given the superior risk/return characteristics of the former.

At lower volatility levels, the optimization approach prefers to balance the equity allocations with sovereign bonds and inflation-linked bonds, while corporate bonds only being preferred with higher equity allocations. While a bias towards sovereign bonds is logical at lower volatility levels, given these diversify more effectively against equities, we consider the above outcomes represent too extreme a bias. Equally, at higher volatility levels, an allocation to sovereign bonds should provide better diversification to equities than corporate bonds especially in down markets for equities. The real return focus of the optimization also means that inflation-linked bonds are preferred relative to nominal bonds at lower volatility levels.

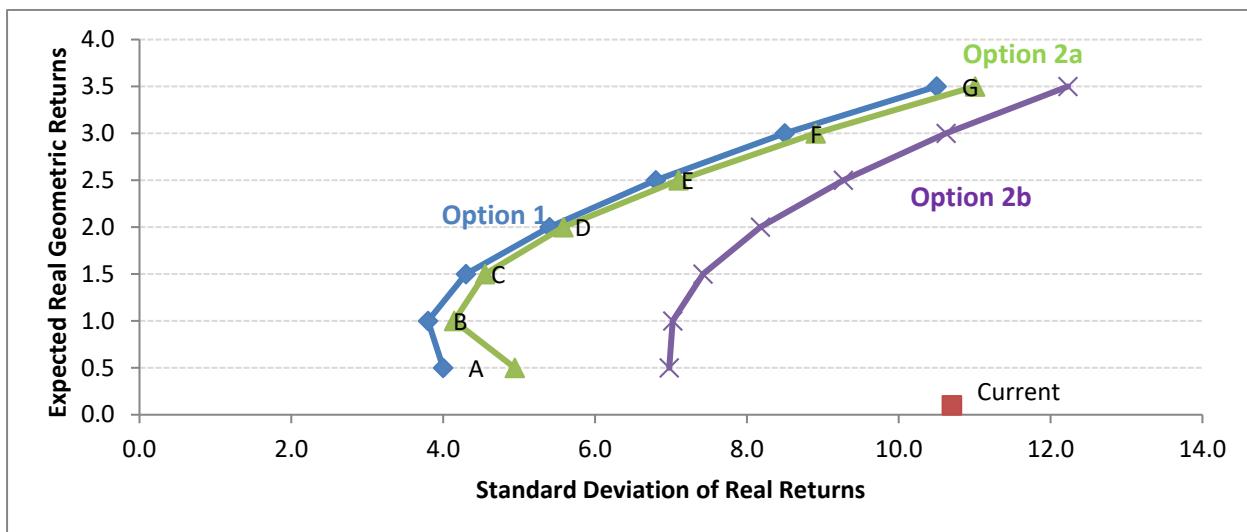
For **Option 2**, we have revised the optimization process by introducing a constraint that the global bond allocation should be 65% sovereign bonds and 35% corporate bonds - this is broadly consistent with the market weights to the two fixed income asset classes. In addition, we have also constrained the exposure to inflation-linked bonds to be a maximum of 50% of the overall exposure to bond assets.

Given that a fully hedged exposure to bonds could create some potential implementation considerations, we have generated Option 2 on two bases:

- Option 2a – no constraints on unhedged and hedged bond asset classes
- Option 2b – 50% currency hedging for all bond asset classes

The revised efficient frontier is shown below – the green line represents the revised frontier under Option 2a while the purple line is that under Option 2b:

'Efficient' Frontier – Option 2



The chart illustrates that Option 2a is not too dissimilar to Option 1 (except at lower returns), but there is a significant difference in the outcomes between Option 2a and Option 2b.

The revised asset allocations from the optimization are as follows:

Asset Class	Asset Allocation							
	Current %	A (2a) %	B (2a) %	C (2a) %	D (2a) %	E (2a) %	F (2a) %	G (2a) %
Broad Market Equities	15.0	-	5.7	16.6	28.2	39.9	52.4	67.4
Sovereign Bonds (Nominal) - U	48.0	15.8	-	-	-	-	-	-
Sovereign Bonds (Nominal) - H	-	16.7	30.7	27.1	23.3	24.6	26.7	21.2
Investment Grade Corporates - U	20.0	-	-	-	-	-	-	-
Investment Grade Corporates - H	-	17.5	16.5	14.6	12.6	13.2	14.4	11.4
Inflation-Linked (Sovereigns) - U	17.0	1.4	-	-	-	-	-	-
Inflation-Linked (Sovereigns) - H	-	48.6	47.2	41.7	35.9	22.3	6.5	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	4.9	4.1	4.6	5.6	7.1	8.9	11.0
VaR @ 5% confidence	-15.5	-7.2	-5.8	-6.0	-7.0	-8.7	-10.8	-13.7
CVaR @ 5% confidence	-19.3	-8.9	-7.3	-7.8	-9.2	-11.4	-14.3	-18.0
Asset Allocation								
Asset Class	Current %	A (2b) %	B (2b) %	C (2b) %	D (2b) %	E (2b) %	F (2b) %	G (2b) %
Broad Market Equities	15.0	8.6	18.1	28.2	38.7	49.1	60.1	73.6
Sovereign Bonds (Nominal) - U	48.0	14.9	13.3	11.7	10.0	11.2	12.9	8.6
Sovereign Bonds (Nominal) - H	-	14.9	13.3	11.7	10.0	11.2	12.9	8.6
Investment Grade Corporates - U	20.0	8.0	7.2	6.3	5.4	6.1	6.9	4.6
Investment Grade Corporates - H	-	8.0	7.2	6.3	5.4	6.1	6.9	4.6
Inflation-Linked (Sovereigns) - U	17.0	22.8	20.5	18.0	15.3	8.1	0.2	-
Inflation-Linked (Sovereigns) - H	-	22.8	20.5	18.0	15.3	8.1	0.2	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	7.0	7.0	7.4	8.2	9.3	10.6	12.2
VaR @ 5% confidence	-15.5	-10.1	-9.7	-9.8	-10.7	-11.8	-13.3	-15.6
CVaR @ 5% confidence	-19.3	-12.6	-12.4	-12.7	-13.7	-15.3	-17.4	-20.3

Table 2: Optimal Portfolios – Constrained Current Asset Classes

5.3 All Asset Classes

We now extend the analysis to include the potential new asset classes.

Especially in respect of the private market asset classes (real estate and infrastructure) being considered, an unconstrained approach to these asset classes is likely to lead to them being heavily favored since volatility is an incomplete measure of risk, reflecting the fact that the returns for these asset classes tend to be smoothed, primarily as a result of the appraisal-based nature of the valuations of private investments.

As such, under **Option 3**, we have incorporated the following constraints for the additional asset classes in addition to those included for Option 2:

- Maximum of 10% for total real estate and infrastructure exposures, public and private

- Maximum of 10% for global high yield exposure
- Maximum of 10% for Agency Residential MBS

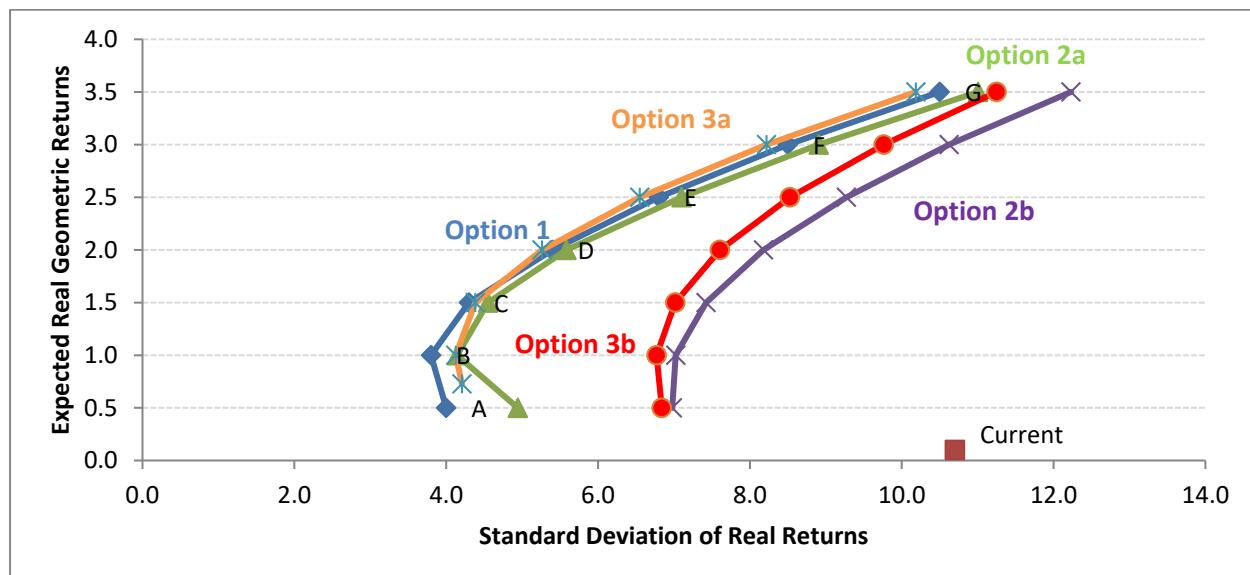
As with Option 2, we have generated Option 3 on two bases:

- Option 3a – no constraints on unhedged and hedged bond asset classes with real estate/infrastructure exposure being viewed on an unhedged basis
- Option 3b – 50% currency hedging for all bond asset classes and 50% currency hedging for real estate/infrastructure exposure

While we also considered including a fully hedged allocation for real estate/infrastructure exposures, the improvement in risk/return for these is not as significant as it is with the bond asset classes

The revised efficient frontier is shown below – the orange line represents the revised frontier with the additional asset classes under Option 3a and the red line under Option 3b:

'Efficient' Frontier – Option 3



If bond asset classes are viewed on a fully hedged basis, then Option 3a represents a slight improvement in the outcomes relative to Option 2a. Similarly, if 50% hedging of bonds is considered, then Option 3b results in an improvement over the results from Option 2b.

The revised asset allocations are as follows:

Asset Class	Asset Allocation							
	Current	A (3a)	B (3a)	C (3a)	D (3a)	E (3a)	F (3a)	G (3a)
	%	%	%	%	%	%	%	%
Broad Market Equities	15.0	-	3.2	13.9	19.1	23.6	35.7	49.3
Real Estate - Listed	-	-	-	-	-	-	-	-
Real Estate - Core	-	-	-	-	4.4	10.0	10.0	10.0
Infrastructure - Listed	-	-	-	-	-	-	-	-
Infrastructure - Core	-	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - U	48.0	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - H	-	32.5	28.2	24.7	20.2	15.4	14.4	13.4
Investment Grade Corporates - U	20.0	-	-	-	-	-	-	-
Investment Grade Corporates - H	-	17.5	15.2	13.3	10.9	8.3	7.7	7.2
Inflation-Linked (Sovereigns) - U	17.0	-	-	-	-	-	-	-
Inflation-Linked (Sovereigns) - H	-	50.0	43.4	38.0	31.1	23.7	12.2	-
Global High Yield - U	-	-	-	-	-	-	-	-
Global High Yield - H	-	-	-	-	4.3	9.1	10.0	10.0
Agency Residential MBS - U	-	-	-	-	-	-	-	-
Agency Residential MBS - H	-	-	10.0	10.0	10.0	10.0	10.0	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.7	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	4.2	4.1	4.4	5.3	6.5	8.2	10.2
VaR @ 5% confidence	-15.5	-6.0	-5.3	-5.3	-6.2	-7.6	-9.7	-12.4
CVaR @ 5% confidence	-19.3	-7.5	-6.6	-6.9	-8.1	-10.0	-12.8	-16.2

Table 3: Optimal Portfolios – Constrained Additional Asset Classes – Option 3a

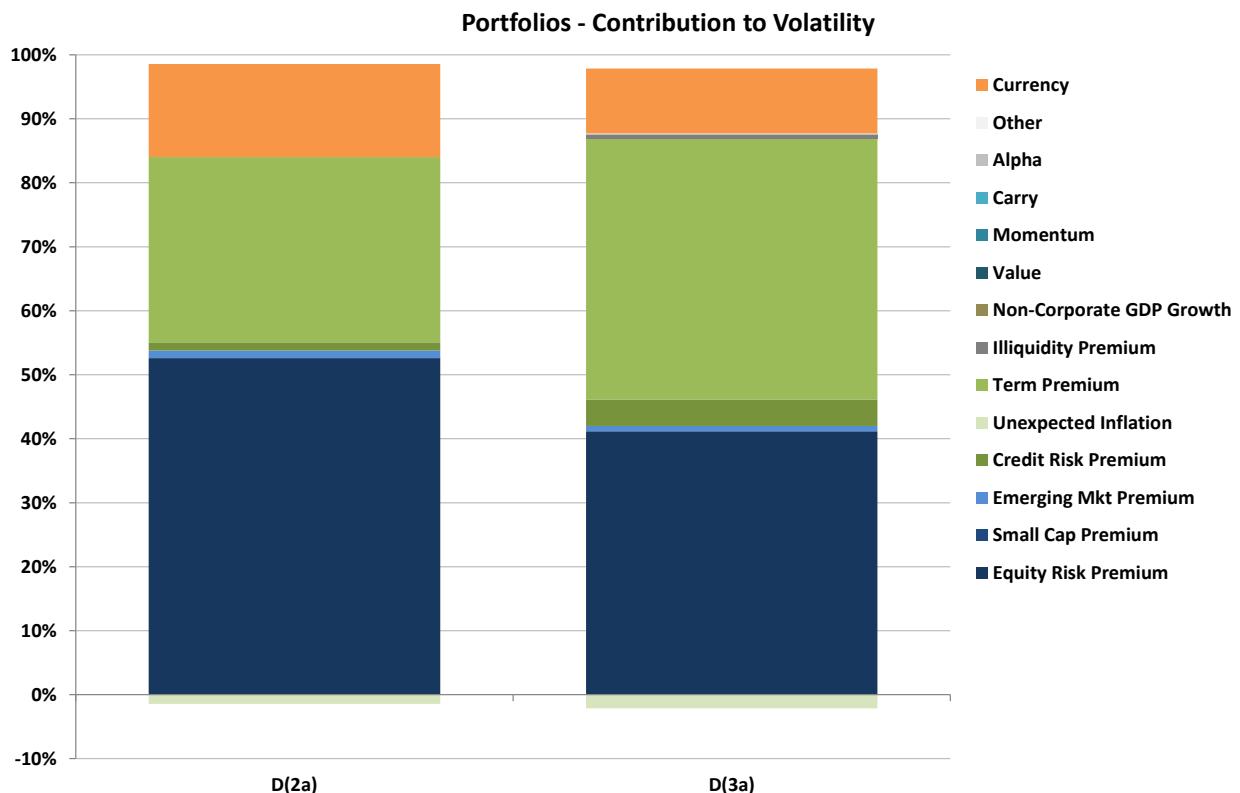
Asset Class	Asset Allocation							
	Current	A (3b)	B (3b)	C (3b)	D (3b)	E (3b)	F (3b)	G (3b)
	%	%	%	%	%	%	%	%
Broad Market Equities	15.0	-	6.6	14.5	24.8	34.0	44.0	55.6
Real Estate - Listed	-	-	-	-	-	-	-	-
Real Estate - Core (50% Hedged)	-	7.9	10.0	10.0	10.0	10.0	10.0	10.0
Infrastructure - Listed	-	-	-	-	-	-	-	-
Infrastructure - Core (50% Hedged)	-	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - U	48.0	15.0	13.1	10.6	9.0	6.9	6.5	5.6
Sovereign Bonds (Nominal) - H	-	15.0	13.1	10.6	9.0	6.9	6.5	5.6
Investment Grade Corporates - U	20.0	8.1	7.1	5.7	4.8	3.7	3.5	3.0
Investment Grade Corporates - H	-	8.1	7.1	5.7	4.8	3.7	3.5	3.0
Inflation-Linked (Sovereigns) - U	17.0	23.0	20.2	16.4	13.8	10.6	5.0	0.0
Inflation-Linked (Sovereigns) - H	-	23.0	20.2	16.4	13.8	10.6	5.0	0.0
Global High Yield - U	-	-	-	-	-	1.8	3.0	3.6
Global High Yield - H	-	-	-	-	-	1.8	3.0	3.6
Agency Residential MBS - U	-	-	1.3	5.0	5.0	5.0	5.0	5.0
Agency Residential MBS - H	-	-	1.3	5.0	5.0	5.0	5.0	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	6.8	6.8	7.0	7.6	8.5	9.8	11.2
VaR @ 5% confidence	-15.5	-9.8	-9.3	-9.1	-9.5	-10.5	-12.0	-13.9
CVaR @ 5% confidence	-19.3	-12.3	-11.8	-11.7	-12.4	-13.7	-15.7	-18.2

Table 4: Optimal Portfolios – Constrained Additional Asset Classes – Option 3b

Private real asset classes are preferred over the public ones, which is not unexpected given the superior risk/return characteristics of the former. With the overall 10% constraint to real assets, the optimizer prefers private real estate at the target return levels being considered.

While these portfolios have lower volatility than those derived with the existing asset classes, the results are not that material. For example, with Portfolio D targeting a 2.0% geometric real return, the volatility with full currency hedging for global bonds reduces from 5.6% to 5.3% with respect to Option 2a relative to Option 3a. As such, while the inclusion of the private asset classes does improve the outcomes and represents a better diversification, the impact is relatively minor especially given the greater complexity that the exposures to the private assets would introduce.

The diversification enhancement is relatively modest, as the following chart from our Global Portfolio Tool shows. The charts show the contribution to portfolio volatility on a risk factor basis, which is marginally more diversified under D(3a).



In this case, term premium risk and the equity risk premium dominate, with currency risk also been present given unhedged equity exposures. The exposure to credit risk premium increases with D(3a) as a result of the increased allocation to non-sovereign risk. The equity risk premium dominates the contributions to portfolio volatility for D(2a) – 54%. The contribution from the equity risk premium reduces to 43% in D(3a), which is the same as that attributable to the term premium risk.

From a practical perspective, achieving a 10% allocation to the private market asset classes will involve some challenges. The exposures to these asset classes can potentially be implemented through direct investments or, more realistically through fund investments given the size of the allocations. With fund investments, it is necessary to make a commitment to invest into the fund, but the timing of the calls for such capital commitments is unknown. As such, it is impractical to achieve the target allocation and most investors tend to be under-allocated to these asset classes. The need to ensure that sufficient liquid assets are available to meet such unknown capital calls creates additional administrative issues for investors allocating to these asset classes.

While the optimizer likes the diversification provided by Agency Residential MBS, the allocations appear relatively high compared with other fixed income asset classes, especially at higher volatility levels.

Therefore, we have rerun the optimizer assuming the following revised constraints:

- Maximum of 5% for private real estate and infrastructure
- Nominal fixed income exposure to be approximately 55% sovereigns, 35% investment grade corporates and 15% Agency Residential MBS, which is broadly consistent with their weights in the Global Aggregate Index¹⁸

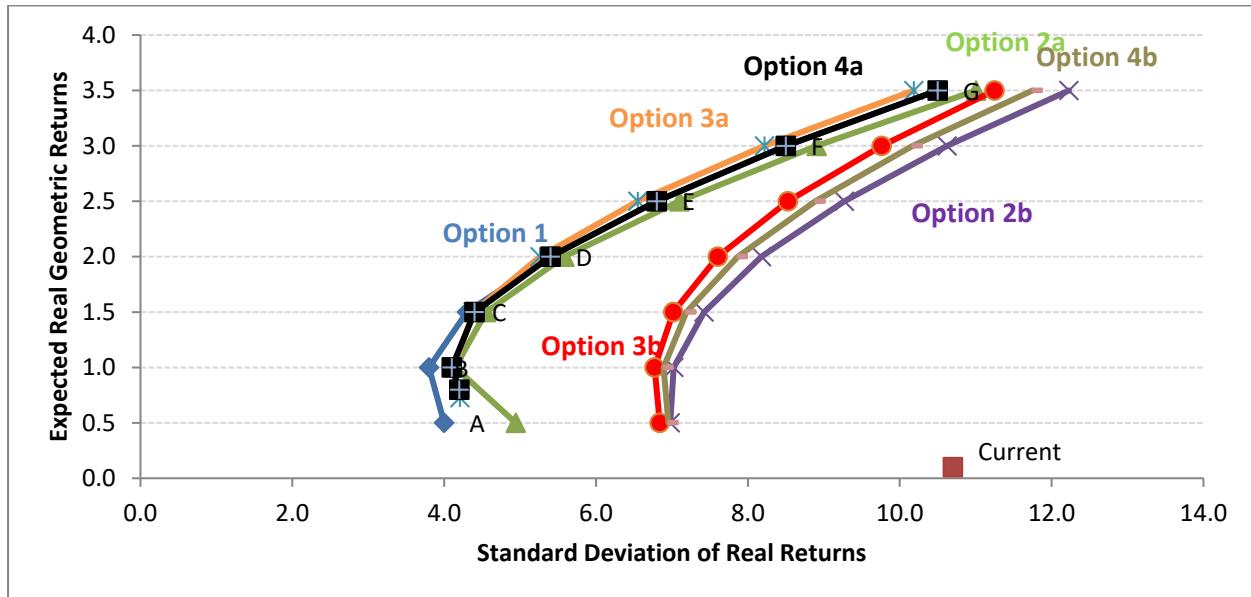
As with Options 2 and 3, we have generated Option 4 on two bases:

- Option 4a – no constraints on unhedged and hedged bond asset classes with real estate/infrastructure exposure being viewed on an unhedged basis
- Option 4b – 50% currency hedging for all bond asset classes and 50% currency hedging for real estate/infrastructure exposure

The revised efficient frontier is shown below - the black line represents the revised frontier with the additional asset classes under Option 4a and the brown line under Option 4b:

¹⁸ In our initial analysis with unhedged asset classes, we used a constraint based on the Multiverse Index, which included high yield. Given the direction from the Financial Committee to exclude candidate asset allocations with more than 40% equities, in this instance, we have not forced the optimization approach to include an exposure to high yield.

'Efficient' Frontier – Option 4



If bond asset classes are viewed on a fully hedged basis, then Option 4a represents a marginal deterioration in the outcomes relative to Option 3a – for example, Portfolio D for 4a has a volatility of 5.4% as opposed to 5.3% for the equivalent portfolio for 3a. If 50% hedging of bonds is considered, then Option 4b is similar to Option 3b at lower volatility levels, but less so as volatility increases – for example, Portfolio D for 4b has a volatility of 7.9% as opposed to 7.6% for the equivalent portfolio for Option 3a.

The revised asset allocations based on these revised constraints are as follows:

Asset Class	Asset Allocation							
	Current %	A (4a) %	B (4a) %	C (4a) %	D (4a) %	E (4a) %	F (4a) %	G (4a) %
Broad Market Equities	15.0	-	3.6	14.7	20.8	31.1	41.4	56.3
Real Estate - Listed	-	-	-	-	-	-	-	-
Real Estate - Core	-	-	-	-	4.3	5.0	5.0	5.0
Infrastructure - Listed	-	-	-	-	-	-	-	-
Infrastructure - Core	-	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - U	48.0	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - H	-	29.6	28.6	25.3	21.2	18.2	22.0	16.1
Investment Grade Corporates - U	20.0	-	-	-	-	-	-	-
Investment Grade Corporates - H	-	16.3	15.7	13.9	11.7	10.0	12.1	8.9
Inflation-Linked (Sovereigns) - U	17.0	-	-	-	-	-	-	-
Inflation-Linked (Sovereigns) - H	-	46.0	44.3	39.1	32.9	24.7	4.7	-
Global High Yield - U	-	-	-	-	-	-	-	-
Global High Yield - H	-	-	-	-	3.3	6.0	8.7	9.3
Agency Residential MBS - U	-	-	-	-	-	-	-	-
Agency Residential MBS - H	-	8.1	7.8	7.0	5.8	5.0	6.1	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.8	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	4.2	4.1	4.4	5.4	6.8	8.5	10.5
VaR @ 5% confidence	-15.5	-5.5	-5.4	-5.5	-6.5	-8.1	-10.1	-12.9
CVaR @ 5% confidence	-19.3	-6.9	-6.8	-7.2	-8.5	-10.6	-13.3	-17.0

Table 5: Optimal Portfolios – Revised Constrained Additional Asset Classes – Option 4a

Asset Class	Asset Allocation							
	Current %	A (4b) %	B (4b) %	C (4b) %	D (4b) %	E (4b) %	F (4b) %	G (4b) %
Broad Market Equities	15.0	1.4	11.0	21.0	31.7	41.6	51.6	64.3
Real Estate - Listed	-	-	-	-	-	-	-	-
Real Estate - Core (50% Hedged)	-	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Infrastructure - Listed	-	-	-	-	-	-	-	-
Infrastructure - Core (50% Hedged)	-	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - U	48.0	14.0	12.6	11.1	9.5	9.9	11.4	7.2
Sovereign Bonds (Nominal) - H	-	14.0	12.6	11.1	9.5	9.9	11.4	7.2
Investment Grade Corporates - U	20.0	7.5	6.8	6.0	5.1	5.3	6.1	3.9
Investment Grade Corporates - H	-	7.5	6.8	6.0	5.1	5.3	6.1	3.9
Inflation-Linked (Sovereigns) - U	17.0	21.5	19.3	17.0	14.5	8.3	-	-
Inflation-Linked (Sovereigns) - H	-	21.5	19.3	17.0	14.5	8.3	-	-
Global High Yield - U	-	-	-	-	-	0.5	1.1	2.4
Global High Yield - H	-	-	-	-	-	0.5	1.1	2.4
Agency Residential MBS - U	-	3.8	3.4	3.0	2.5	2.7	3.1	1.9
Agency Residential MBS - H	-	3.8	3.4	3.0	2.5	2.7	3.1	1.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	7.0	6.9	7.2	7.9	8.9	10.2	11.7
VaR @ 5% confidence	-15.5	-9.9	-9.4	-9.4	-10.0	-11.1	-12.6	-14.7
CVaR @ 5% confidence	-19.3	-12.3	-11.9	-12.1	-13.0	-14.5	-16.4	-19.3

Table 6: Optimal Portfolios – Revised Constrained Additional Asset Classes – Option 4b

5.4 Final Candidate Asset Allocations

We have been informed that the FC believes that increasing the equity allocation beyond 40% is too much when compared with the current SAA of 15%. Therefore, we have been requested to consider two different constraints: maximum exposure to equities <= 30% and <= 40%.

In relation to establishing the final candidates for further analysis, we have excluded those with equity allocations above 40% and will consider the impact of these constraints in our recommendations.

Another important consideration is the extent to which the bond asset classes should be assumed to be hedged to CLP. While the quantitative analysis shows superior risk/return outcomes on a fully hedged basis, the size of the PRF's assets may be a constraint although we do not have sufficient knowledge on the liquidity of CLP forward markets to know whether this will be the case or not. Another factor arguing against a fully hedged position is that this will marginally reduce the diversification benefits to the overall fund. For this reason, we have assumed 50% hedging to CLP.

However, we recognize that full hedging does provide a superior risk/reward outcome and that the reduction in diversification is marginal and as such have also included an analysis with full hedging of the bond asset classes.

Further analysis can be undertaken on the feasibility of hedging 100% of the fixed income assets, especially given that the majority of these are managed by Banco Central de Chile.

Based on the above discussion, the candidate asset allocations we will examine in the next section, based on **50% hedging** for global bonds, are as follows:

Asset Class	Asset Allocation											
	Current %	B (2b) %	B (4b) %	C (2b) %	C (4b) %	C' (4b) %	C'' (4b) %	D (2b) %	D (4b) %	E' (4b) %	E'' (4b) %	
Broad Market Equities	15.0	18.1	11.0	28.2	21.0	29.0	30.0	38.7	31.7	40.0	40.0	
Real Estate - Core	-	-	5.0	-	5.0	5.0	-	-	5.0	5.0	-	
Sovereign Bonds (Nominal) - U	48.0	13.3	12.6	11.7	11.1	10.5	11.0	10.0	9.5	10.8	12.0	
Sovereign Bonds (Nominal) - H	-	13.3	12.6	11.7	11.1	10.5	11.0	10.0	9.5	10.8	12.0	
Investment Grade Corporates - U	20.0	7.2	6.8	6.3	6.0	5.0	6.0	5.4	5.1	5.8	6.5	
Investment Grade Corporates - H	-	7.2	6.8	6.3	6.0	5.0	6.0	5.4	5.1	5.8	6.5	
Inflation-Linked (Sovereigns) - U	17.0	20.5	19.3	18.0	17.0	15.0	15.0	15.3	14.5	8.0	8.0	
Inflation-Linked (Sovereigns) - H	-	20.5	19.3	18.0	17.0	15.0	15.0	15.3	14.5	8.0	8.0	
Global High Yield - U	-	-	-	-	-	-	-	-	-	-	-	
Global High Yield - H	-	-	-	-	-	-	-	-	-	-	-	
Agency Residential MBS - U	-	-	3.4	-	3.0	2.5	3.0	-	2.5	2.9	3.5	
Agency Residential MBS - H	-	-	3.4	-	3.0	2.5	3.0	-	2.5	2.9	3.5	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
Expected Geometric Real Return (%)	0.1	1.0	1.0	1.5	1.5	1.9	1.7	2.0	2.0	2.4	2.4	
Standard Deviation (Risk) (%pa)	10.7	7.0	6.9	7.4	7.2	7.6	7.4	8.2	7.9	8.6	8.6	
VaR @ 5% confidence	-15.5	-9.7	-9.7	-9.8	-9.7	-10.0	-9.8	-10.7	-10.3	-11.1	-10.7	
CVaR @ 5% confidence	-19.3	-12.4	-12.3	-12.7	-12.5	-13.0	-12.8	-13.7	-13.3	-14.5	-13.9	

These are consistent with the portfolios derived earlier except for portfolios C'(4b) and E'(4b) which have been adjusted to have 30% and 40% equity weights and their counterparts (C''(4b) and E''(4b)) which have no exposure to private market asset classes.

The candidate asset allocations we will examine in the next section based on **100% hedging** for global bonds are as follows:

Asset Class	Asset Allocation										
	Current %	C (2a) %	C (4a) %	D (2a) %	D (4a) %	D' (4a) %	D'' (4a) %	E (2a) %	E (4a) %	F' (4a) %	F'' (4a) %
Broad Market Equities	15.0	16.6	14.7	28.2	20.8	30.0	30.0	39.9	31.1	40.0	40.0
Real Estate - Core	-	-	-	-	4.3	5.0	-	-	5.0	5.0	-
Sovereign Bonds (Nominal) - U	48.0	-	-	-	-	-	-	-	-	-	-
Sovereign Bonds (Nominal) - H	-	27.1	25.3	23.3	21.2	19.0	21.0	24.6	18.2	23.0	25.0
Investment Grade Corporates - U	20.0	-	-	-	-	-	-	-	-	-	-
Investment Grade Corporates - H	-	14.6	13.9	12.6	11.7	10.0	12.0	13.2	10.0	13.0	14.0
Inflation-Linked (Sovereigns) - U	17.0	-	-	-	-	-	-	-	-	-	-
Inflation-Linked (Sovereigns) - H	-	41.7	39.1	35.9	32.9	25.0	26.0	22.3	24.7	5.0	6.0
Global High Yield - U	-	-	-	-	-	-	-	-	-	-	-
Global High Yield - H	-	-	-	-	3.3	5.0	5.0	-	6.0	8.0	8.0
Agency Residential MBS - U	-	-	-	-	-	-	-	-	-	-	-
Agency Residential MBS - H	-	-	7.0	-	5.8	6.0	6.0	-	5.0	6.0	7.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	1.5	1.5	2.0	2.0	2.3	2.1	2.5	2.5	2.8	2.6
Standard Deviation (Risk) (%pa)	10.7	4.6	4.4	5.6	5.4	6.3	5.8	7.1	6.8	8.0	7.4
VaR @ 5% confidence	-15.5	-6.0	-5.5	-7.0	-6.5	-7.8	-7.3	-8.7	-8.1	-9.8	-9.2
CVaR @ 5% confidence	-19.3	-7.8	-7.2	-9.2	-8.5	-10.3	-9.6	-11.4	-10.6	-12.9	-12.1

Again, these are consistent with the portfolios derived earlier except for portfolios D'(4a) and F'(4a) which have been adjusted to have 30% and 40% equity weights and their counterparts (D''(4a) and F''(4a)) which have no exposure to private market asset classes.

6

Simulations, Back Testing, and Stress Testing - Analysis of Candidate Portfolios

6.1 Introduction

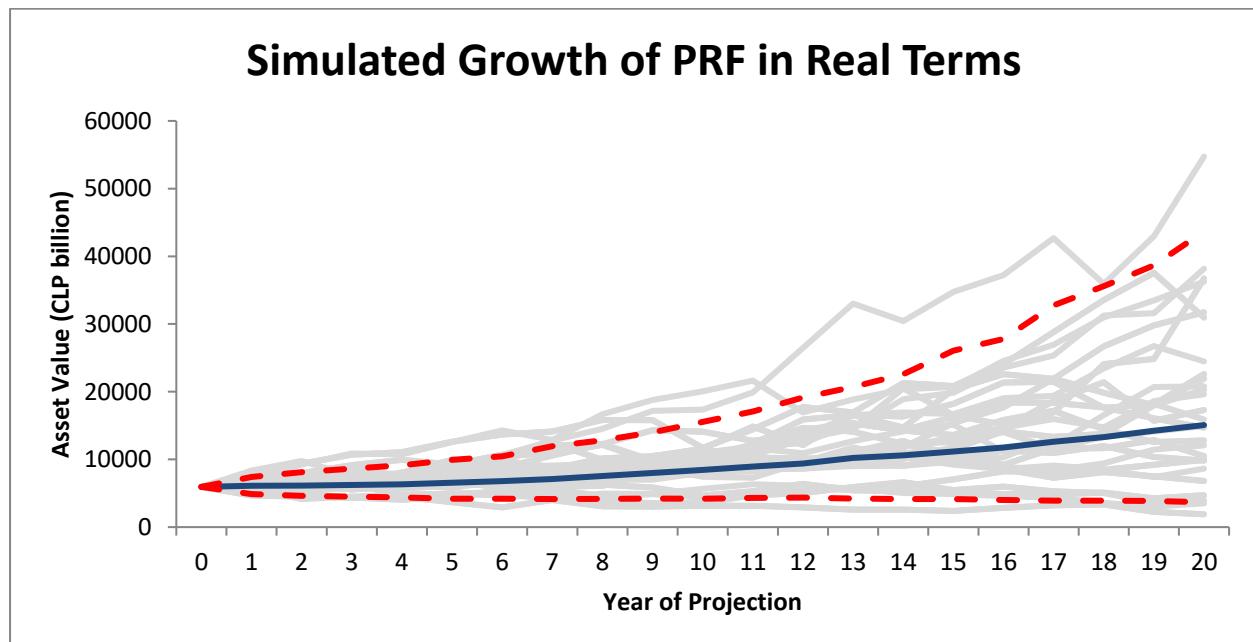
This section contains our detailed analysis of the candidate portfolios. These are analyzed from an asset only perspective in terms of their ability to achieve various real return objectives as well as a quasi-asset/liability perspective in relation to the potential ability to enhance the longer-term value of the PRF while also enabling it to meet its liabilities.

6.2 Modelling the Fund's Cash Flows

6.2.1 *Projected Growth in PRF*

The following chart shows the simulated growth of the PRF assuming the assets continued to be invested in accordance with the current SAA. As such, this chart makes allowance for:

- Real inflows in accordance with the approach outlined in Section 4.4.1
- Real investment income associated with the current SAA
- Withdrawals as outlined in Section 4.4.2



The blue line represents the median over time of the distribution for the simulated growth of the PRF in real terms, while the dotted red lines represent the 5th percentile and 95th percentile of the distribution. The expectation is for a slight decline in the real value of the assets in the initial years, partly as a result of the current deficit resulting in lower inflows and partly as a result of lower investment returns as bond yields globally are assumed to gradually rise to those implied by our assumed ‘steady state’ yield curves.

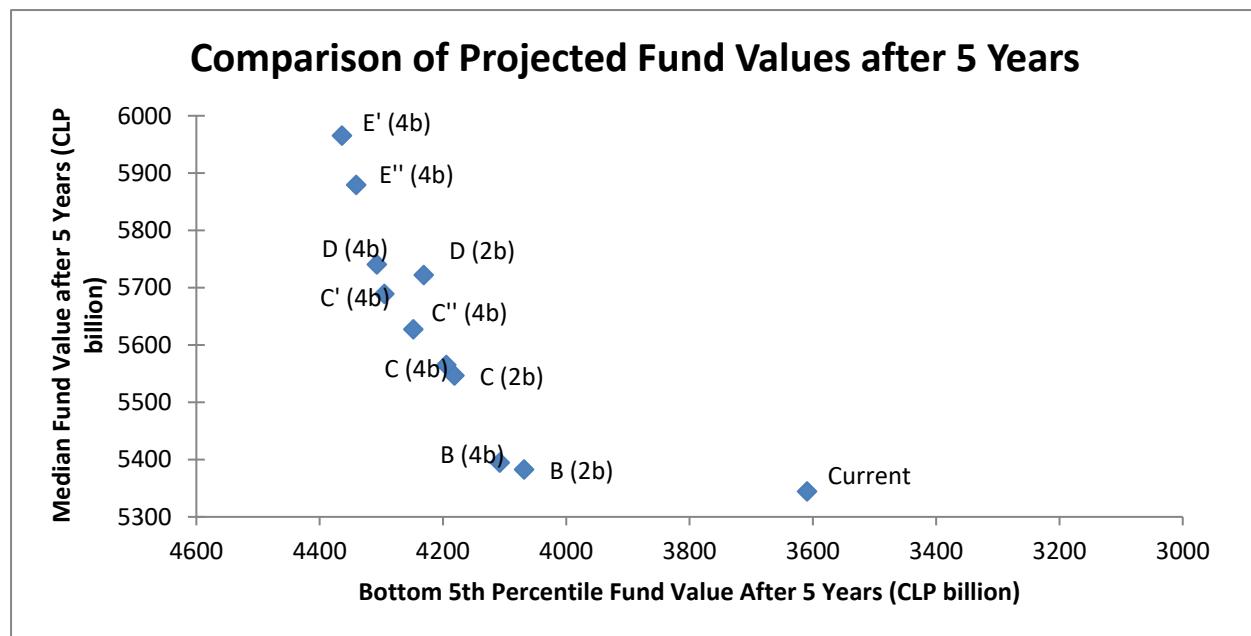
Treating a lower 5th percentile fund value at the end of a particular time horizon as a less desirable outcome (or increasing “risk”), and a higher median fund value as a more desirable outcome (increasing “return”), the proposed investment strategies can be compared. These are reflected in the charts that follow in Section 6.3.1.

6.3 Analysis of Candidates

6.3.1 *Projected Fund Values*

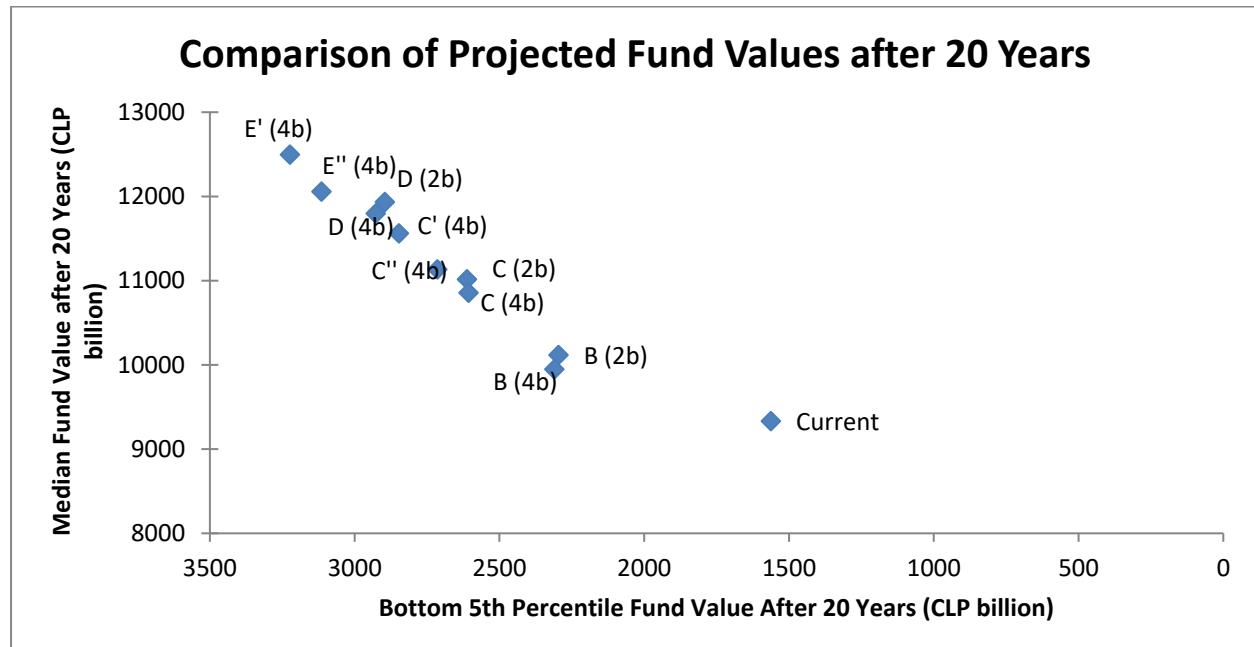
50% Hedging of Global Bonds

The following chart shows the projected position for the candidate portfolios based on 50% hedging of global bonds after five years. The horizontal axis represents the bottom 5th percentile of the distribution for the projected fund value after 5 years while the vertical axis is the median of that distribution.



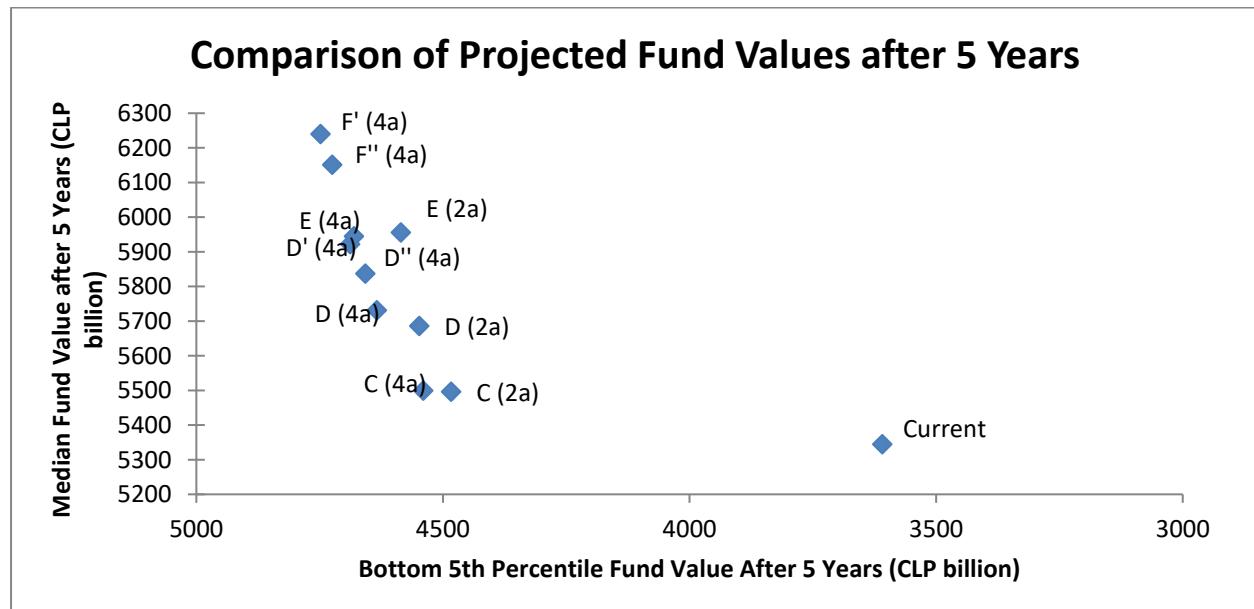
In general as the allocation to risky assets increases, the risk/return position from the perspective of “worst-case” outcomes improves. That is, the more conservative portfolios represent a higher risk position in the sense that these lead to lower projected fund value levels even in the “worst-case” situations.

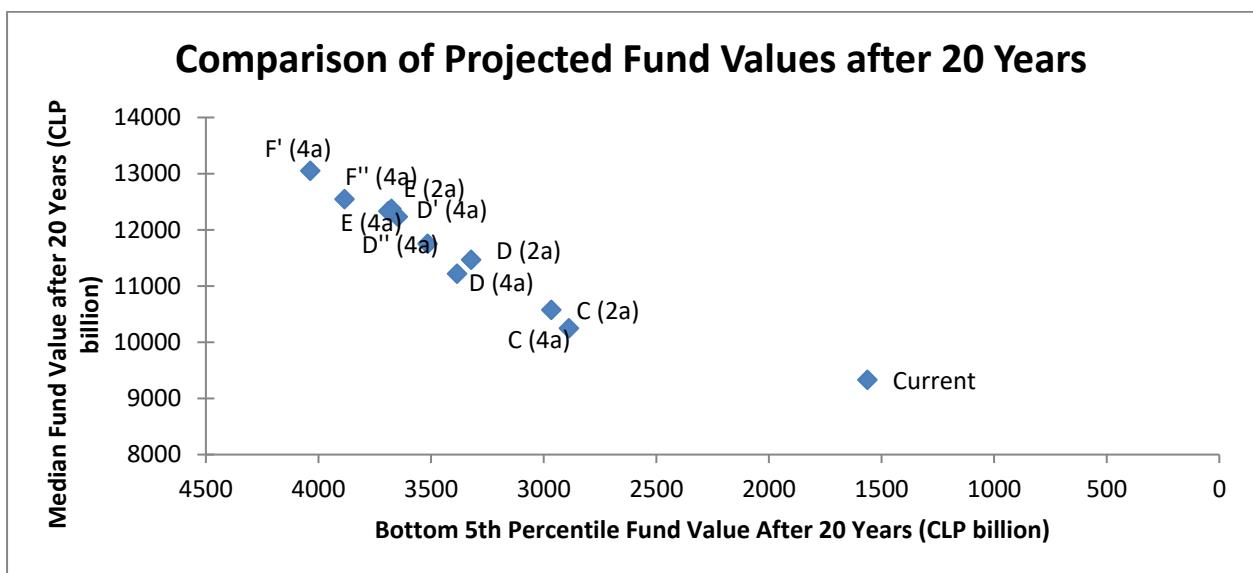
The next chart is similar, but looks at a 20-year horizon. In this case, the variations are much more significant as we go from portfolio B to portfolio E.



Full Hedging of Global Bonds

The following charts are similar, but show the projected position for the candidate portfolios based on full hedging of global bonds.





6.3.2 Probability of Not Achieving Real Return Targets

50% Hedging of Global Bonds

One important risk assessment is the likelihood of not achieving investment objectives. The following table shows, for each of the candidate portfolios, the probability of not achieving the various real return investment objectives over various time horizons.

Objective	Time Horizon	Probability of not achieving investment objective										
		Current %	B (2b) %	B (4b) %	C (2b) %	C (4b) %	C' (4b) %	C'' (4b) %	D (2b) %	D (4b) %	E' (4b) %	E'' (4b) %
1% pa real return	3	52.7	46.9	47.8	43.5	43.9	41.7	43.0	40.6	40.9	39.3	40.4
	5	53.5	45.5	46.7	41.2	42.0	38.8	40.3	37.2	37.8	35.7	37.1
	10	53.9	41.9	43.4	35.8	36.9	32.7	34.8	30.5	31.3	28.3	30.4
1.5% pa real return	3	56.1	51.4	52.3	47.8	48.4	45.9	47.3	44.7	45.1	43.1	44.6
	5	57.6	51.3	52.5	46.8	47.8	44.4	46.1	42.7	43.2	40.5	42.2
	10	59.8	50.1	51.5	43.9	45.2	40.3	42.9	37.9	38.9	35.2	37.9
2% pa real return	3	59.0	55.9	57.0	52.2	53.0	50.4	51.5	48.8	49.4	47.0	48.4
	5	61.6	56.9	58.1	52.4	53.4	50.0	51.9	48.0	48.8	45.4	47.8
	10	65.6	58.2	59.8	52.0	53.3	48.8	51.2	45.9	46.9	42.9	45.7

It should be noted that, while these portfolios have in general been established to achieve a specific expected real geometric return, by their nature, they will tend to have around a 50% chance of actual returns being higher than expected and 50% chance of being lower.

In this respect, we consider that one important criterion for an investment objective is that it must be achievable. In general, we would advocate that the probability of achieving an investment objective should be at least 67% - in other words, from the perspective of a risk measure, the probability of **not** achieving the objective should be no more than 33%. However, in the above table, we have highlighted those portfolios that would have a probability of not achieving the relevant real return objective of not more than 40%.

With reference to the above table, the proposed real return objectives would need to be accompanied by an appropriate time horizon. For example, if the investment objective were to

be a real rate of return of at least 1.5% per annum, the time horizon would need to be at least 10 years. This would necessitate consideration being given to D(2b), D(4b), E'(4b) and E''(4b) portfolios.

It will be noted that the inclusion of equities for shorter horizons still reduces the probability of not achieving the investment objectives even though the asset class could face considerable losses in the short-term. However, this outcome is a function of the following factors:

- The negative correlation between movements in the CLP and equity markets; and
- The low expected real returns on the fixed income asset classes.

100% Hedging of Global Bonds

Objective	Time Horizon	Current %	Probability of not achieving investment objective									
			C (2a) %	C (4a) %	D (2a) %	D (4a) %	D' (4a)	D'' (4a)	E (2a)	E (4a)	F' (4a)	F'' (4a)
1% pa real return	3	52.7	41.2	42.3	37.9	38.1	36.1	37.3	36.3	35.8	35.3	36.3
	5	53.5	38.5	39.9	34.3	34.7	32.1	33.5	32.1	31.7	30.7	31.7
	10	53.9	32.4	34.0	26.1	26.4	22.7	24.5	22.8	22.2	21.0	22.3
1.5% pa real return	3	56.1	47.5	49.1	43.4	43.9	41.2	42.7	40.9	40.8	39.7	40.6
	5	57.6	45.7	47.8	41.0	42.0	38.1	40.1	37.6	37.5	35.7	37.1
	10	59.8	42.7	45.5	35.3	36.4	31.2	33.9	30.7	30.3	28.0	30.1
2% pa real return	3	59.0	53.6	55.6	48.8	49.8	46.3	47.9	45.5	45.7	43.7	45.0
	5	61.6	53.4	56.0	47.8	49.0	44.7	46.9	43.8	43.9	41.4	43.2
	10	65.6	52.9	56.5	45.1	46.9	40.4	43.6	39.1	39.4	36.1	38.5

In this case, the more aggressive portfolios would have a reasonable chance of achieving a real return of 2% per annum over a 10-year time horizon.

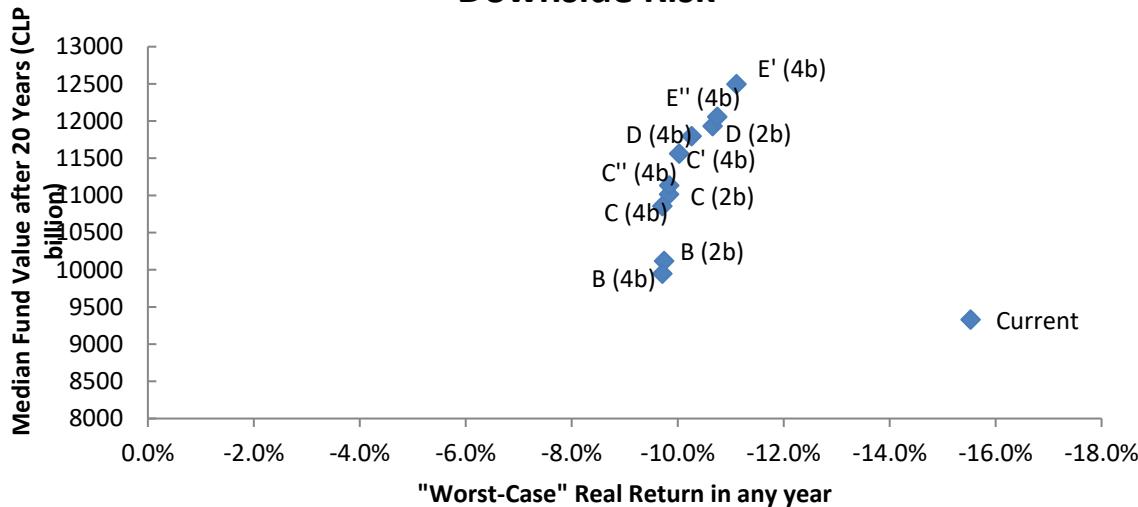
6.3.3 Other Considerations

The above analysis has focused on analyzing the portfolios from a longer-term perspective. Another consideration will be concerns on extremely negative returns in the short-term – for example, at present, the approach has been to have a 95% probability that the Fund would not lose more than 10% of its value in USD terms in a given year.

50% Hedging of Global Bonds

The following chart compares the projected fund value after 20 years with “worst-case” returns in any year – that is, the bottom 5th percentile of the distribution of the simulated real returns in any year. This is similar to the current risk tolerance, except that the figures below are in real terms (rather than nominal) and in CLP terms (rather than USD).

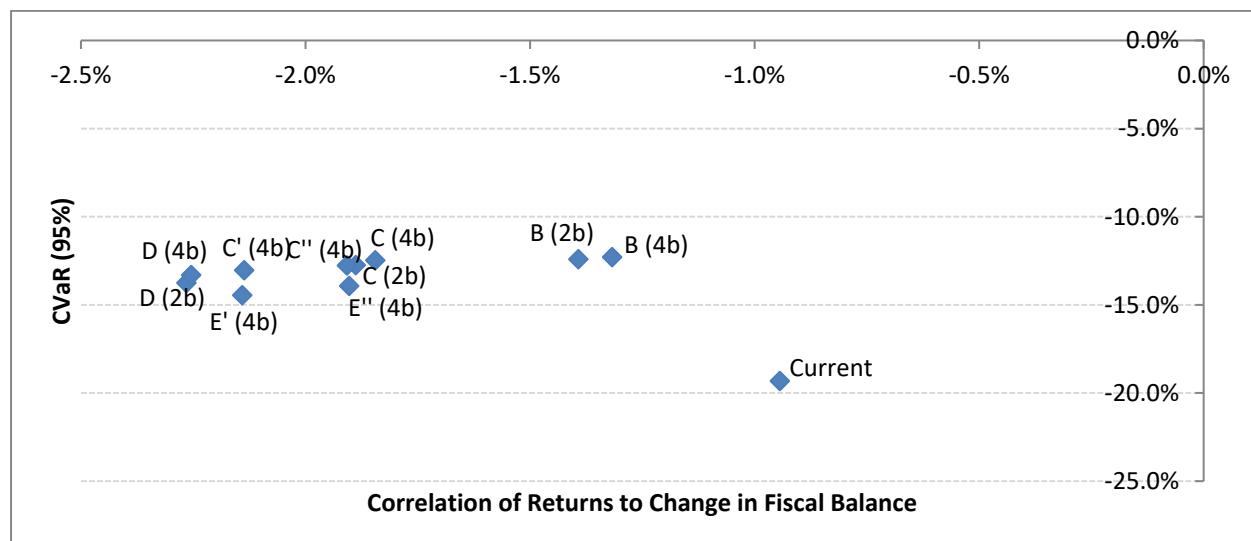
Comparison of Projected Fund Value and Short-Term Downside Risk



The situation is similar to the efficient frontier analysis in the current SAA is not optimal. The “least risk” position in this instance is associated with portfolios B.

We have also analyzed the correlation between real portfolio returns and the expected movement in the fiscal position in order to assess how different candidate portfolios might improve diversification from an overall perspective. The following chart compares downside risk (as measured by CVaR) against the correlation between real portfolio returns and the expected movement in the fiscal position in order to assess how different candidate portfolios might improve diversification from an overall perspective

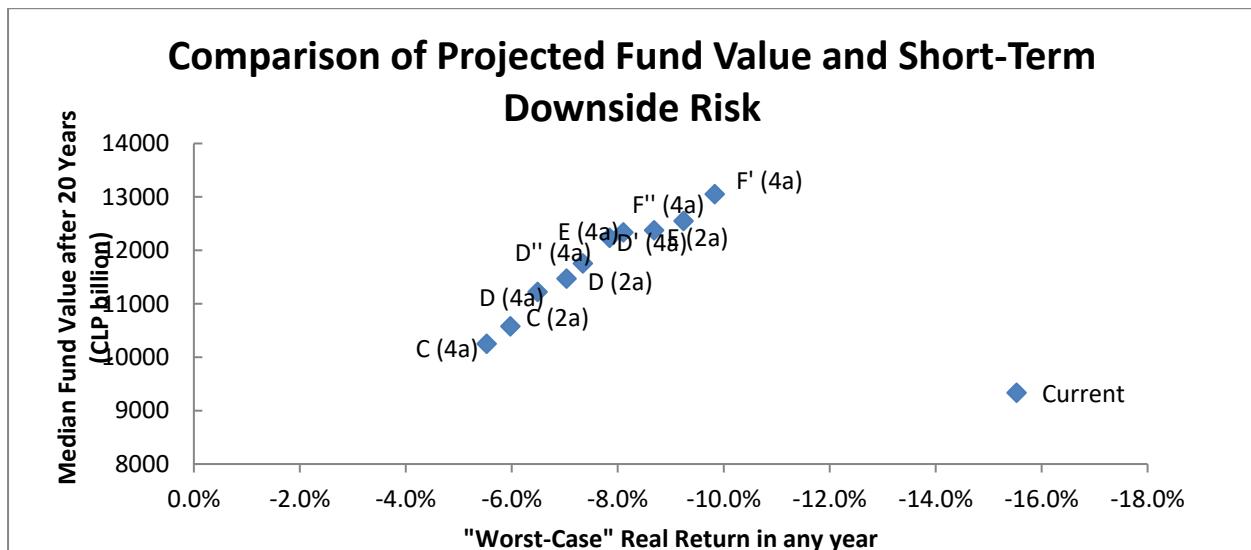
Trade-Off Between Correlations and Downside Risks



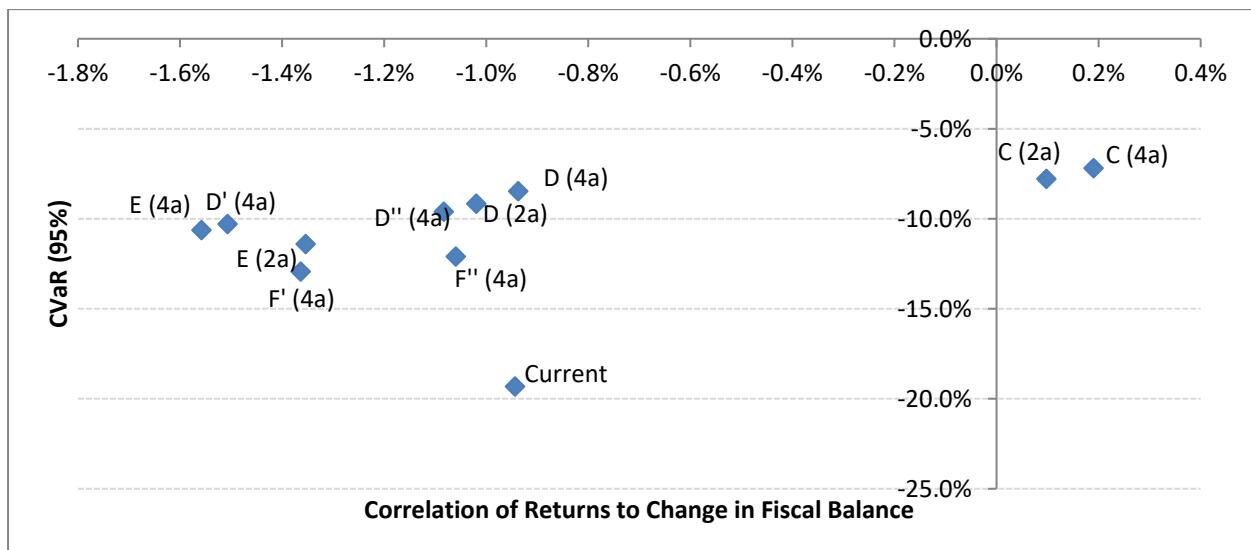
In general as the exposure to equities increases, the negative correlation also increases although the improvements are relatively marginal.

100% Hedging of Global Bonds

The following charts are similar, but show the position with the candidate portfolios based on 100% hedging of the currency exposures of global bonds.



Trade-Off Between Correlations and Downside Risks



6.3.4 Stress Testing

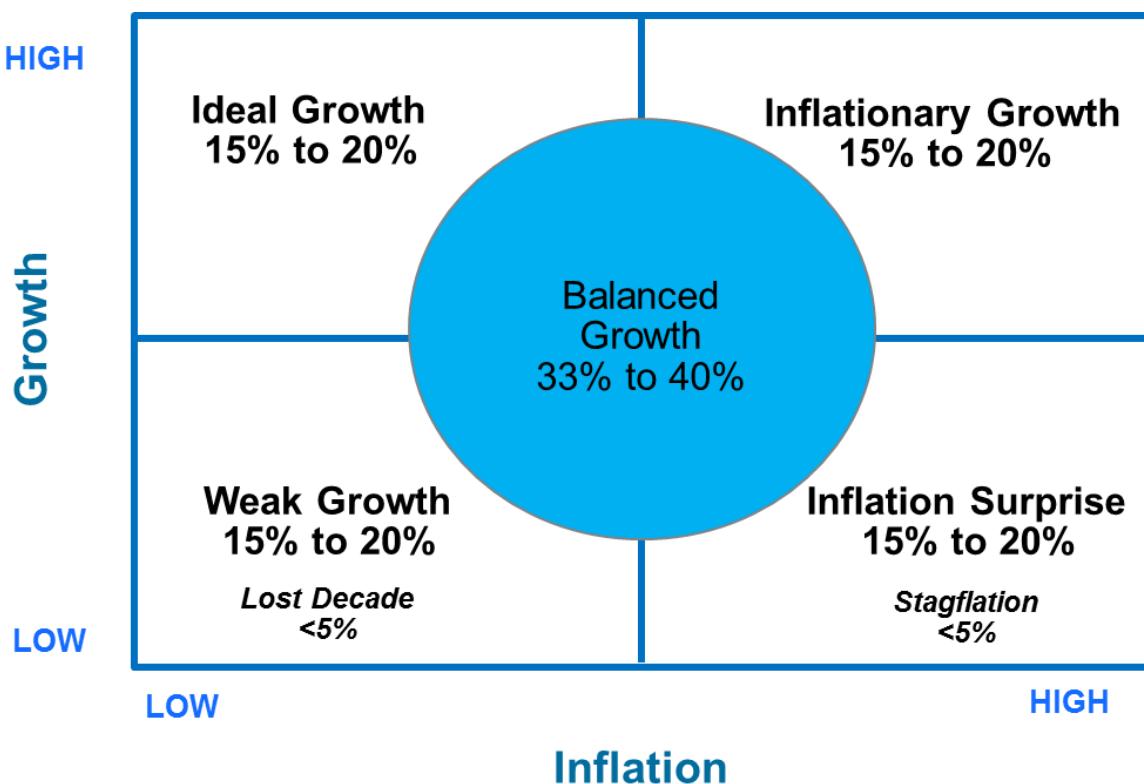
To complement the stochastic modelling, we also conduct scenario analysis to stress test the recommended candidate portfolios. As such, we seek to simulate extreme market conditions that may not be well captured in the return distributions assumed by other modelling techniques.

We use an economic growth / inflation matrix for “Primary” scenarios encompassing both positive and negative environments. Four “Secondary” scenarios are also included to address other potential environments of interest to clients.

The scenarios are global, while recognizing that the United States tends to lead the global economic cycle and has the largest financial markets. The growth and inflation matrix is based on conditions over an intermediate-term time horizon (~3 years). Conditions are assumed to trend back to normal thereafter for most scenarios (except for Stagflation and Lost Decade).

Markets are assumed to react to the environment over three years, with the bulk of the impact in year 1 for equity markets. There is an assumed equity “overshoot” built into many of the scenarios, which is unwound in years 4-10. The returns are generally intended to be the central tendency for a given scenario, not extreme returns.

The scenarios cover a spectrum of outcomes, and with the exception of Lost Decade and Stagflation, are not intended to be extreme departures from Balanced Growth. This scenario is broadly consistent with the economic conditions underpinning our capital market assumptions.



Scenario	Description
Balanced growth	Economic growth and inflation are consistent with Mercer's long-term base case conditions. Interest rates gradually rise to equilibrium over the next decade, and equity valuations decline slightly as a result.
Ideal growth	The global economy enjoys a period of above average growth as economies return to the long-term trend growth line. Since growth is partially using existing excess capacity (equipment, plant and labor), inflationary pressures remain contained. Equities experience strong earnings growth, while interest rates rise only modestly.
Inflationary growth	Economic growth is robust, particularly in resource intensive emerging markets, and global central banks are slow to react. Commodity price pressure re-intensify, while rising wages put additional pressures on consumer prices. Central banks react belatedly. Equities benefit from strong growth, but wage growth erodes profit margins, while higher interest rates pressure valuations.
Inflation surprise	Supply constraints or a geopolitical event leads to a substantial increase in commodities, resulting in below trend economic growth, particularly for commodity importers. Loose monetary policies amplify inflationary pressures as central banks attempt to balance high unemployment and high inflation. Both stocks and bonds suffer negative real returns over the intermediate-term.
Stagflation	As a more severe version of the Inflationary Surprise scenario, central banks lose control of monetary policy and bond vigilantes drive rates higher. The scenario stretches on for a number of years as central banks struggle to rein in inflation and support growth.
Weak Growth	Global growth continues to disappoint over the next few years, perhaps descending into another recession, as governments favor austerity over stimulus and deleveraging intensifies. Deflation risks are at the forefront of central bankers' concerns, keeping policy rates very low (or negative). Equity earnings stagnate, and investors bid valuations lower.
Lost Decade	A secular decline in productivity and poor demographics results in a prolonged period of weak growth with intermittent recessions. Some major economies lapse into deflation, and central banks keep rates near zero. Equity earnings decline and investors push valuations down significantly due to weak growth prospects.

The secondary scenarios are as follows:

Scenario	Description
China / emerging markets crisis	Emerging markets enter a period of tumult as a result of economic imbalances, resulting in poor economic growth, currency devaluation and depressed equity valuations. There is a spillover effect on developed markets and economies. Equity valuations decline, while a flight-to-safety results in a decline in Treasury yields.
Financial crisis	Global markets are roiled by a financial crisis similar to 2008/09 with sharp losses from equities and other risky assets in a short period of time.
Lower rates for longer	Economic growth and inflation are consistent with Balanced Growth, but a savings glut keeps interest rates below equilibrium, providing support to equity valuations.
Higher rates	A return to normal economic growth levels leads interest rates to rise to equilibrium much faster than currently discounted by markets even as inflation remains well-behaved, putting downward pressure on equity valuations.

The detailed results for the candidate portfolios under the assumption of 50% hedging for global bonds for each of these scenarios are included in Appendix M – the 50% hedging approach has been used as this represents the middle of the three approaches being considered for currency hedging of global bonds. It should be noted that the returns are shown in **nominal** terms from a CLP perspective. That is, the scenarios make an allowance for how the CLP can be expected to perform under each scenario.

As would be expected, the portfolios with higher exposures to equities generally perform worse in those scenarios that are bad for equities. The China / Emerging Markets crisis is not as severe as it might otherwise be, since the CLP is assumed to depreciate against developed market currencies under this scenario. This situation is most pronounced with the Current SAA given all the currency exposures are unhedged.

6.3.5 *Historical Back Testing*

In this section, we have examined how the candidate asset allocations would have performed had they been in place historically.

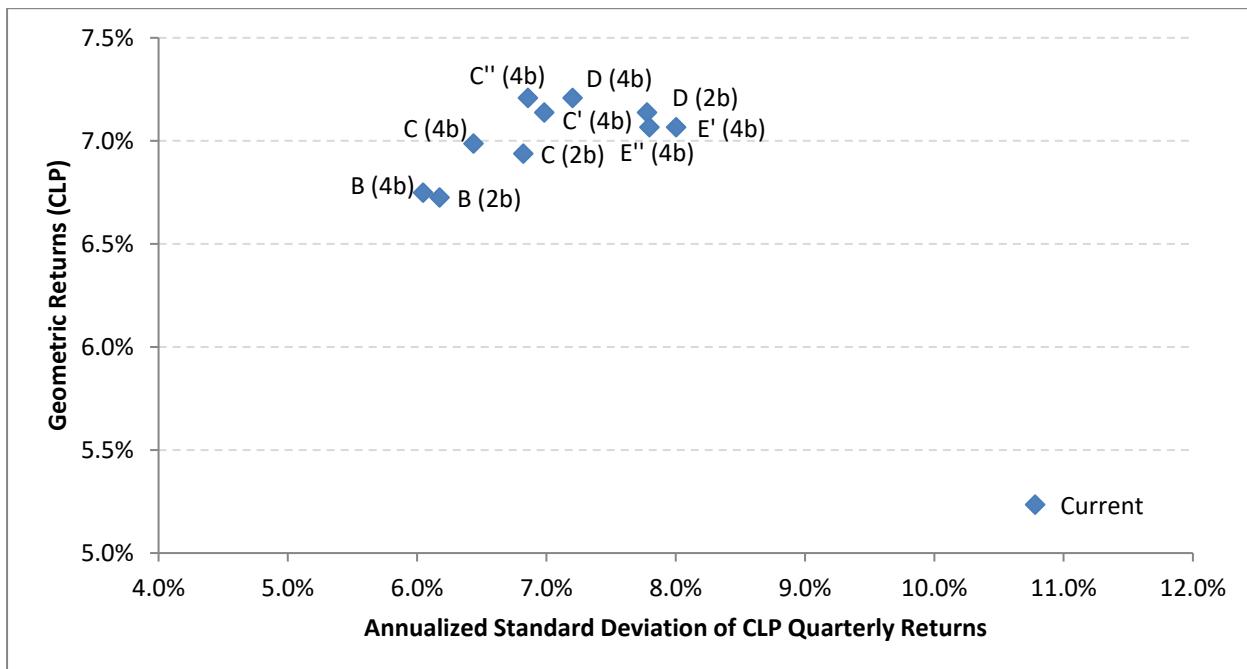
The analysis has been undertaken over the period from 1 January 2005, which is the longest period for which we can derive global bond returns on a hedged to CLP basis as this is the earliest date from which we can derive the forward premiums from a CLP perspective.

The analysis has been undertaken in ***nominal*** terms.

50% Hedging of Global Bonds

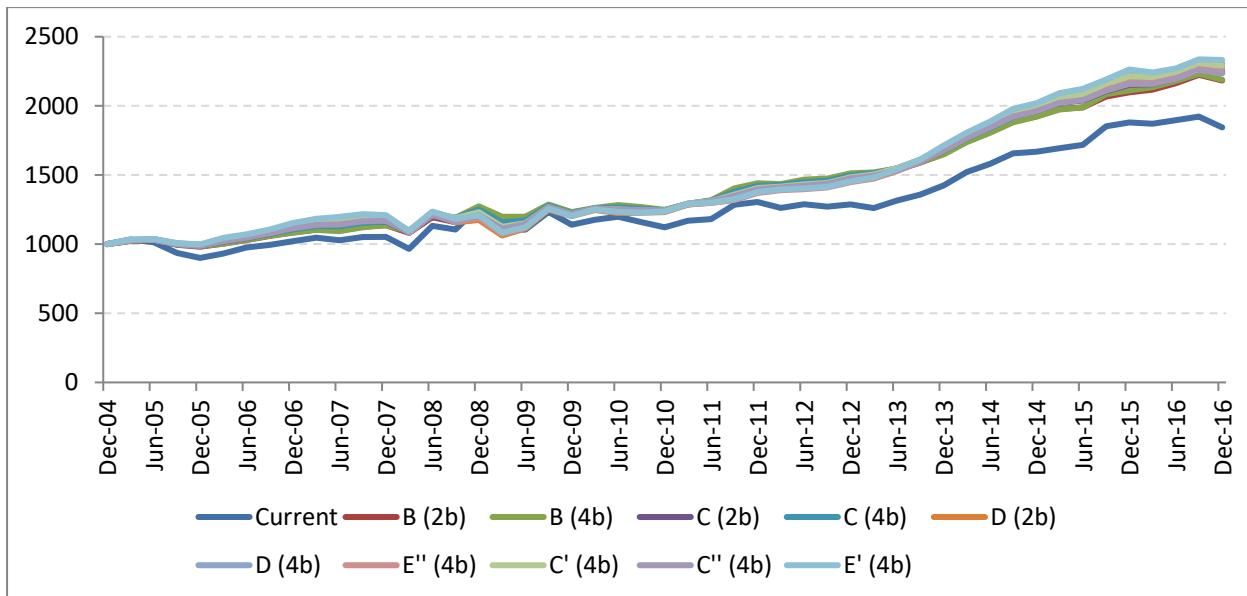
The following chart shows the historical returns and volatilities for candidates over the 12-year period to December 2016.

Historical Risk/Returns



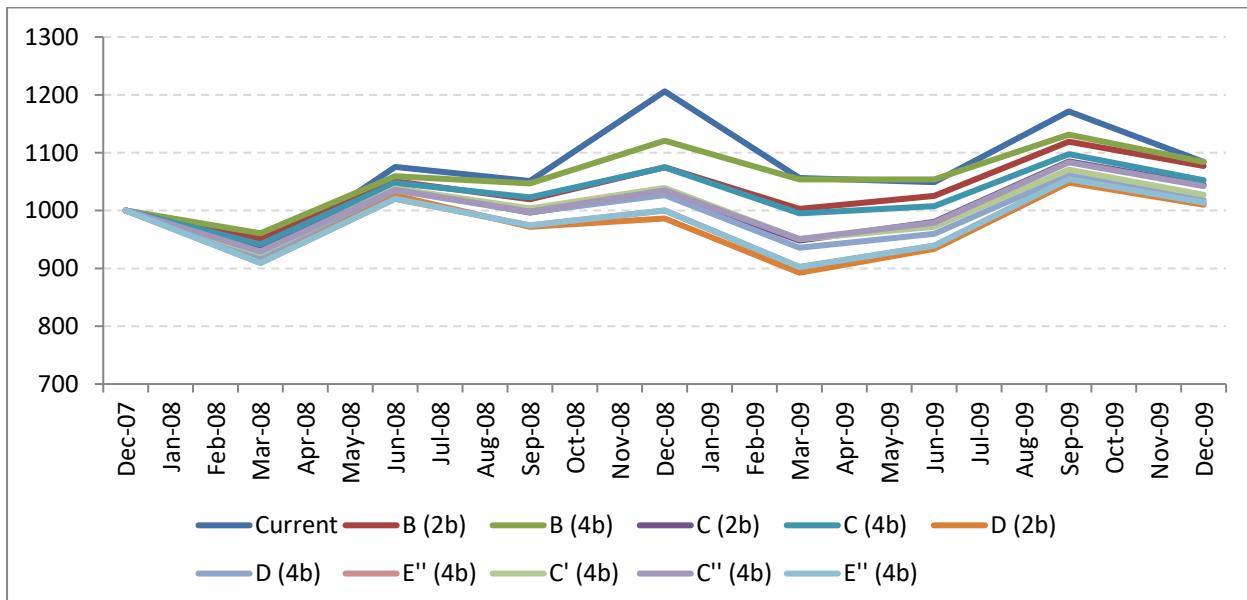
The following chart shows the growth of 1000 if assumed to be invested in each of the candidates at the beginning of 2005. In line with the above results, the current portfolio has lagged the other candidates over this full period.

Growth of 1000 for Period from 2005 to 2016 – 50% hedging of global bonds



The following chart shows the impact during the period surrounding the global financial crisis:

Growth of 1000 for Period from 2008 to 2009 – 50% hedging of global bonds

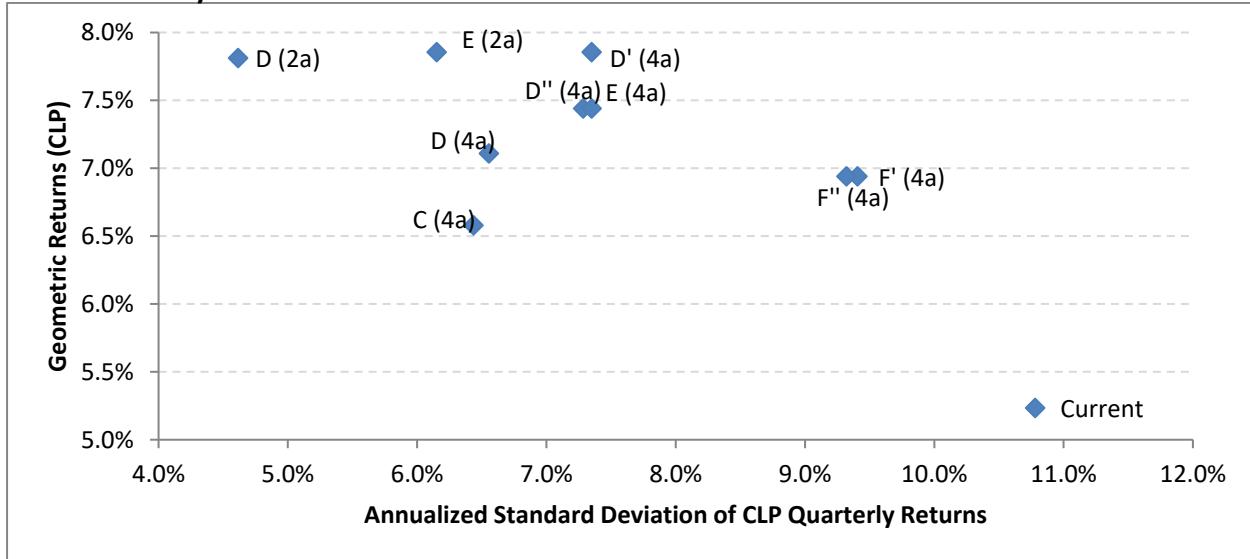


Especially, during the worst of the crisis in late 2008, the current SAA performed strongest largely as a result of the unhedged global government bond exposure which benefited both from the fall in bond yields during that period and the weakness in CLP.

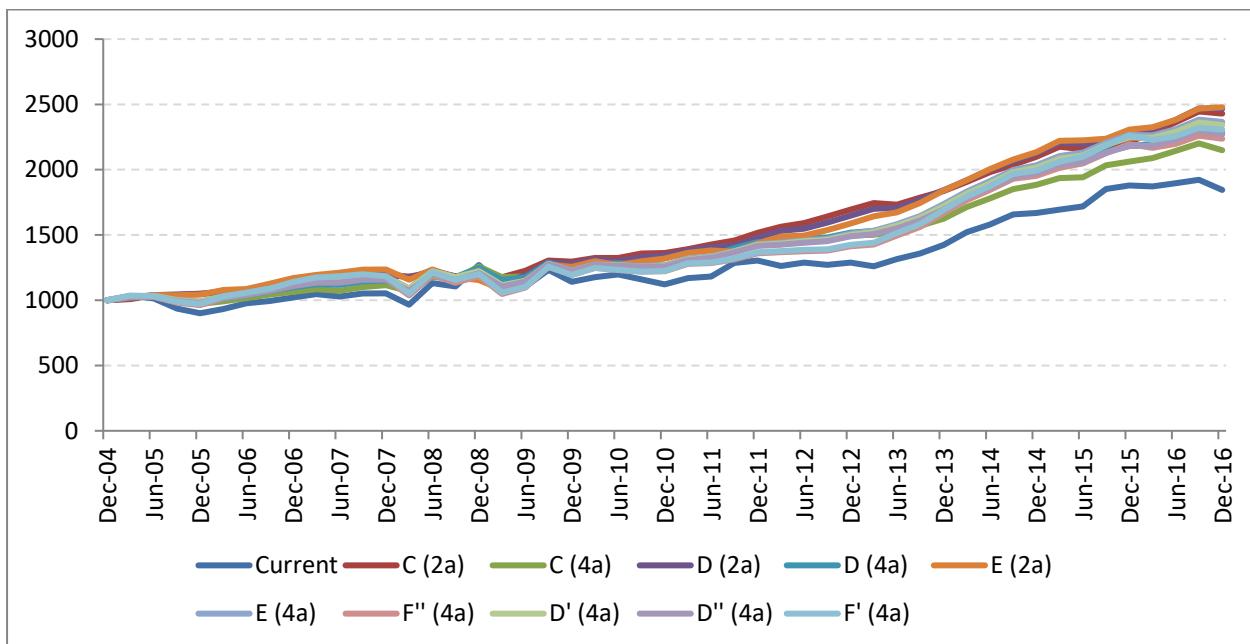
100% Hedging of Global Bonds

The following charts are similar, but show the position with the candidate portfolios based on 100% hedging of the currency exposures of global bonds.

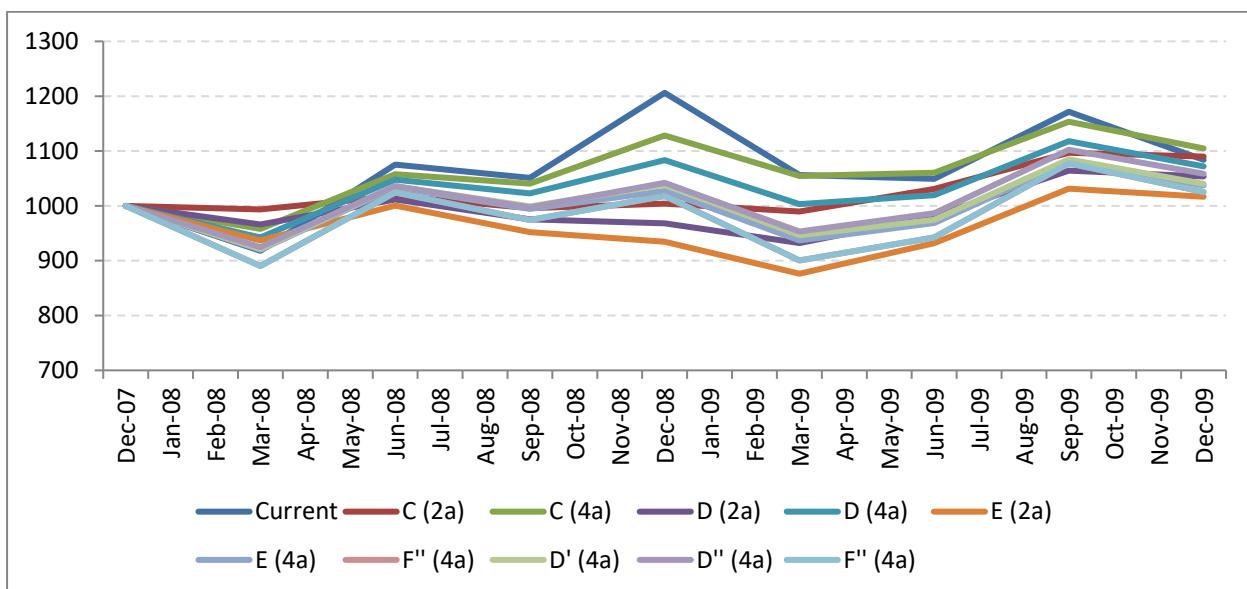
Historical Risk/Returns



Growth of 1000 for Period from 2005 to 2016 – 100% hedging of global bonds



Growth of 1000 for Period from 2008 to 2009 – 100% hedging of global bonds



The extent of the outperformance of the Current SAA during the worst of the global financial crisis is greater than was the case with the 50% hedged bond candidates.

6.4 Conclusions and Recommendations

As indicated in Section 5.4, we have been informed that the FC believes that increasing the equity allocation beyond 40% is too much when compared with the current SAA of 15%. Therefore, our recommendations below are structured such that we first make our recommendations on the basis that the maximum exposure to equities is 30% and then secondly on the basis of a 40% maximum exposure to equities.

The key conclusion from the analysis that we have undertaken is that incorporating an allowance for hedging the currency exposures of global bond assets to CLP materially improves the outcomes relative to the situation if those currency exposures remain unhedged. As such, we have presented below 3 different options in relation to the currency hedging approach for global bond assets:

- Global bonds continue to be managed on an unhedged basis
- Global bonds become managed on a 50% hedged to CLP basis
- Global bonds become managed on a fully hedged to CLP basis

Another key conclusion from the analysis is that seeking greater diversification via the inclusion of additional asset classes improves results, but only marginally given the practical constraints we have incorporated. That is, a higher allocation to asset classes (such as real estate) than the 5% we have used would improve results but would create greater implementation challenges. As such, a 5% constraint is proposed, at least, as an initial stage.

However, given the greater complexity and governance that private asset classes introduces to an investment program and the fact that exposures to these asset classes are not necessarily needed in order for the PRF to achieve its likely objectives, we have proposed possible

alternative SAAs with and without the 5% real estate exposure. In the case of unhedged asset classes, given currency risk from a CLP perspective is a common risk factor affecting all asset classes, the potential inclusion of a 5% real estate allocation has very little impact on the risk/return outcomes and our unhedged recommendations exclude any real estate exposure.

6.4.1 30% Maximum Equity Exposure

If 30% is to be the maximum equity exposure, then we have outlined five recommendations below depending on the different currency hedging approaches for global bonds and whether or not real estate exposure is included:

Asset Class	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Unhedged bonds %	50% hedged bonds, real estate %	50% hedged bonds, no real estate %	100% hedged bonds, real estate %	100% hedged bonds, no real estate %
Sovereign and government-related bonds (unhedged)	17				
Sovereign and government-related bonds (50% hedged)		21	22		
Sovereign and government-related bonds (100% hedged)				19	21
Inflation-linked sovereign bonds (unhedged)	44				
Inflation-linked sovereign bonds (50% hedged)		30	30		
Inflation-linked sovereign bonds (100% hedged)				25	26
Investment Grade Corporate bonds (unhedged)	6				
Investment Grade Corporate bonds (50% hedged)		10	12		
Investment Grade Corporate bonds (100% hedged)				10	12
Agency Residential MBS (unhedged)	3				
Agency Residential MBS (50% hedged)		5	6		
Agency Residential MBS (100% hedged)				6	6
Global High Yield (unhedged)					
Global High Yield (50% hedged)					
Global High Yield (100% hedged)				5	5
Broad Market Equities	30	29	30	30	30
Core Real Estate		5		5	
Total	100	100	100	100	100
Expected Real Return	1.2%	1.9%	1.7%	2.3%	2.1%
Standard Deviation	9.8%	7.6%	7.4%	6.3%	5.8%
Probability of not achieving real return of 1% over 10 years	43.0%	32.7%	34.8%	22.7%	24.5%
Probability of not achieving real return of 1.5% over 10 years	49.7%	40.3%	42.9%	31.2%	33.9%
Probability of not achieving real return of 2% over 10 years	56.3%	48.8%	51.2%	40.4%	43.6%
VaR @ 5% confidence	-13.9%	-10.0%	-9.8%	-7.8%	-7.3%
CVaR @ 5% confidence	-17.7%	-13.0%	-12.8%	-10.3%	-9.6%

Assuming that global bonds were to be 50% hedged to CLP, we would recommend that the objectives be expressed as:

"MoF will not tolerate a greater than 40% chance of not achieving returns that are at least 1% per annum above inflation over 10 year time periods"

"MoF will not tolerate a greater than 5% chance of the real return in CLP terms in any one year being below -10%"

If 100% hedging of bonds is to be adopted, then we believe the real return objective could be increased from 1% per annum shown above to 1.5% per annum.

Alternatively if the global bonds continue to be unhedged, then we believe the real return objective would need to be reduced from 1% per annum shown above to 0.5% per annum and the downside risk tolerance reduced by being below -10% to -14%.

6.4.2 40% Maximum Equity Exposure

If 40% is to be the maximum equity exposure, then we again have outlined five recommendations:

Asset Class	Alternative 1 Unhedged bonds %	Alternative 2 50% hedged bonds, real estate %	Alternative 3 50% hedged bonds, no real estate %	Alternative 4 100% hedged bonds, real estate %	Alternative 5 100% hedged bonds, no real estate %
Sovereign and government-related bonds (unhedged)	22				
Sovereign and government-related bonds (50% hedged)		22	24		
Sovereign and government-related bonds (100% hedged)				23	25
Inflation-linked sovereign bonds (unhedged)	24				
Inflation-linked sovereign bonds (50% hedged)		16	16		
Inflation-linked sovereign bonds (100% hedged)				5	6
Investment Grade Corporate bonds (unhedged)	8				
Investment Grade Corporate bonds (50% hedged)		11	13		
Investment Grade Corporate bonds (100% hedged)				13	14
Agency Residential MBS (unhedged)	4				
Agency Residential MBS (50% hedged)		6	7		
Agency Residential MBS (100% hedged)				6	7
Global High Yield (unhedged)	2				
Global High Yield (50% hedged)					
Global High Yield (100% hedged)				8	8
Broad Market Equities	40	40	40	40	40
Core Real Estate		5		5	
Total	100	100	100	100	100
Expected Real Return	1.8%	2.3%	2.1%	2.8%	2.6%
Standard Deviation	10.0%	8.6%	8.2%	8.0%	7.4%
Probability of not achieving real return of 1% over 10 years	37.4%	28.3%	30.4%	21.0%	22.3%
Probability of not achieving real return of 1.5% over 10 years	43.9%	35.3%	37.9%	28.0%	30.1%
Probability of not achieving real return of 2% over 10 years	50.6%	43.0%	45.7%	36.1%	38.5%
VaR @ 5% confidence	-13.7%	-11.1%	-10.8%	-9.8%	-9.2%
CVaR @ 5% confidence	-17.6%	-14.4%	-13.9%	-12.9%	-12.1%

Assuming that global bonds were to be 50% hedged to CLP, we would recommend that the objectives be expressed as:

"MoF will not tolerate a greater than 40% chance of not achieving returns that are at least 1.5% per annum above inflation over 10 year time periods"

"MoF will not tolerate a greater than 5% chance of the real return in CLP terms in any one year being below -12%"

If 100% hedging of bonds is to be adopted, then we believe the real return objective could be increased from 1.5% per annum shown above to 2% per annum.

Alternatively if the global bonds continue to be unhedged, then we believe the real return objective would need to be reduced from 1.5% per annum shown above to 1.0% per annum and the downside risk tolerance reduced by being below -12% to -14%.

6.4.3 *Mercer Recommendation*

We have outlined above 10 possible recommended strategic asset allocations.

The candidates with unhedged global bonds have the advantage of being the easier to implement as these do not include any recommended allocations to real estate and do not require consideration to be given to the implementation of currency hedging. However, these candidates have inferior risk/return outcomes as compared to those candidates that have the currency exposures associated with global bonds partially or fully hedged.

The analysis of the candidates would suggest that fully hedging global bonds is likely to provide the better outcomes. However, given the size of the PRF, there may be potential liquidity issues associated with the CLP forward/NDF markets if these exposures were to be fully hedged which together with the reduced overall diversification that results from currency hedging, means that we would recommend the options with 50% hedging for the global bond assets be considered.

The candidates with 5% real estate exposure provide marginally superior risk/return outcomes as compared to those candidates without real estate exposure. However, these candidates present greater implementation challenges given it will take time to build the desired allocation to the asset class.

Unless there is a strong desire to target the highest real return consistent with a 40% maximum to equities, we would recommend that the 30% maximum equity allocation be considered. This is expected to result in the PRF continuing to grow in real terms after covering the projected withdrawals. If it is considered desirable to grow the PRF at a faster rate, then the 40% maximum could be considered.

Therefore, on the basis of the above discussion, we would recommend the adoption of the following as the revised SAA for the PRF:

Asset Class	Current (@31 March 2017)	Recommended SAA
	%	%
Sovereign and government-related bonds (50% hedged)		21
Sovereign and government-related bonds (unhedged)	46	
Inflation-linked sovereign bonds (50% hedged)		30
Inflation-linked sovereign bonds (unhedged)	17	
Investment Grade Corporate bonds (50% hedged)		10
Investment Grade Corporate bonds (unhedged)	20	
Agency Residential MBS (50% hedged)		5
Broad Market Equities	17	29
Core Real Estate		5
Total	100	100

In conjunction with the adoption of this Recommended SAA, we would recommend the following objectives:

"MoF will not tolerate a greater than 40% chance of not achieving returns that are at least 1% per annum above inflation over 10 year time periods"

"MoF will not tolerate a greater than 5% chance of the real return in CLP terms in any one year being below -10%"

7

Portfolio Construction

7.1 Introduction

Subsequent to the decision regarding the strategic asset allocation, the next step is to determine what the portfolio construction and implementation will be in order to achieve the intended and desired asset class exposures. This process includes considerations such as whether to be passive or active in a particular asset class, the number of managers and strategies for the total portfolio (and per asset class), and how ESG considerations should be integrated in the portfolio. When reviewing current asset class exposures that will continue, we evaluate the efficacy and efficiency of the current portfolio construction considering coverage of the markets, fees, and the amount of (additional) governance effort and oversight that alternative exposure would entail. All of these factors are also considered in relation to new asset classes.

When assessing the potential merits of active management in each of the asset class, we use as a reference the performance of the median manager/strategy within each universe. While not a highly technical measure, from a practical standpoint we consider that for all of the additional governance and oversight efforts, in addition to higher fees, that active management would encompass, at a minimum, the investor should be compensated by at least median manager returns over the long-term provided these are better than what the indexed exposure can offer.

We also look at the consistency of the median return pattern by calculating the information ratio (IR), which is the ratio of the excess returns to the volatility of these returns¹⁹ for the median manager return. A positive number indicates that the active strategy is generating positive excess return. In general, a higher number is better – it gives us an indication that the investor is getting compensated for the risk the strategy is taking.

7.2 Asset Classes

The following assets classes were considered in this SAA review:

¹⁹ The formula for information ratio, or IR, is [(Return of the portfolio)-(Return of the benchmark)]/(Tracking Error)

Broad Asset Class	Asset Class
Public Equity	Broad Market Equity (including EM)
Defensive Fixed Income	Sovereign Bonds (Nominal) Inflation-Linked (Sovereign) Investment Grade Corporates Agency Residential MBS
Growth Fixed Income	Global High Yield
Real Assets	Infrastructure Real Estate

The current asset classes in the portfolio are Broad Market Equity, Sovereign and Inflation-Linked Bonds and Investment Grade Corporates. All of these exposures are passively managed, with the strategies attempting to mimic and track the portfolio and performance of an index. In the case of Broad Market Equity, this exposure is managed by two external investment managers: Mellon Capital and Blackrock. The Investment Grade Corporates portfolio is also managed by two managers: Blackrock and Rogge Global Partners. The Sovereign and Inflation-Linked portfolios are managed by the Central Bank of Chile.

Asset classes that are not yet included in the portfolio but that are considered in this SAA are Agency Residential MBS, Global High Yield and Infrastructure and Real Estate. After reviewing the current asset class exposures we will also review how the MoF might best implement these exposures.

7.3 Current Asset Classes

7.3.1 *Global Equity (including EM)*

This exposure is managed attempting to replicate the performance of the MSCI All Country World Index (ACWI) and excluding Chile as a constituent country (0.13% of the ACWI as of 12/13/16). The benchmark captures large- and mid-cap companies in 46 countries, covers approximately 85% of the global equity opportunity set, includes 2,486 constituent companies and has an average market capitalization of \$15.1 billion.

In June 2007, MSCI launched the MSCI ACWI Investable Market Index (ACWI IMI), which attempts to extend coverage in the same 46 countries but cover 99% of the global equity opportunity set by including more coverage of companies, especially in the small capitalization market. The ACWI IMI has 8,628 constituent companies and an average market capitalization of \$5.0 billion.

Below we compare the performance of these two benchmarks:

Name	1 yr (%)	3 yrs (%pa)	5 yrs (%pa)	7 yrs (%pa)	10 yrs (%pa)	15 yrs (%pa)
MSCI All Country World Index	8.5	3.7	10.0	7.8	4.1	6.5
MSCI All Country World Investable Market Idx	9.0	3.8	10.2	8.1	4.4	7.0

Name	2001 (%)	2002 (%)	2003 (%)	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)
MSCI All Country World Index	-15.9	-19.0	34.6	15.8	11.4	21.5	12.2	-41.8
MSCI All Country World Investable Market Idx	-15.4	-17.3	36.2	16.9	12.1	21.5	11.7	-42.0

Name	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)
MSCI All Country World Index	35.4	13.2	-6.9	16.8	23.4	4.7	-1.8	8.5
MSCI All Country World Investable Market Idx	37.2	14.9	-7.4	17.0	24.2	4.4	-1.7	9.0

The historical performance of the ACWI IMI has not been competitive enough versus the ACWI, and this before accounting for the potentially higher cost that the former benchmark would carry if the MoF wanted to replicate it instead of the current ACWI benchmark. So in terms of exposure to the global equity asset class, the current benchmark and strategy covers the desired exposure well.

Next, we explore if consideration should be given to managing this exposure actively and whether there is a structure or set of strategies that would, in repeatable fashion and over time, offer a materially better risk-adjusted return. As a starting point, we look at the historical performance of global equity strategies in the past 20 years and compare them to the ACWI benchmark in the chart below.

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16

Comparison with the Global Equity universe (Percentile Ranking)



In this chart we show the performance of the MSCI ACWI ("ACWI") versus the performance of the entire global equity universe²⁰, represented in quartiles, where a ranking of 1 is best and 100 is worst. The number of strategies included in this universe as of the past year was 592 while back 20 years it was 52. The returns in this universe are all gross of fees.

As the chart shows, the performance of the ACWI benchmark, beyond the 1 year results, has been about median except for the 15 and 20 years annualized results, where being indexed earned an annualized return of 6.5% and 6.1%, ranking in the bottom quartile (80th or worse) in this universe. It is interesting to note that the number of global strategies (this includes all types of strategies-passive, enhanced, active, smart beta, quantitative, fundamental, etc.) has increased significantly from 20 years ago, when the universe was represented by 52 strategies whereas today there are 592. Given the increasingly more favorable ranking that the index has achieved in more recent years, this could lend credence to the theory that the significant proliferation of products and strategies in global equity have made the market more efficient and thus the benchmark harder to beat. When we look at the consistency of this return pattern via the IR, the results of the median manager are more compelling.

Information Ratio (against MSCI ACWI)	1 yr (%)	3 yrs (%pa)	5 yrs (%pa)	7 yrs (%pa)	10 yrs (%pa)	15 yrs (%pa)
Global Equity Median Manager	-0.32	0.09	0.32	0.31	0.24	0.37

Changing the current global equity strategy in the PRF to an active strategy would involve paying active fees for investment management, which need to be considered in the calculus of whether this would result in better outcomes on an after (net) of fees basis. To determine this we subtract a representative fee of 0.52%²¹ from the median manager results in the global universe.

The table below compares trailing performance periods.

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
MSCI ACWI	8.48%	3.69%	9.96%	7.83%	4.12%	6.47%	6.14%
Median Manager	6.24%	3.50%	10.74%	8.61%	4.59%	7.52%	7.64%
Median Manager(Net)	5.72%	2.98%	10.22%	8.09%	4.07%	7.00%	7.12%
'Winner'	Index	Index	Manager	Manager	Index	Manager	Manager
Magnitude	2.77%	0.71%	0.26%	0.26%	0.05%	0.53%	0.98%

Over the past 10 years, the median manager return, after fee and on an annualized basis, has been nearly the same of that versus the benchmark (4.12%). While it is recognized that managing to an index return incurs a fee, it is significantly below what is charged for active management. Longer-term results, both for 15- and 20- year annualized periods are more compelling for active management, as the excess return over the benchmark on a net of fee basis is 0.53% and 0.98% respectively.

²⁰ The Mercer Global Equity universe consists of equity strategies invested in stocks of companies around the world. Additionally, the returns are most highly correlated to a global equity index such as the MSCI Global Index.

²¹ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

We show the same analysis but on a calendar year basis below.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
MSCI ACWI	15.0%	22.0%	26.8%	-13.9%	-15.9%	-19.0%	34.6%	15.8%	11.4%	21.5%
Median Manager	16.3%	20.4%	32.9%	-8.3%	-14.7%	-18.2%	34.6%	16.4%	12.6%	22.9%
Median Manager (Net)	15.8%	19.9%	32.3%	-8.8%	-15.2%	-18.7%	34.1%	15.9%	12.1%	22.3%
'Winner'	Manager	Index	Manager	Manager	Manager	Manager	Index	Manager	Manager	Manager
Magnitude	0.8%	2.1%	5.5%	5.2%	0.7%	0.2%	0.5%	0.1%	0.7%	0.8%

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
MSCI ACWI	12.2%	-41.8%	35.4%	13.2%	-6.9%	16.8%	23.4%	4.7%	-1.8%	8.5%
Median Manager	12.5%	-41.3%	33.8%	13.1%	-7.1%	16.8%	27.3%	4.5%	0.1%	6.2%
Median Manager (Net)	12.0%	-41.8%	33.3%	12.6%	-7.6%	16.3%	26.8%	4.0%	-0.4%	5.7%
'Winner'	Index	Manager	Index	Index	Index	Index	Manager	Index	Manager	Index
Magnitude	0.2%	0.0%	2.1%	0.6%	0.8%	0.6%	3.3%	0.7%	1.4%	2.8%

In any given year performance is mixed, with the median manager outperforming the index 11 of the last 20 calendar year periods on an after fee basis.

An alternative approach to consider for active management is one that would split the mandate between developed and developing (emerging) markets. Active management in the emerging markets-only space has consistently added value over the long-term (detailed charts are shown in Appendix P). However, given the severe downward performance witnessed in the last few years, especially in 2015 (-14.9%) and 2011 (-18.4%), and when these markets have been negative in four of the past six years, even the median manager's return of 3.1% has been inferior to the median manager performance of the broad global equity manager (4.6%). While we believe a stand-alone tilt towards emerging markets could potentially add return over the long-term, the decision to go active either in global equities (ACWI) and/or in a dedicated emerging markets mandate would have to be made first. While frontier markets exposure could also be considered, at this point, given the size of the market (\$108.7B in market cap versus \$39.6T for ACWI) and unless the PRF would consider a niche allocation to this asset class, this exposure would simply not move the needle and/or influence to total fund's performance outcome materially.

More recently, we have witnessed a proliferation of factor-based benchmarks and strategies, which attempt to track the performance of the market on an alternative approach from a market capitalization-weighted benchmark. Instead of weighting of each constituency in the benchmark based on its market capitalization, alternative indexing methods uses other factors, such as GDP or volatility, to determine constituency within the benchmark. Examples of such benchmarks include the All Country World Minimum Volatility Index and the All Country World

Momentum Index. Both of these benchmarks are variations of the current ACWI benchmark used by the PRF.

- The ACWI Minimum Volatility Index was launched in November 2009. The index is calculated by optimizing the MSCI ACWI Index, its parent index, in USD for the lowest absolute risk (within a given set of constraints). Historically, the index has shown lower beta and volatility characteristics relative to the MSCI ACWI Index. It is designed to provide the lowest return variance for a given covariance matrix of stock returns. The constraints help maintain index replicability and investability and include index turnover limits, for example, along with minimum and maximum constituent, sector and/or country weights relative to the parent index.
- The ACWI Momentum Index was launched in February 2013. The index is designed to reflect the performance of an equity momentum strategy by emphasizing stocks with high price momentum, while maintaining reasonably high trading liquidity, investment capacity and moderate index turnover. A momentum value is determined for each stock in the MSCI parent index by combining the stock's recent 12-month and 6-month local price performance. This momentum value is then risk-adjusted to determine the stock's momentum score. A fixed number of securities with the highest momentum scores are included in each MSCI Momentum Index, generally covering about 30% of the parent index market cap. Constituents are weighted by the product of their momentum score and their market cap.

We show the performance of these benchmarks below in the global equity universe:

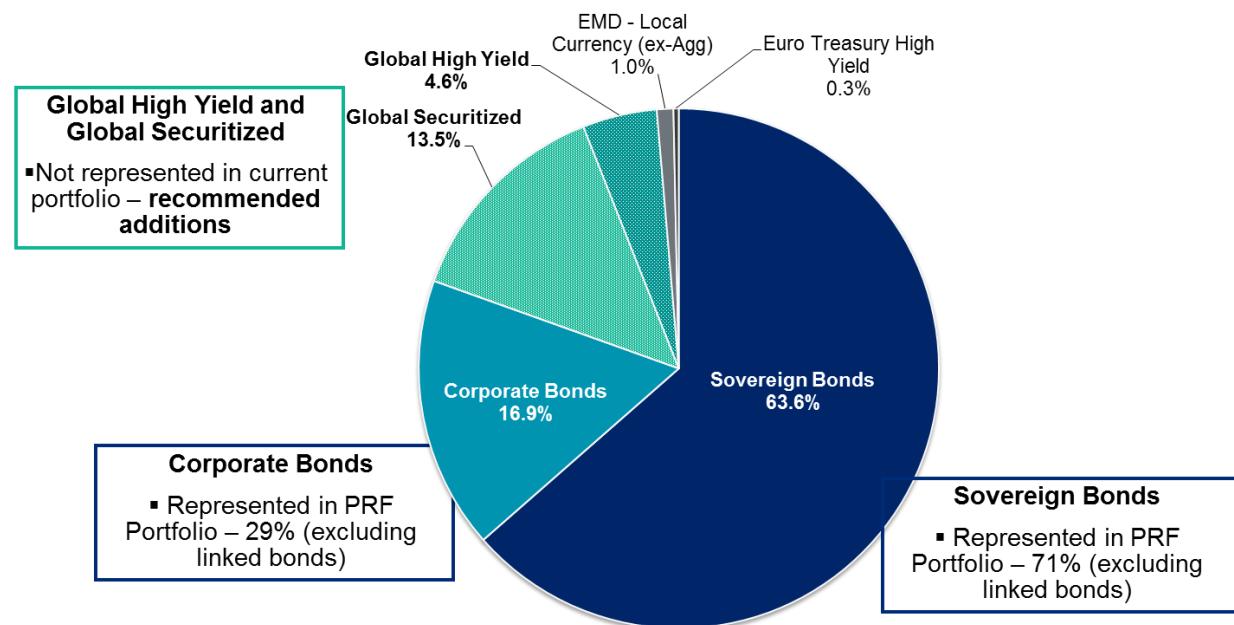


While results for the past five years have been similar for these benchmarks as the ACWI, longer-term results have been stronger. However, it is worth noting that Low Volatility has benefited from the disproportionate performance of defensive sectors over the last few years. It has been one of the factors in favor, though the fourth quarter of 2016 brought a reversal of that. It is important to note that these benchmarks were created in 2009 and 2013, so there are only

3 and 7 years of true performance. This would bode for studying these benchmarks further in the future but, for the time being, maintaining the current capitalization weighted index and exposure.

7.3.2 Global Fixed Income

As indicated earlier in this report, the Bloomberg Barclays Multiverse Index, the broadest available benchmark for global fixed income exposure, is currently composed of the following sectors:



Benchmark data from Bloomberg/Barclays

Noted in the graphic above are exposures that are already represented in the PRF portfolio along with those that are being recommended as potential additions in this SAA study. In particular, the PRF already has exposures to the government and corporate-related sections of the Global Aggregate portion, which represents over 85% of the fixed income universe. The remainder of the universe is made up of the securitized sector (primarily US Mortgage-Backed Securities) and High Yield, or those securities rated below investment grade.

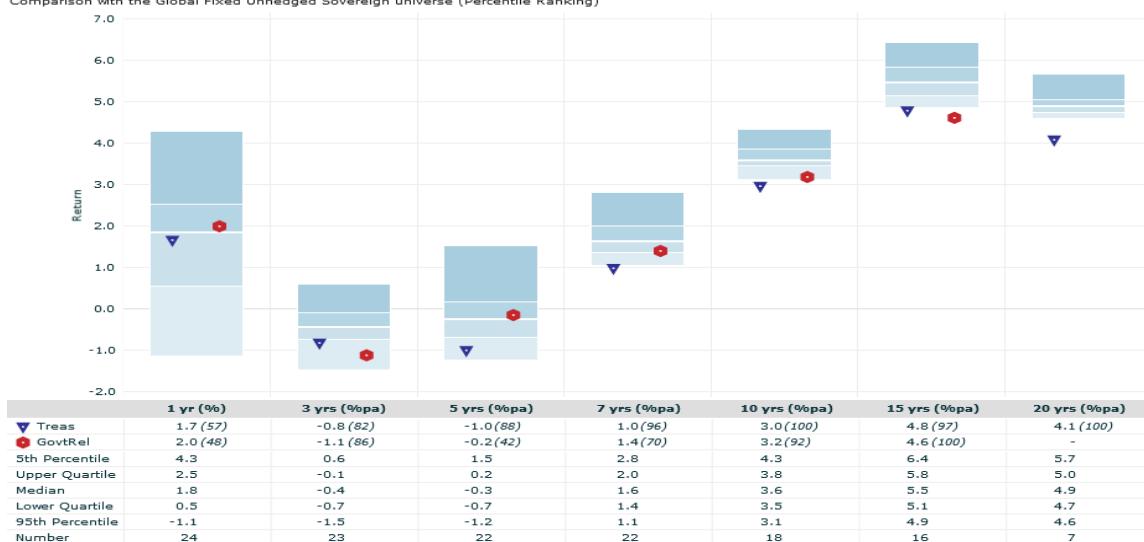
7.3.2.1 Sovereign Bonds (Nominal)

This allocation is managed by the Central Bank of Chile and covers both treasury-only and government-related instruments. In the charts below, we compare the performance of the two benchmarks tracked - Bloomberg Barclays Global Aggregate Treasury Index (unhedged) ("Treas") and Bloomberg Barclays Global Aggregate Government related Index (unhedged) ("GovtRel") - against the global fixed sovereign universe²²:

²² Global Fixed Income Unhedged Sovereign universe consists of global fixed income composites invested in bonds with no permanent regional or country bias. The returns of sovereign products are most highly correlated to a global

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16

Comparison with the Global Fixed Unhedged Sovereign universe (Percentile Ranking)



As the chart shows, longer-term performance of the universe of global sovereign strategies has been competitive before making allowance for fees. Similar to the observation in the global equity section, it is interesting to note that 20 years ago there were only 7 strategies whereas today there are 24 strategies managing sovereign focused portfolios. This market is generally deemed to be very efficient given the liquidity and the efficient exchange of information in sovereign instruments. Short of making interest/duration/yield bets, it is hard for a manager to outperform the index in this space. Considering this, it is surprising that the number of strategies has increased throughout the years. One reason may be as time has passed, more investors are getting comfortable with the idea of global bonds instead of just home country bonds.

Looking at fees in the sovereign sector, a typical active management fee is 23 basis points²³. The tables below present performance results considering the higher fees paid for active management.

unhedged fixed income index such as the Citigroup WGBI or the J.P. Morgan World Bond Index and are gross of fees.

²³ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

Treasuries:

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
Global Agg Treas Index	1.65%	-0.83%	-1.01%	0.98%	2.96%	4.78%	4.08%
Median Manager	1.84%	-0.44%	-0.26%	1.62%	3.58%	5.45%	4.88%
Median Manager(Net)	1.61%	-0.67%	-0.49%	1.39%	3.35%	5.22%	4.65%
'Winner'	Index	Manager	Manager	Manager	Manager	Manager	Manager
Magnitude	0.05%	0.16%	0.53%	0.41%	0.39%	0.44%	0.57%

Government-related:

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
Global Agg Gov't Index	1.99%	-1.13%	-0.15%	1.39%	3.18%	4.61%	n/a
Median Manager	1.84%	-0.44%	-0.26%	1.62%	3.58%	5.45%	n/a
Median Manager(Net)	1.61%	-0.67%	-0.49%	1.39%	3.35%	5.22%	n/a
'Winner'	Index	Manager	Index	Index	Manager	Manager	n/a
Magnitude	0.38%	0.46%	0.33%	0.00%	0.17%	0.61%	n/a

In general, the results of these tables point to the ability of active management to add value after fees, albeit sometimes a small amount of value, in this universe. This is somewhat striking for an asset class considered to be a very “efficient” asset class. The IR for the median manager in the treasury and government-related universe is as follows:

Information Ratio for median sovereign manager against the following benchmarks:	1 yr (%)	3 yrs (%pa)	5 yrs (%pa)	7 yrs (%pa)	10 yrs (%pa)	15 yrs (%pa)
Bg Barclays Global Aggregate: Treasury Index	0.04	0.18	0.51	0.46	0.38	0.50
Bg Barclays Global Aggregate: Gov't Related Idx	-0.06	0.23	0.00	0.11	0.15	0.33

The IR shown above for the different trailing time-periods point to the investor being compensated by the median active manager from a return perspective given the risk incurred.

7.3.2.2 Inflation-Linked Bonds

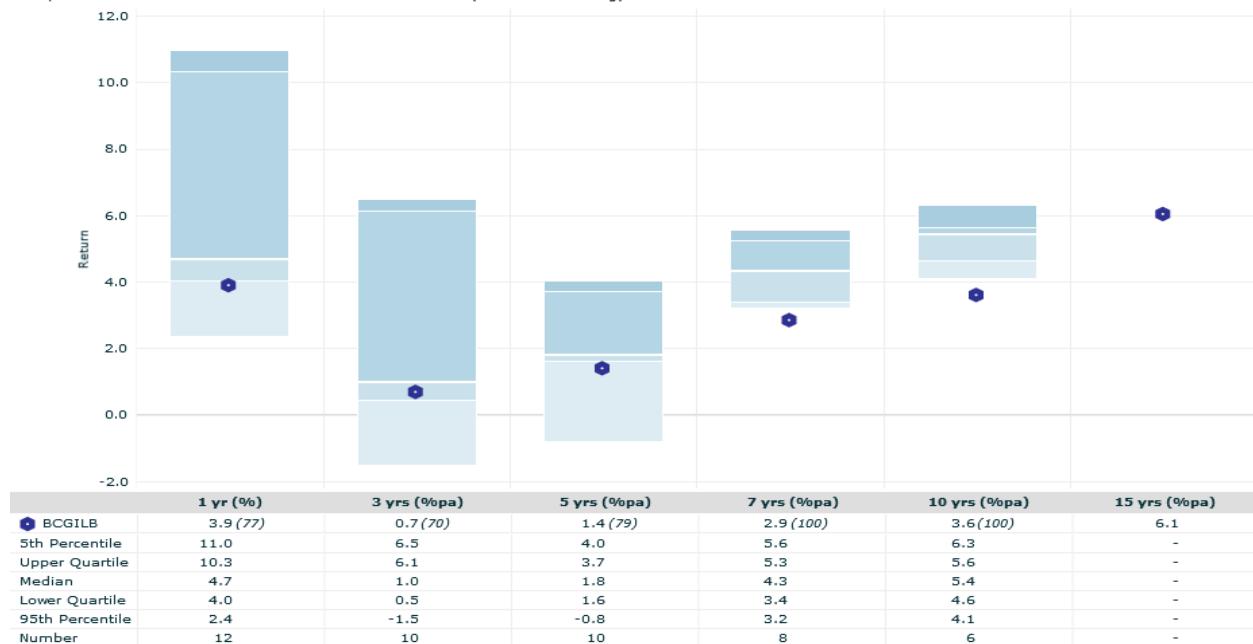
This allocation is managed internally by the Central Bank of Chile. It is a passive mandate meant to track the Bloomberg Barclays Global Inflation Linked Bond Index unhedged (“BCGILB”). Below we show the results of the universe of global inflation-linked bonds²⁴. The sample size of the universe, particularly going back 5+ years, is less than 10, which simply does

²⁴ The Mercer Global Inflations Linked Bonds universe consists of global inflation-linked bonds composites. The products offer inflation protection because bonds' yields are tied to inflation rate. The returns are gross of fees. The returns are highly correlated with Bloomberg Barclays Global Inflation-Linked Index.

not present a meaningful enough sample to compare and/or draw any conclusions from. The information ratio for the median manager has been 0.28 and 0.44 for the 5 and 10 year periods, respectively. Given the significant cost advantage afforded in the management of this exposure currently along with the objective of this allocation, the current management of this exposure is very efficient.

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16

Comparison with the Global Inflation-Linked Bonds universe (Percentile Ranking)



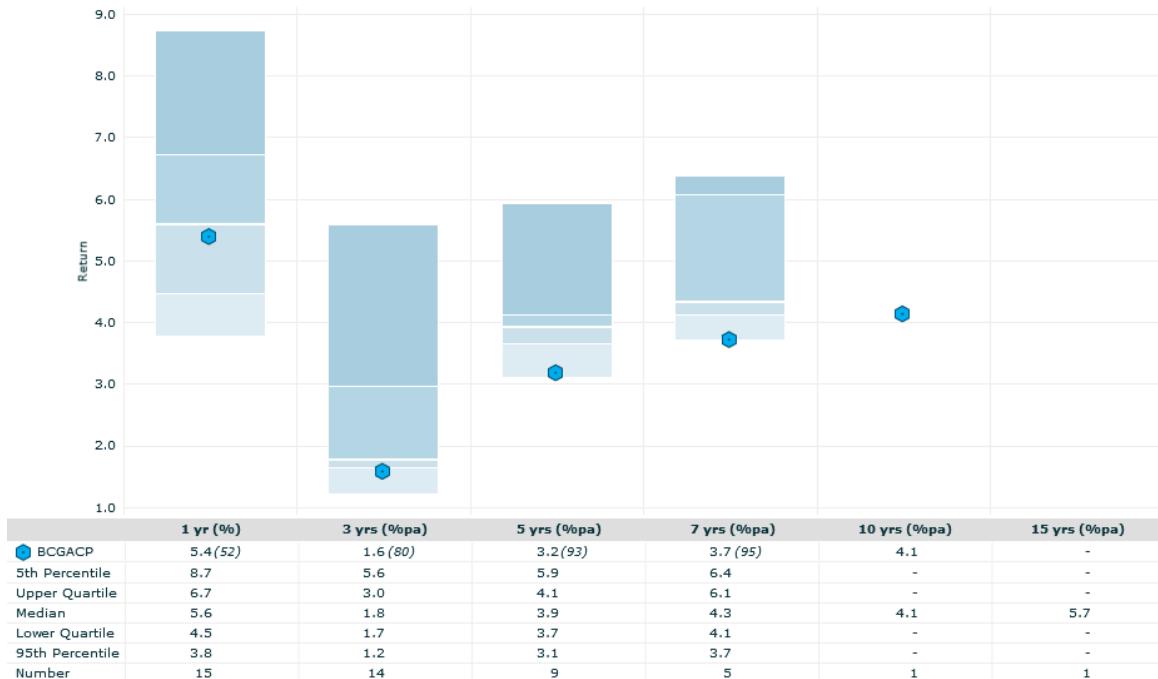
This Mercer universe is less than 15 years old, so no data populates for the 15 year universe period; however, the Bloomberg Barclays Global Inflation Linked Bond Index has return history of greater than 15 years, so its return is populated.

7.3.2.3 Investment Grade Corporates

The Investment Grade Corporates exposure is managed by two external managers-Blackrock and Rogge Global Partners. It is passively managed and meant to track the Bloomberg Barclays Global Aggregate Corporate Bond Index Unhedged (“BCGACP”). We show trailing performance of the global credit universe²⁵ below:

²⁵ The Mercer Global Credit universe consists of global credit composites. The returns are gross of fees. The returns are highly correlated with Bloomberg Barclays Global Aggregate Credit Index.

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16
Comparison with the Global Credit Unhedged universe (Percentile Ranking)



The low number of strategies represented in this universe presents similar challenges as those with the inflation-linked universe, namely the low sample size challenges making any definitive conclusions about the value of active versus passive management. The average fee for an active global credit manager is 26 basis points²⁶ and if we apply this to the median return for the 3 years in the chart above, the excess return from active median management would have been 0.00%. There certainly does not appear to be a strong case for considering active management, at least not at this point, for this asset class.

7.4 Additional Asset Classes

The additional asset classes being considered are Agency Residential MBS and Global High Yield. While we have also analyzed the possible inclusion of exposures to Infrastructure and Real Estate, we have included exposures to Real Estate in some of our recommendations in Section 6.4.

7.4.1 Agency Residential MBS

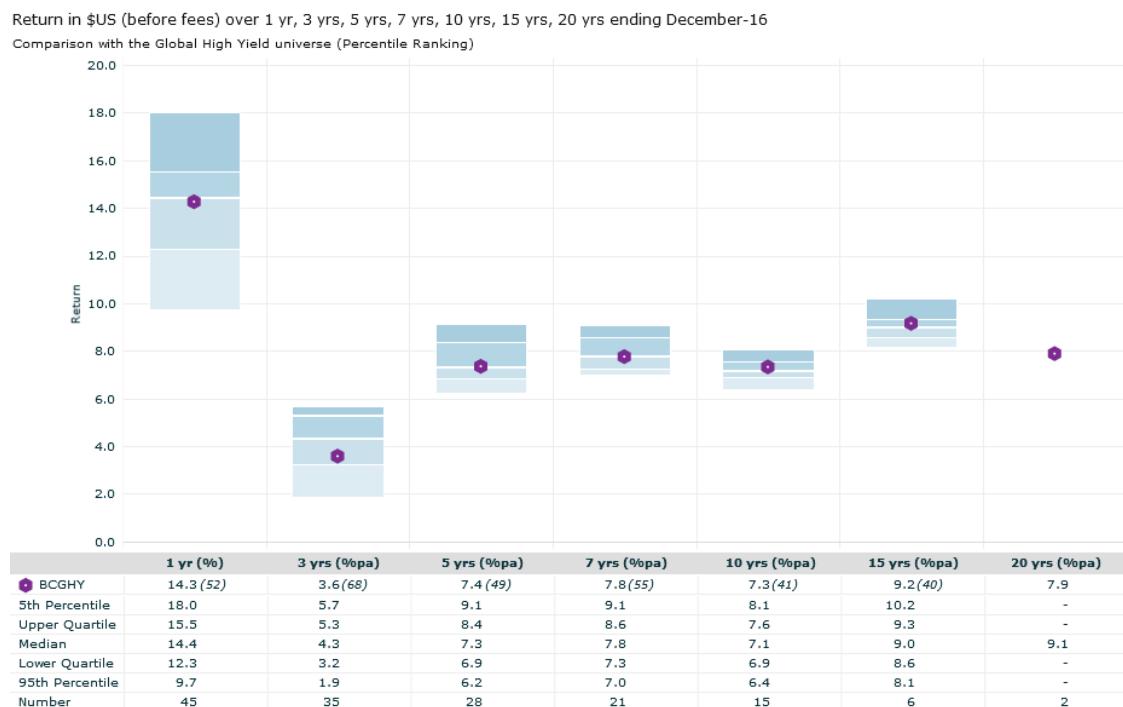
While a manager could be sought to manage this exposure on an active or passive mandate, it is not very common to have this type of mandate managed on a stand-alone basis. This mandate would be more efficiently managed as part of an overall passive or active mandate as part of an aggregate/multiverse mandate, while restricting to the maximum allowed based on the investment allocation ultimately selected. Alternatively, this mandate could be managed against the Bloomberg Barclays U.S. MBS Index. If managed passively, this exposure could be

²⁶ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

managed by one investment manager. If actively managed, potentially two complementary managers could be considered.

7.4.2 Global High Yield

As mentioned earlier, global high yield is one asset class within the fixed income universe that is not currently represented in the PRF portfolio. The chart below shows performance for trailing periods of the Bloomberg Barclays Global High Yield Index ("BCGHY") in the global high yield universe²⁷. As with other asset classes, the high yield market has grown substantially over the past 20 years, and is now a more common part of general investor portfolios.



Looking at fees in the high yield sector, a typical active management fee is 44 basis points²⁸. The tables below present performance results considering the typical fees paid for active management.

²⁷ The Mercer Global High Yield universe consists of bond strategies whose average quality is less than or equal to a Ba1/BB+ rating. The returns are gross of fees. Additionally, the returns are most highly correlated to a high yield fixed income index such as the Merrill Lynch Global High Yield Index or the Bloomberg Barclays Global High Yield Index.

²⁸ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
Global High Yield Index	14.27%	3.60%	7.37%	7.78%	7.35%	9.18%	7.90%
Median Manager	14.44%	4.33%	7.31%	7.81%	7.15%	9.03%	9.14%
Median Manager (Net)	14.00%	3.89%	6.87%	7.37%	6.71%	8.59%	8.70%
'Winner'	Index	Manager	Index	Index	Index	Index	Manager
Magnitude	0.28%	0.29%	0.50%	0.41%	0.64%	0.59%	0.80%

In general, the results of these charts show the value of indexing in this universe. The IR for the median manager in this universe also supports the use of indexing, with values of -0.03 and 0.01 over the 5- and 7-year periods, respectively. However, this sector can still be highly cyclical, and the market is less efficient than larger sectors (for example, government bonds). These factors could provide potential opportunities for skilled investors - although the historical evidence is not that compelling.

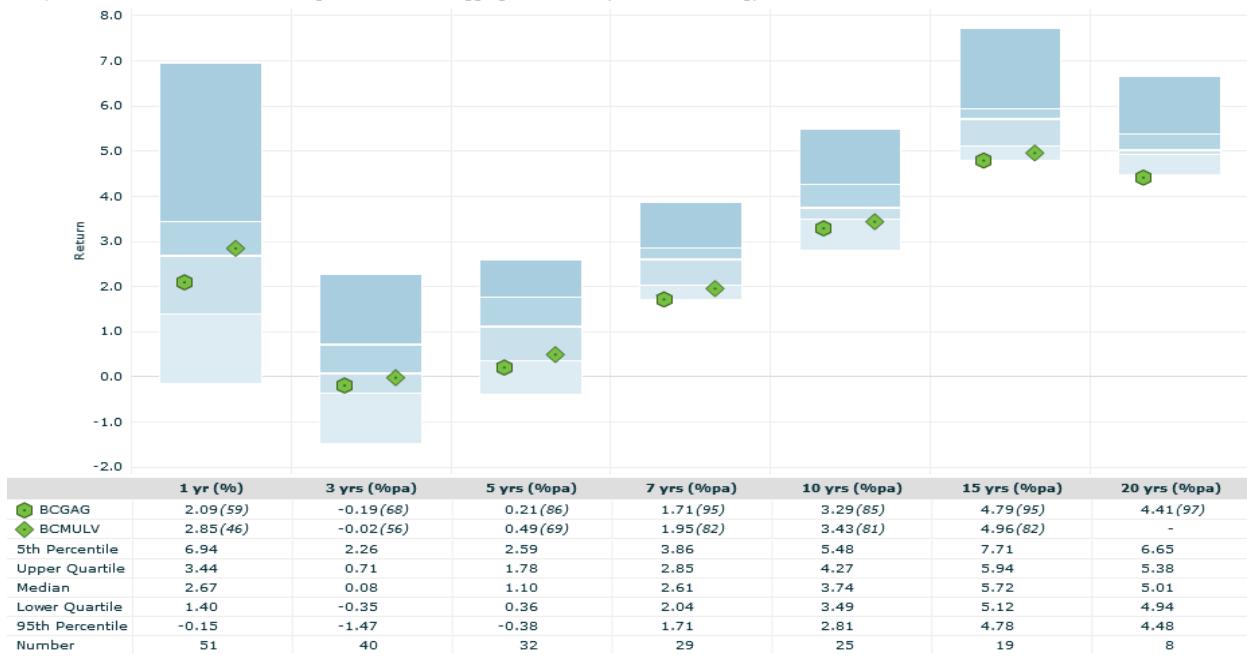
7.4.3 Global Aggregate/Multiverse Mandate

In the event that the PRF adds these new asset classes to the overall fixed income portfolio, it would make sense to consider these as part of a broad global fixed income mandate that would encompass the majority of the sectors and exposures of the Bloomberg Barclays Multiverse Index, which includes the current asset classes in the portfolio (Sovereigns and Corporates) and also the new asset classes under consideration (High Yield and Securitized-Mortgages). The asset class not included is Inflation-Linked, but this asset class could continue to be managed as stand-alone exposure.

Below we show the performance for global fixed income mandates within a broad global fixed income universe²⁹ and compare it against both the Bloomberg Barclays Global Aggregate ("BCGAG") and Multiverse ("BCMULV") Indices:

²⁹ The Mercer Global Fixed Unhedged Broad Market/Aggregate universe consists of global fixed income composites invested in bonds with no permanent regional or country bias. The returns are most highly correlated with an aggregate benchmark such as the Bloomberg Barclays Global Aggregate Index and are gross of fees.

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16
 Comparison with the Global Fixed Unhedged Broad Market/Aggregate universe (Percentile Ranking)



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While 20 years ago this universe was not too robust in terms of observations (8), since then the number of strategies has grown significantly and offers enough of a sample to make potential conclusions meaningful. Focusing our analysis against a Multiverse mandate, since this is what we would be considering given the potential addition of the new asset classes, and considering the typical fee for an active globe fixed income mandate of 27 basis points³⁰ we show the results of the median manager/strategy performance in this universe net of these fees:

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
Multiverse Index	2.85%	-0.02%	0.49%	1.95%	3.43%	4.96%	na
Median Manager	2.67%	0.08%	1.10%	2.61%	3.74%	5.72%	5.01%
Median Manager (Net)	2.40%	-0.19%	0.83%	2.34%	3.47%	5.45%	na
'Winner'	Index	Index	Manager	Manager	Manager	Manager	na
Magnitude	0.45%	0.17%	0.34%	0.39%	0.03%	0.49%	na

The information ratios for the median manager performance are shown below on a trailing period:

³⁰ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

Information Ratio for median manager:	1 yr (%)	3 yrs (%pa)	5 yrs (%pa)	7 yrs (%pa)	10 yrs (%pa)	15 yrs (%pa)
Barclays Global Multiverse Index	-0.09	0.07	0.37	0.38	0.25	0.41

As can be appreciated from the trailing performance chart, the median manager/strategy has added value against the benchmark for all trailing periods except 1 and 3 years. In addition, when looking at the consistency of this performance, via the information ratio, these results do appear to have been consistent.

While a global fixed income mandate against the Bloomberg Barclays Multiverse Index can be accomplished via a passive approach, and basically extending the current mandates of sovereigns and corporates, active management approaches could potentially be considered as part of this overall exposure. Given the extreme volatility that fixed income markets have experienced over the last couple of years, together with the ability of managers/strategies to position their portfolios using the full spectrum of sectors in the benchmark (via over-weights/under-weights/duration and maturity positioning/etc.) active managers have been able to outperform the benchmark consistently.

It is to be recognized, however, that moving to an active mandate for all of the mandates in the fixed income portfolio, would encompass the Banco Central de Chile managing less of the assets of this portfolio, which would increase the total fees paid for the management of this portfolio. In addition, there would need to be additional resources, effort and an increased governance oversight to establish the goals, objectives and monitoring that an active mandate(s) would encompass. The PRF must weigh the additional resources and expense in light of these additional requirements. A potential change to an active mandate would also have to extend the period of evaluation for this mandate, as there are periods when active management will underperform and the PRF must be able to explain and bear shorter-term underperformance in order to give active strategies the opportunity to outperform over the longer-term. If the PRF decided to use active management for a mandate against the Bloomberg Barclays Multiverse Index, given the significant allocation this would represent and not wanting to be subject to firm-specific risk in terms of style and performance, the mandate should be split amongst at least 3-4 managers/strategies. If the asset allocation ultimately selected does not include high yield, then the mandate could be managed against the Bloomberg Barclays Aggregate Index (while restricting the MBS allocation to the allocation selected for this asset class).

Below we show a chart showing the rolling 3 year performance of the median active manager/strategy noting the periods when it out- and under-performs:

Rolling 3 yr Excess Return vs. Universe Median in \$US (before fees) over 15 yrs and 1 mth ending December-16
Comparison with the Global Fixed Unhedged Broad Market/Aggregate universe



7.4.4 Core Real Estate

Our assumptions for the unlisted core real estate asset class reflect a globally diversified exposure. We have also assumed a core approach to investing, which is consistent with the approaches that we see from institutional investors in relation to their initial investments in these asset classes. That is, the focus is on the stable cashflows, with some potential inflation adjustments with a relatively lower risk approach as compared to other approaches which bring more risk and complexity.

We envisage that any investment for the PRF in core real estate would be more fund structures rather than direct investment in buildings. In the case of real estate, these funds could be through either open-ended and/or closed-ended fund structures³¹.

We consider that the implementation of any exposure to core real estate would be undertaken through one of the following approaches:

- The MoF conducts its own due diligence on the funds of interest, selects them and manages the cash flow requirements associated with capital calls for the funds and redemptions themselves
- The MoF delegates the due diligence and selection process to an advisor, who also manages the cash flow requirements on behalf of the MoF. This is similar to a segregated

³¹ Closed-ended funds typically specify a life to the fund, which may be extended at the discretion of the general partner (or fund manager) or with the limited partners' consent. Open-ended funds require a capital contribution upon admission to the fund, while closed-ended funds require a capital commitment, which is subsequently drawn upon over time as the general partner makes investments. Open-ended funds use the capital and make and rebalance investments on an on-going basis, while closed-ended funds have a limited period of time to make new investments. The managers of open-ended funds can

- mandate for public market asset classes in that the investor can determine the guidelines and restrictions applicable to the investments and potentially can enable the MoF to be involved in the decision-making to the extent they want to be.
- The MoF invests in a fund-of-fund in which case the MoF would have no influence over the underlying funds selected by the fund-of-fund manager

Given the private nature of the asset class, it will take time for the PRF to build up any exposure – for example, in the case of closed-end funds, it will be dependent on suitable funds being open for new capital. That is, the fund manager when they launch a fund, seeks to gain commitments from investors to invest in the fund. In this respect, it is necessary to make a commitment to invest into the fund, but the timing of the actual calls for such commitments by the manager is unknown as these will generally only be called when the manager is seeking to make investments. As such, it is impractical to achieve the target allocation and most investors tend to be under-allocated to the asset class or else over-commit in the understanding that not all commitments will be called at the same time. The need to ensure that sufficient liquid assets are available to meet such unknown capital calls creates additional administrative issues for investors allocating to the asset class. The use of open-ended funds helps to address some of these issues.

Given the unlisted nature of this asset class, finding an appropriate benchmark can be challenging. We observe investment managers in this space benchmarking performance against the FTSE EPRA/NAREIT Developed Index and/or the FTSE EPRA/NAREIT Global Index, for example. These could be considered as a starting point but the final benchmark would be determined based on the managers and specific strategies selected.

7.5 Conclusion

The current allocation to global equities, via an indexed approach of the ACWI benchmark, offers the appropriate exposure to the asset class in an extremely cost-effective manner. The recent return experience of active managers does not appear to be compelling enough to take on the additional oversight, expense and governance that would be required to monitor and evaluate the performance of active strategies. However, we would recommend that the PRF study some of the alternative equity indices that have been launched with the possibility that these could be introduced at a future date to complement the current market-capitalization benchmark. In particular, we think low volatility strategies that provide some “protection” when there is a significant downturn in the equity markets should be considered.

If the PRF considered moving the equity exposure to active management, it would necessitate the acquisition of resources in order to be able to evaluate and monitor the performance and objective of these strategies. These resources could come in the form of a manager database that offers qualitative/quantitative assessments of active managers and strategies, the hiring of an external consultant and/or bringing this specialty “in-house”. Regardless of the approach, this would encompass additional oversight and evaluation above and beyond making sure that the strategies are cost effective and are tracking the different indices, which is closer to the current practice and approach.

In the fixed income space, the PRF should consider expanding the current indexed fixed income mandate of sovereigns and corporates to include agency residential MBS (securitized) and high

yield securities. Since active management in a global fixed income mandate benchmarked against the Bloomberg Barclays Multiverse Index mandate had proven to consistently add value, the PRF should consider adding some element of active management via external manager(s). We recognize that this would encompass additional oversight and cost (and also entail the acquisition of resources described above) and that this might not be a priority to the PRF.

In the inflation-linked space, the current management and exposure being offered by the indexed strategy managed by the Central Bank of Chile should continue as it is an extremely cost effective and representative exposure to the asset class.

8

Implementation Plan

8.1 Introduction

Mercer has been requested to provide an implementation plan to converge from the current asset allocation to the final recommended new strategic asset allocation (SAA) for the PRF.

In Section 6.4, we included 10 possible recommended new SAAs depending on the extent to which hedging the currency exposures of global bond is considered as well as the possible introduction of an exposure to core unlisted real estate. For the purposes of the development of an implementation plan, we have assumed that the PRF adopts our recommendation as outlined in Section 6.4.3 – that is, the recommended allocation if real estate is included, there is a maximum of 30% to equities and global bond exposures are 50% currency hedged. This is shown below.

Asset Class	Current (@31 March 2017)	Recommended SAA
	%	%
Sovereign and government-related bonds (50% hedged)		21
Sovereign and government-related bonds (unhedged)	46	
Inflation-linked sovereign bonds (50% hedged)		30
Inflation-linked sovereign bonds (unhedged)	17	
Investment Grade Corporate bonds (50% hedged)		10
Investment Grade Corporate bonds (unhedged)	20	
Agency Residential MBS (50% hedged)		5
Broad Market Equities	17	29
Core Real Estate		5
Total	100	100

As such, the transition plan shown below is an example of how the implementation could be for one specific recommendation (of all the alternatives being discussed).

8.2 Transition Plan

In general, we would recommend that the transition from the current asset allocation to the adopted new SAA should be gradual to minimize any impacts associated with the actual timing of movements in asset allocations. For example, if the increased equity allocation were implemented in one stage just before a market decline, then the increased allocation might be occurring at a market high and therefore have a negative impact on longer-term returns. Market

timing is a different strategy to consistently get right and therefore the phased transition seeks to address this issue.

Our recommended approach is for the transition to be gradually implemented over the period to the end of 2020, as shown below – this assumes that the decision to adopt the new SAA is made during the Third Quarter of 2017:

Asset Class	Initial (@31				
	March 2017	By End 2017	By End 2018	By End 2019	By End 2020
	%	%	%	%	%
Sovereign and government-related bonds	46	43	35	29	21
Inflation-linked sovereign bonds	17	19	23	26	30
Investment Grade Corporate bonds	20	19	16	13	10
Agency Residential MBS	0	0	3	4	5
Broad Market Equities	17	19	21	25	29
Core Real Estate	0	0	2	3	5
Total	100	100	100	100	100

The key points in relation to this proposed plan are as follows:

- No allocations to the new asset classes are proposed for the remainder of 2017, which allows the MoF to determine the approach to be adopted for gaining exposure to these asset classes and, if necessary, to amend investment guidelines and to select any new managers or, in the case of core real estate, advisors. For example, in the case of introducing an exposure to Agency Residential MBS, one approach is to just extend the current global corporate bond mandates for BlackRock and Rogge to include MBS – the MoF would need to satisfy itself that the managers have the necessary capabilities. If this approach were adopted, then it would just be necessary to amend the guidelines and to amend the benchmark for the managers to the Bloomberg/Barclays Global Aggregate ex Government Index. Alternatively, it could be decided to appoint a specialist MBS manager for the mandate.
- In the case of core real estate, the transition program is likely to be significantly influenced by the actual opportunities that arise during the transition period.
- After the first year, we have assumed that the transition program for the public market asset classes will be approximately evenly spread.

As indicated above, the transition plan is based on the adoption of the specific recommended SAA proposed in Section 6.4.3. The eventual transition plan would need to reflect the actual SAA that is adopted. In this respect, some of the candidates outlined in Section 6.4 include allocations to global high yield. In this respect, the above approach in the first bullet-point could be extended to include global high yield as well as MBS. That is:

- To further extend the current global corporate bond mandates to not only include MBS but also Global High Yield; or
- To appoint a specialist Global High Yield manager for the mandate.

The above transition plan focuses on the physical assets, but another important aspect of the transition plan will be the move from the global bond assets being managed on an unhedged basis to the 50% hedged basis assumed in the above recommended SAA. As with the transition program for the physical assets, we recommend that the implementation of the revised hedging approach should be done gradually.

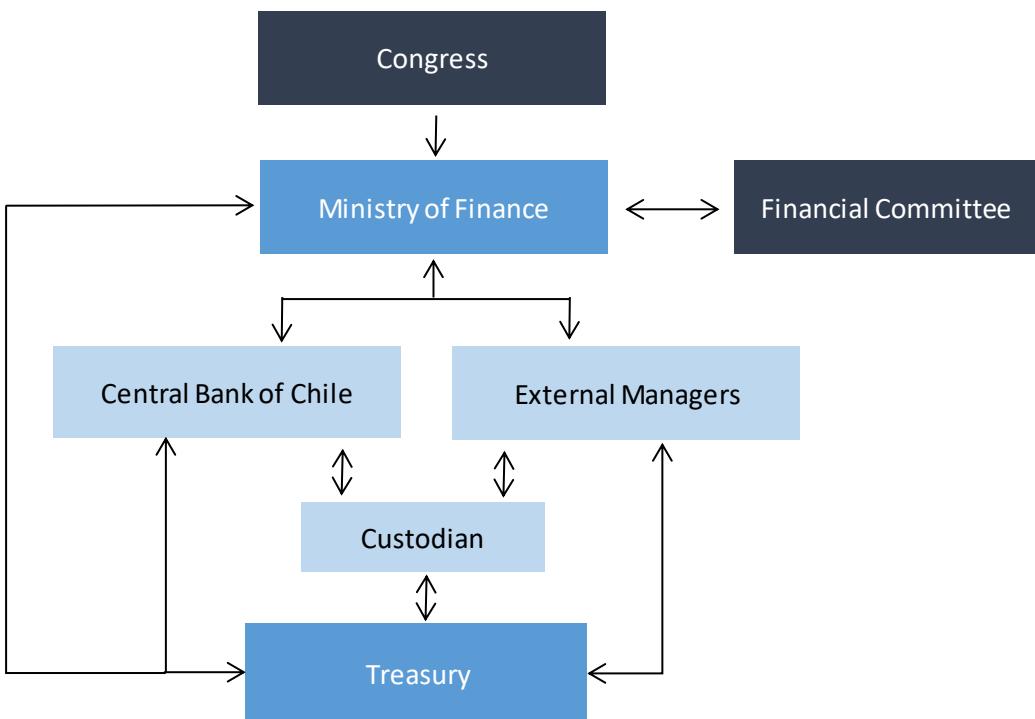
A more important consideration is potentially the manner in which such currency hedging would be implemented. For the externally managed portfolios of BlackRock and Rogge, this could be implemented through changing the guidelines such that their benchmark indices changed to being measured on an unhedged to USD basis to a 50% hedged to CLP basis. However, the sovereign bond and inflation-linked bond exposures are managed by the Central Bank of Chile (“CBC”) and, in our experience, it would be unusual for a central bank to be entering into forward exchange contracts on its own currency.

One possible approach would be for the MoF to look to appoint an external manager to operate a currency overlay, potentially over the entire global bond exposure. This manager could be retained to passively replicate the currency exposures in the benchmarks. If this approach was undertaken, then it would not be necessarily to amend the guidelines for BlackRock or Rogge. The feasibility of this approach should be considered in conjunction with any study on the potential adoption of a fully currency hedged approach to global bonds rather than the 50% hedging we have used as the basis for the above transition plan.

8.3 Organizational Framework

Mercer has also been asked for our opinion about how the MoF should be organized for the new investment policy and how the new investment policy should be monitored and evaluated, and how often the investment policy should be reviewed.

Our understanding at present is the organization framework for the management of the PRF is as follows:



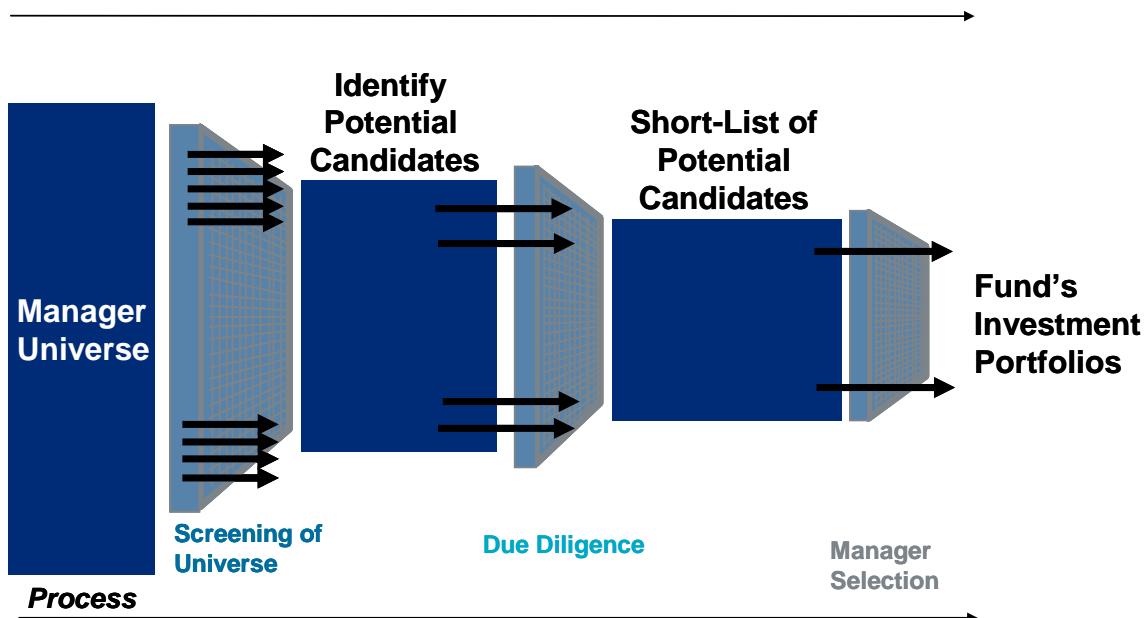
Within MoF, there is a Sovereign Wealth Funds Unit (“SWF Unit”) that oversees the MoF’s involvement in the management of the Funds. This unit is responsible for monitoring the performance of the fund managers, acting as Technical Secretary to the Financial Committee and preparing the periodic reports on the SWFs.

The appointment of external managers, together with the contracting and performance monitoring, was initially the responsibility of the CBC but since January 2014, the contractual and monitoring responsibilities have passed to the MoF. However, we understand that, at the request of the MoF, the CBC is still responsible for carrying out tenders for the appointment of external managers. In addition, the CBC can potentially contract external managers to manage part of its portfolio, in which case the CBC would be responsible for supervision and monitoring.

8.3.1 *External Manager Selection*

Given the potential increase in the number of externally managed mandates that could result from the implementation of any new investment policy, we recommend that consideration be given to the responsibility for the appointment of external managers moving from the CBC to the SWF Unit within the MoF. The Unit would need to develop the necessary expertise and the approach to be pursued for evaluation of new candidates.

The following graphic describes the general process that institutional investors follow in relation to the selection of external investment managers.



In general, we consider there are three distinct stages to the process:

- From the manager universe, establishing an initial long-list of potential candidates
- Reducing the initial long-list to a short-list of the strongest candidates
- Establishing which of the short-list candidates are the most appropriate to be appointed for the required mandate

These stages are discussed below.

Establishing Initial Long List

The size of the initial long list will, to a large extent, be dependent on how many managers the investor is eventually seeking to appoint for the particular selection exercise. For example, if the investor was seeking to eventually appoint 2 to 3 managers, then the initial long list might comprise 10 to 12 names.

There are three broad approaches that institutional investors utilize in establishing the initial long list. These are: i) to directly utilize an investment consultant; ii) to indirectly utilize an investment consultant through subscribing to their database and iii) to gather information themselves.

Directly Utilize an Investment Consultant

Under this approach, the investor engages an investment consultant. The investment consultant will then seek to understand the key requirements of the investor and then uses these as a filter to produce a long list from the consultant's most highly rated managers for the particular selection exercise that the investor is undertaking. For example, in these circumstances Mercer would tend to provide, in addition to the list, copies of our manager

profiles which summarize our assessment of the managers so that the investor has an initial understanding of the reasons for our rating of the managers.

Some investors will continue to engage the consultant to provide assistance throughout the entire selection exercise. However, others will just use the information provided by the consultant as a starting point and would then proceed to issue a Request for Proposal ("RFP") or Request for Information ("RFI") to the managers on the long-list.

Indirectly Utilize an Investment Consultant

Under this approach, the investor will be subscribing to the consultant's database³² and will conduct their own screening from that database. This would generally be used to supplement any pre-existing knowledge that the investor has on the potential candidates – for example, such knowledge may have been gathered from the visits that managers may have made in the past.

Having identified the initial long-list, the investor would then proceed to issue a RFP/RFI as above.

Gather Information Themselves

Under this approach, the investor would typically issue a preliminary RFI. For example, many government institutions might do this via an open tender on their website. As part of this exercise, they might specify various qualifying criteria that managers would need to meet. For example, this might include:

- Length of period that the manager has been in existence
- Minimum/maximum assets under management in aggregate and/or the particular strategy
- Length of track record in the particular strategy

The investor would then conduct a preliminary assessment of the responses. This would ensure that the respondents meet the required criteria, but would also include an assessment of the potentially strongest responses. This assessment would tend to encompass some analysis of the performance track records, but should also include an overview of the firm's investment process and capabilities.

Having identified the initial long-list, the investor would then proceed to issue a RFP/RFI as above.

Reducing the Long List to a Short List

Again, the size of the short list will, to a large extent, be dependent on how many managers the investor is eventually seeking to appoint for the particular selection exercise. For example, if the investor was seeking to eventually appoint 2 to 3 managers, then the initial long list of 10 to 12 names might be reduced to a short list of 4 to 6 managers.

³² For example, Mercer has a database – our Global Investment Manager Database ("GIMD"). There are more than 130 large institutional investors around the world that subscribe to GIMD for assistance in their selection and monitoring of external fund managers.

Where the investor has engaged a consultant to assist throughout the entire selection process, the consultant would actively work with the investor to derive the short list. Indeed, in some instances, the selection process might not involve any assessment of an initial long list and would just go straight to the establishment of the short list.

In those instances where a consultant is not engaged throughout the entire selection process, the investor will conduct its own review of the proposals it has received. This process could involve some preliminary due diligence beyond the proposals, perhaps via conference calls. These calls may be to either address issues that may not have been clear from the proposals or to look to gain greater insights on the capabilities of managers than can be gained from reviewing the proposals.

Final Selection

There are two broad approaches that institutional investors utilize in making the final selection of the most appropriate candidate(s). These are: i) to establish a selection committee to evaluate the candidates on the short list and ii) to form a team to conduct detailed due diligence on the candidates on the short list.

Establish a Selection Committee

In some cases, the selection committee might just comprise the investor's Investment Committee. In other instances, a separate committee might be established. In the case of the PRF, this could potentially be the Financial Committee.

The selection committee will conduct interviews of the candidates on the short-list. Generally, a discussion outline is provided to the firms on the short-list to ensure their presentations are focused on the issues of most relevance and importance to the investor. The time allocated to each manager would generally be 60-90 minutes.

The assessment undertaken by the selection committee will generally involve the use of some form of scoring system to turn the qualitative views of the assessment into a quantifiable decision. The actual scoring process will either be:

- Conducted independently by every member of the selection committee and then the results are discussed before a final decision is made
- Conducted via consensus whereby the selection committee agrees on the scores to be given to each candidate against each of the selection criterion

The strongest candidate(s) will then be identified and then, subject to possible ratification by the Investment Committee, are appointed, subject to contract negotiation.

Establish a Due Diligence Team

Under this approach, a team would be established to conduct on-site due diligence on the short-listed firms. This team would comprise relevant individuals with the necessary experience within the investor's organization and might include a representative from any consulting firm that has been involved in the selection process.

The main advantages of this approach, as opposed to that described above, are:

- By being on-site in the manager's offices, the due diligence team will have access to more of the investment team than will be the case when interviews are conducted by a selection committee
- Generally, the due diligence meetings might comprise a half-day at the least and therefore enables a much more thorough assessment of the capabilities of the manager than can be gained in the time that is usually allocated to presentations to a selection committee

The assessment of each candidate would be undertaken in a similar manner to that outlined for the selection committee.

8.3.2 *Review and Monitoring of Investment Policy*

We do not consider the adoption of any new investment policy, such as the indicative SAA used in this section, poses any significant refinements to the current processes used to monitor and evaluate the existing investment policy. The possible exception is the monitoring of any core real estate allocation given the private nature of this asset class.

We recommend that ongoing SAA reviews should be undertaken every three to five years or sooner in the event that there are significant changes to:

- the nature of the liabilities that the PRF exists to meet;
- the basis for which inflows to the PRF is structured; or
- the economic and investment environment such that there are reasonable grounds to assume that the assumptions underpinning the existing investment policy are no longer relevant.

In Section 6.4.3, we have recommended two aspects to the risk tolerance statement for the PRF associated with the recommended SAA used in this section:

"MoF will not tolerate a greater than 40% chance of not achieving returns that are at least 1% per annum above inflation over 10 year time periods"

"MoF will not tolerate a greater than 5% chance of the real return in CLP terms in any one year being below -10%"

The first of these statements is intended to be a longer-term measure and as such is not something that can be monitored on a regular basis. Indeed, once the specific measure and the strategic asset allocation are adopted, it is unlikely that these will be changing in the short-term. Instead, this should be assessed on an ongoing basis as part of subsequent reviews of the strategic asset allocation.

However, the second measure, which is a Value-at-Risk (VaR) measure, can be assessed on an ongoing basis. We note that the current quarterly reports for the PRF include details of the historical standard deviation of the PRF, which is provided by the custodian.

From a risk management perspective, we would propose that the actual estimated VaR be monitored relative to the risk limit to ensure that the risk being experienced is in line with expectations. In the event that the calculated VaR at any point exceeds the target by, for example, more than 2%, then this could be regarded as a trigger to investigate as to whether changes should be made to the asset allocation to bring the calculated VaR back in line with the limit – this would likely be achieved through a reduction in the equity allocation. This should be considered in relation to the MoF's rebalancing policy.

Furthermore, if these figures were to indicate a significant deterioration in the risk levels relative to those of the previous year, then this might also signal a need for a formal review of the strategic asset allocation sooner than the proposed three yearly cycle – this would be similar to the example mentioned above of a significant change in the economic environment.

We would suggest that the VaR calculation be undertaken on a monthly or quarterly basis.

As a general observation, we would comment that ex-ante (or forward looking) approaches for determining VaR are more relevant than ex-post (or backward looking) approaches. That is, since the VaR aims to be an ex-ante limit, it is important that an ex-ante approach is used rather than simply calculating one with reference to historical returns. However, the estimation of ex-ante VaR requires the use of risk models and therefore this introduces “model risk” – that is, the risk that the model will underestimate the actual risk that is being taken. This measure seeks to provide a limit on the total expected downside risk for a particular year. That is, the VaR would be determined at the start of each year based on the investment strategy expected for that year and then compared with the limit, which we have proposed be -10% in the example above.

We would propose that the MoF discuss this issue with the custodian, although any inclusion of private core real estate will complicate the actual calculation of any forward looking VaR since the illiquid nature of the asset class provides challenges for quantitative risk measures.

In the event that the MoF is unable to access the right tools to estimate VaR on a forward-looking basis, we would recommend that the reporting from the custodian be extended to include the historical VaR in addition to the current reporting of the historical standard deviation.

9

ESG Considerations

9.1 Responsible Investment Overview

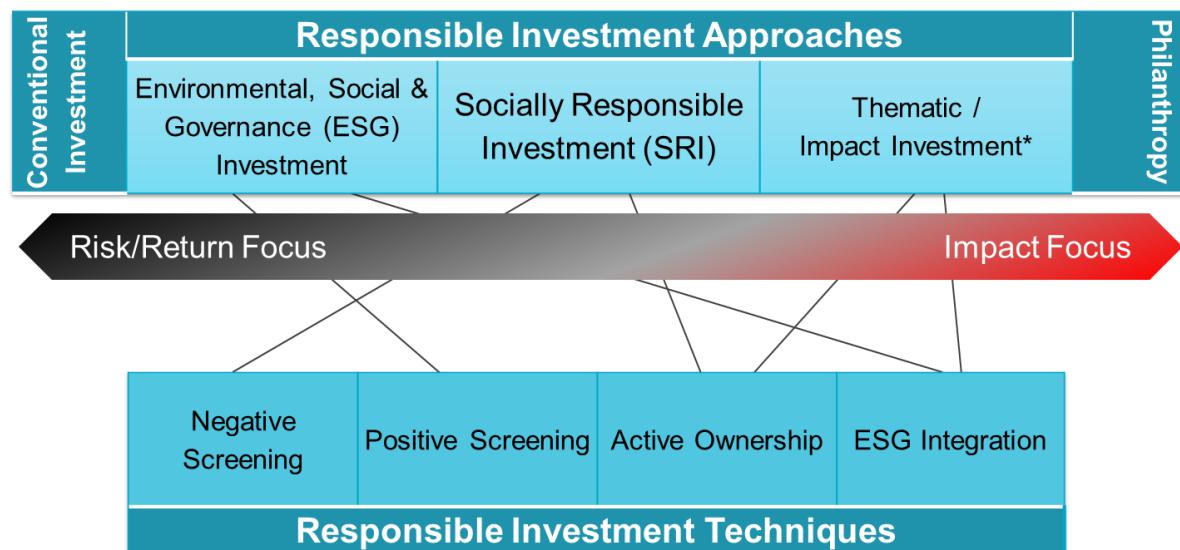
Definitions

The Responsible Investment (RI) landscape today is diverse and complex. It also suffers from some very basic term confusion. This may seem like mere semantics to the uninitiated but it has actually proven detrimental to the overall adoption of responsible investment principles through time.

The roots of the modern RI movement can be traced back to divestment campaigns starting in the 1960s and thereafter focused on eliciting social change through investor action. These campaigns covered issue areas as diverse as apartheid, tobacco and weapons manufacture and their effects can still be felt today with the most recent and prominent such campaign centered around fossil fuels. These efforts spawned a practice in the investment industry which became known as Socially Responsible Investment (SRI) which relies mainly on the exclusion of securities from a portfolio (negative screening) due to ethical ramifications. SRI practitioners have also adopted active ownership practices – e.g. voting proxies and filing resolutions in public equity – centered on trying to shift attitudes/practices at companies to align with best practices around environmental, social and governance (ESG) issue management.

More recently ESG investment has risen to the fore alongside Impact Investment. ESG investment attempts to move beyond negative screening to consider the influence of ESG information on company financial performance – both risk and return. The techniques most often employed by ESG investors include positive screening – including only those companies with the best ESG performance in their eligible universe – or ESG integration – embedding consideration of ESG factors into investment processes. Impact investing essentially concentrates the ESG investment thesis and focuses on generating ESG impact first, usually within a specific industry or region. Historically impact investing has been relegated to private market asset classes though recognition and measurement of ESG impact in public markets is growing. Today in practice many so-called “responsible investors” employ an array of techniques in their investment processes and the lines between SRI, ESG and Impact are increasingly blurred.

Figure 1: Taxonomy of Responsible Investment Approaches and Techniques



* Please note this figure attempts to identify those techniques which are most commonly used by investors practicing each approach but this is meant to be illustrative; the relationship between investment approaches and techniques is not fixed.

Trends and Growth Drivers

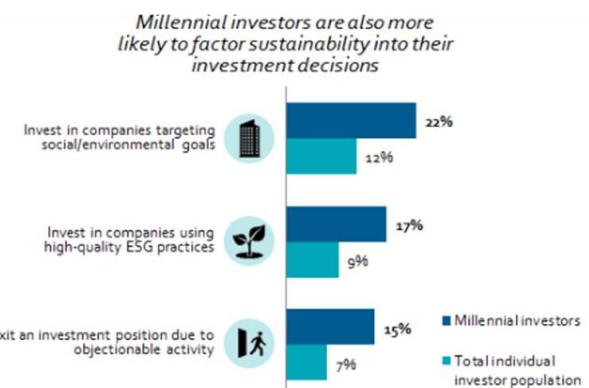
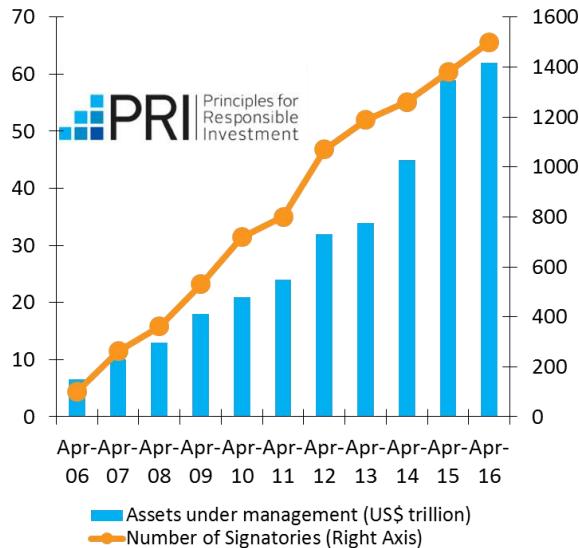
RI is not a passing fad. Today, signatories to the United Nation's Principles of Responsible Investment (PRI) represent over \$60 trillion dollars in assets under management (AUM) and over 30% of global managed assets utilize some form of RI approach or technique³³. Both of these values have been steadily increasing over recent years (see Figure 2).

In signing the PRI (Mercer is a service provider signatory), investors voluntarily commit to a belief that “[ESG] issues can affect the performance of investment portfolios (to varying degrees across companies, sectors, regions, asset classes and through time).” They also agree to six principles underlying this central belief. While these principles are aspirational and not all PRI signatories are created equal, the degree to which the market has publicly signaled its support for this effort is notable.

³³ http://www.gsi-alliance.org/wp-content/uploads/2015/02/GSIA_Review_download.pdf - This report provides one of the most comprehensive global overviews of RI investment activity though excludes Latin America from its purview.

Figure 2: Institutional and Retail Investor Preferences are Changing

INVESTOR PREFERENCE



..and women are almost 2X more likely than men to balance return and impact when making an investment

Signatory base > half of the world's institutional assets

Source: <http://www.unpri.org/whatsnew/signatory-base-aum-hits-59-trillion/>

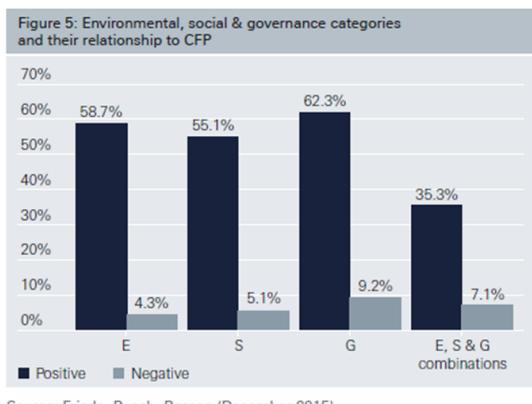
Consumer Attitudes

Source: Morgan Stanley Institute for Sustainable Investing; [Sustainable Signals: The Individual Investor Perspective](#); 2015.

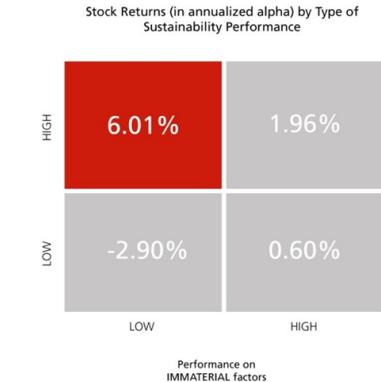
We expect these trends to continue for the foreseeable future. Growth drivers include shifting attitudes amongst younger generations which tend to prefer sustainable brands and stand to gain control of trillions of dollars in wealth over coming decades (Figure 2) and a strengthening case for the linkage between material ESG factors and positive financial performance. On the latter, thousands of primary academic and industry studies have been performed attempting to analyze and understand the linkage between ESG factors and company (or in some cases, bond or fund) financial performance. This large body of research has spawned a series of meta-analyses which overwhelmingly point to a non-negative financial impact.

One recent such analysis found that over 90% of 2000+ primary studies surveyed –considering E, S and G factors separately and ESG together – showed a non-negative impact of ESG on company financial performance (Figure 3, left side). Another recent research effort hints at a whole new body of forthcoming research around the materiality of certain ESG factors to financial performance outcomes (Figure 3, right side). The study highlighted here shows that companies performing best on ESG factors deemed material for their industry sector by the Sustainability Accounting Standards Board, an emerging standard-setter for ESG disclosure and accounting in public markets, outperformed companies with poor performance on those same factors by a convincing margin over the study period. So as ESG data continues to proliferate – covering innumerable metrics and from a growing array of sources – the opportunity to take advantage of information asymmetries and to gain an alpha advantage will grow. However investors will also increasingly be challenged to find relevant signals in the noise.

Figure 3: The Strengthening Performance Case



Research base favors a positive connection between ESG and corporate financial performance



Firms with good performance on material sustainability issues enjoy the strongest financial returns.



Source: Deutsche Asset Management/University of Hamburg; ESG & Corporate Financial Performance: Mapping the Global Landscape; 2015.



Source: Working Paper by Mozaffar Khan, George Serafeim, and Aaron Yoon, Harvard Business School (2015); SASB, 2015-2016

9.2 Responsible Investment in Practice

ESG Governance

There is no precise template for the integration of ESG considerations into institutional investor portfolios. However, over Mercer's decade+ of experience working with and advising clients on ESG related matters, we have developed a [Framework for Sustainable Growth](#) which describes a set of best practices (Appendix Q). This framework categorizes related actions into three buckets – beliefs, process and portfolio – and is presented linearly in Figure 4, though in reality many clients implement their approaches to ESG investing differently and not in the order prescribed here. In general, we expect such efforts to be context dependent and evolutionary in nature rather than revolutionary.

This said, a typical ESG integration process will start with the development of related beliefs. Mercer published its [investment beliefs](#) in 2014 and included in them 5 main pillars, one of which is sustainability (Appendix R). In this section of our beliefs, we articulate a clear appreciation of the potential for ESG factors to improve long-term risk adjusted investment returns and acknowledge the value of active ownership as a means of building and preserving long-term value in line with the following four key points:

1. ESG factors can highlight both investment risks and opportunities.
2. Taking a sustainable investment view is more likely to create and preserve long-term investment capital.
3. Active ownership helps the realization of long-term shareholder value.
4. Accessing long-term streams of returns and long-term themes, rather than focusing on short-term price movements, can add value.

For many organizations, establishing a similar principles-based set of beliefs can be quite useful as a starting point for further action. Some organizations also find it necessary to develop an exclusion list (e.g. ex tobacco or fossil fuels) typically to reflect a set of institutional ethical values. Typically these beliefs are described in relation to how ESG factors influence the “three Rs”: investment **Risk** and **Return** and organizational **Reputation**:

- **Risks:** As a long-term, largely passive investor, it is important for MoF to be an effective steward of entrusted assets. A growing body of literature points to the potential for ESG risks and long-term secular environmental or social trends to cause company/market disruption and erode investor value.
- **Returns:** A growing body of literature points to the potential for material ESG factors to positively impact investment returns in public equity and other asset classes. MoF should determine its conviction in this thesis and, if strong, how then to incorporate such factors into the investment process. Secular environmental or social trends present risks but also opportunities.
- **Reputation:** It is important to protect the reputation of the organisation and that of its stakeholders. Damage to investor reputations can arise from investment exposure to companies that do not practice good governance, engage in fraudulent activity and/or create significant damage to the environment or society.



ESG investment beliefs or exclusionary criteria can both be determined through a workshop (or a series of interventions) which culminates in a directional decision and leads to the formalized documentation of the institutions vies. Such workshops are typically most effective if they build off a solid basis of common understanding amongst the appropriate decision makers. To develop such a basis, group education sessions to describe the current state of practice in the market can be quite useful preceding any such workshop. Additionally some groups find that having conducted assessments of the ESG exposure embedded in the organization’s current portfolio can be helpful to informing conversations around beliefs/exclusions.

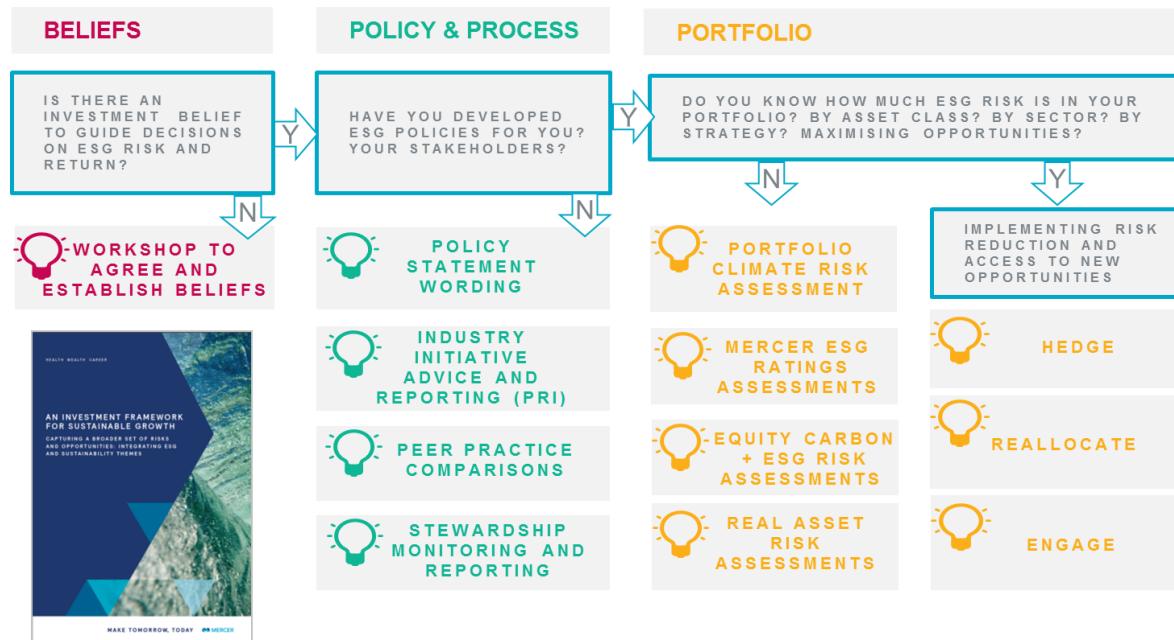
Once ESG-related beliefs have been determined and articulated, the next logical step is to incorporate them into existing investment processes. This first requires a review of the range of potential options for considering ESG factors in investment decisions and for the relevant decision makers to determine a practical path forward. Once the appropriate options have been selected, codifying them in the Investment Policy Statement (IPS) will typically happen next prior to their implementation.

Once beliefs and processes have been covered, it then remains for the organization to determine how it wants to alter its portfolio based on these preceding decisions. For the MoF it can be useful to envision the end state before determining a process for getting there since there are a number of pathways toward ESG integration. To outline this end state we have included below some commentary regarding the potential portfolio actions the MoF could take to implement an ESG program at the total fund and individual asset class levels.

A few notable examples of ESG beliefs statements which other organizations have developed follow:

- PGGM has produced a [responsible investment beliefs document](#) which clearly articulates the organization's rationale for considering ESG factors in its investment:
 - "Responsible investment pays off: we firmly believe that sustainability factors materially influence the risk-return profile of the investments and that this influence will steadily increase in the future.
 - No good and stable return in the long term without sustainable development: We firmly believe that sustainable development is necessary in order to generate stable and good investment returns for our clients in the long term.
 - The driving force of capital: We firmly believe that in addition to providing a stable, good pension for our clients' beneficiaries', we also have to consider how we can make a positive contribution to sustainable development through our investment decisions."
- The Pension Protection Fund (PPF UK) [Statement of Investment Principles](#) says "by acting as a responsible and vigilant asset owner, we can protect and enhance the value of our investments, and environmental, social and governance (ESG) factors can have an impact on the long-term performance of our investments, and the management of ESG risks and exploitation of ESG opportunities can, therefore, add value to our portfolio."
- AXA Group's [responsible investment policy](#) states in part "AXA believes that ESG factors have the potential over time to impact investment portfolios across companies, sectors, regions and asset classes."
- CalPERS developed a set of [institutional investment beliefs](#) which incorporate consideration of ESG factors (in particular, Investment Belief 4: Long-term value creation requires effective management of three forms of capital: financial, physical and human).
- bclMC has articulated its responsible investment beliefs as part of a larger [responsible investment policy document](#) and a related [fact sheet](#). Specifically they state "we believe companies that take (ESG) matters into account have less investment risk and generate better long-term value than do companies with less robust practices."

Figure 4: Mercer's Framework for Sustainable Growth – Sample Decision Process



ESG Portfolio Implementation

Total Fund/Top Down

The primary decision which most institutional investors make relates to asset allocation. Incorporating ESG factors into asset allocation modeling – typically the primary input to such a decision – can be challenging since standardized frameworks for the consideration of ESG factors in models typically grounded in the central tenants of Modern Portfolio Theory (MPT) do not exist, creating “model risk”. To address potential gaps in quantitative risk assessment methods we recommend organizations take a [Broader Perspective on Risk](#) by adding a qualitative dimension to their process for considering large scale, difficult to model risks (Appendix S). These quantitative risks can be added to existing risk dashboards or treated separately and rated/ranked based on the size of their perceived risk and related opportunity set. See

Figure 5 and 6 for reference.

In addition to taking a high-level view of such risks, some methods of quantifying ESG risks/opportunities do exist at the asset allocation level. For instance we've developed a unique method of quantitatively assessing the risk of climate change in an asset allocation context. Mercer's proprietary risk modeling framework is described in detail in our [Investing in a Time of Climate Change](#) report which was sponsored by investors representing \$1.5 trillion of assets under management (Appendix T). Related outputs can inform a variety of potential asset allocation or cross asset class adjustments including: considering environmentally-themed or high quality ESG strategies in various asset classes; hedging climate change transition or physical risk across the portfolio; developing a company and policy-maker engagement strategy, etc.

These portfolio actions will have varying effects on risk/return expectations/outcomes, though generally speaking incorporating ESG into a portfolio allocation will require MoF to make an “active” investment decision which amounts to a bet on the ability of ESG quality securities to increase the long-term risk-adjusted value of the MoF’s fund. The size of this bet can be scaled up or down depending on MoF’s appetite for variance (e.g. in terms of Tracking Error) from its current passive, typically market-cap-weighted positions. This being said, other process-oriented decisions (e.g. adding ESG as a factor in passive manager selection criteria) would involve less of a departure from MoF’s current practices and may be more tolerable short term.

These total fund actions aside, the approach to addressing ESG in individual asset classes varies given the inherent differences across financial markets (e.g. public vs. private; debt vs. equity), investment approaches (e.g. passive vs. active; quantitative vs. fundamental; region; style), the available product landscape and common practice. The following sub-sections discuss specific actions the MoF could take in its various asset class buckets both current and as recommended by Mercer in its First Report dated 12/12/16.

Figure 5: Adding a Qualitative Dimension to Portfolio Risk Assessment

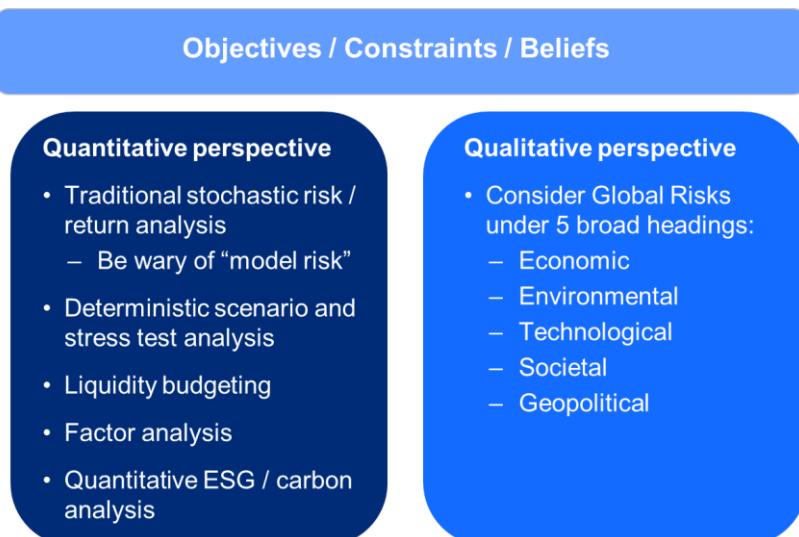


Figure 6: Example Framework for Qualitative Consideration or Large Scale Environmental Risks

Risk Factor	Possible impact	Time Horizon	Risk Mitigants	Opportunity Capture
Failure of climate change adaptation	<ul style="list-style-type: none"> Stranded asset risks See Mercer's Investing in a Time of Climate Change study – wide range of impacts depending on climate change scenario 	<ul style="list-style-type: none"> While a transition to a low-carbon economy is arguably underway, the potential for assets to become stranded is dependent on political will and the pace of technology change both of which take place over uncertain time frames. 	<ul style="list-style-type: none"> ESG aware / sustainability-themed strategies Structural biases away from areas expected to be most affected 	<ul style="list-style-type: none"> Private markets capture of opportunities (renewables, low carbon technologies) Long/short strategies that consider this theme (which could apply below also)
Extreme weather / natural catastrophes	<ul style="list-style-type: none"> Impact on agriculture Destruction of physical assets 	<ul style="list-style-type: none"> Already of concern in certain high risk areas (e.g. coasts). Expected to worsen significantly after 2050 if climate change continues unabated. 	<ul style="list-style-type: none"> ESG aware / sustainability-themed strategies Undertake "portfolio look-through" to assess environmental risk of real asset holdings 	<ul style="list-style-type: none"> Insurance-linked securities strategies might offer short-term opportunities due to capital scarcity after a disaster. But may also be exposed to structural under-provisioning against extreme weather risk longer term.
Resource scarcity	<ul style="list-style-type: none"> Water crisis Food / commodity price spikes 	<ul style="list-style-type: none"> Already of concern in certain high risk areas (e.g. coasts). Expected to worsen significantly after 2050 if climate change continues unabated. 	<ul style="list-style-type: none"> Assess water risk in existing holdings Thematic equity Insurance 	<ul style="list-style-type: none"> Infrastructure, natural resources and agriculture may offer select opportunities. Inflation hedges
High Risk / Low Opp.				Low Risk / High Opp.

*Color coding of chart above provided for illustrative purposes; this would ultimately need to be determined by MoF.

Public Equity

Since equity only represents 15% of the PRF's strategic allocation (and 100% of this allocation is passive) placing the majority of focus on this asset class for ESG assessment may seem counterintuitive. However, the field of responsible investment is most advanced in the public equity asset class where ESG data availability is most robust and communication channels between shareholders and company management are reasonably well established. By virtue of these market realities and because many investors have large equity exposures, this asset class typically receives the most attention when an organization has adopted an ESG investment program.

For PRF, placing large emphasis on equity in the development of a RI program may seem out of step with the organization's exposure. However focusing on this asset class makes more sense in consideration of the following:

- PRF may wish to increase its allocation to equity in line with Mercer's broader recommendations as part of this report.
- Equity, though currently a small allocation, accounts for a large share of the organization's overall investment risk pie.
- As a passive "universal investor" PRF "owns the market" and so is exposed to systemic risks which it cannot diversify away – this may warrant greater emphasis on engagement with companies and regulators to ensure long-term management of ESG issues which could adversely impact the market (e.g. climate change).
- Other majority fixed income investors (e.g. PPF and AXA) have developed responsible investment programs which apply across asset classes.

For instance, as many as 149 different organizations³⁴ have developed some form of ESG data which can be used to assess the ESG quality of individual companies and portfolios thereof. This data is typically tailored toward equity analysts looking to understand the potential impact of ESG factors on company cash flows. This data has also been used to underpin a vast and growing array of ESG-enhanced indices, which seek to capture alpha or reduce risk by tilting typical market-capitalization-weighted passive exposures toward ESG quality stocks. MSCI, FTSE Russell and S&P Dow Jones all offer various ESG index products along with a number of boutiques.

Deciding to shift a passive equity allocation to an **ESG-tilted allocation** does entail an active management decision which many passive investors like the MoF struggle with. However, many ESG indices are constructed to maintain broad market exposure and minimize tracking error versus a "traditional" parent index which may make them a more palatable option. If such an active decision is not palatable, for passive investors there is really no other viable means by which to express an ESG thesis in the portfolio except through **active ownership**.

Active ownership involves two central activities – the voting of proxies and engagement with company management around issues deemed by the investor to be integral to the maintenance of long-term shareholder value. Many of the most controversial proxy voting resolutions relate to progressive environmental, social or governance matters. While the MoF outsources its equity investment to asset managers, there are nevertheless ways in which it can influence voting and engagement activities through its manager selection and monitoring processes.

Passive Manager Selection

For instance, passive managers typically compete on price and their operational strength. However, one often overlooked distinction between passive managers is their proxy voting and engagement approaches and record. Managers tend to vote very differently when it comes to controversial topics like climate change³⁵ and so endeavoring to understand how well a

³⁴ http://ratesustainability.org/hub/index.php/search/report_in_graph accessed 1/13/17.

³⁵ https://www.ceres.org/press/mutual-funds-chart-larger-size-jpg/image_view_fullscreen

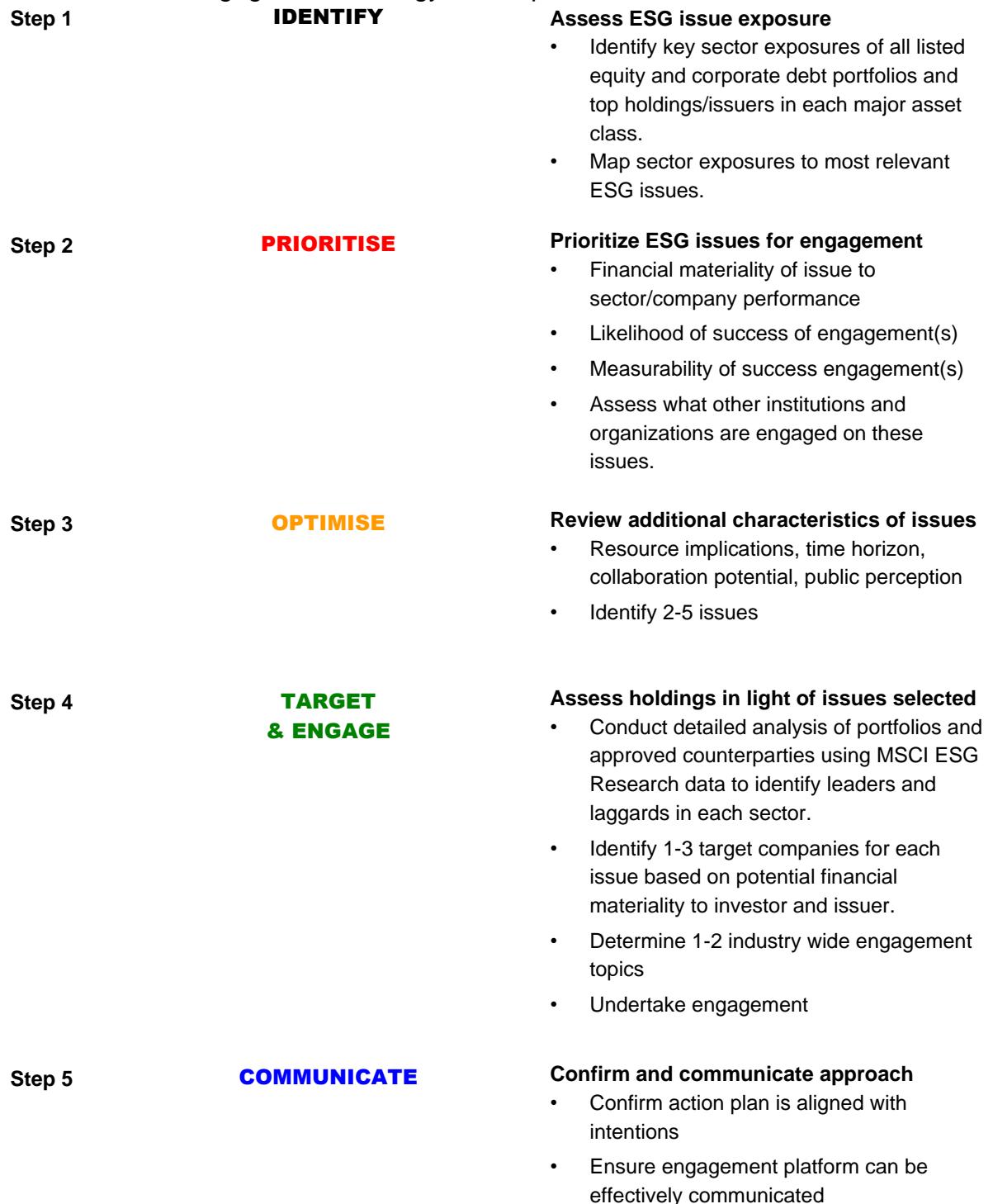
manager's active ownership philosophy aligns with the philosophy of the MoF is of value. Of course, in order to make these determinations the MoF would first need to decide what it believes with respect to ESG issues and which manager's voting/engagement guidelines/records best reflect these beliefs.

In order to make determinations regarding the quality of passive manager approaches to active ownership, several firms have developed proprietary ESG ratings which assess how well investment managers undertake their active ownership activities such as voting, engagement, industry collaboration and reporting. As an example, our [ESGp](#) ratings are tailored for passive managers. We use a four-factor framework that focuses on four key aspects of responsible investment within a passive context, including: voting and engagement process, implementation and resources, ESG integration and internal initiatives (focus on ESG initiatives within the business), and industry collaboration/firm-wide activities. Mercer uses a four-point scale with ESGp1 signifying leaders and ESGp4 signifying laggards.

For investors in commingled products, voting and engagement activities are delegated to fund managers by default. However for large investors like MoF with SMAs, bespoke proxy voting and engagement guidelines can be applied and MoF can maintain control of its votes. Voting and engagement activity can be managed by in-house corporate governance staff or by any number of outsourced voting and engagement service providers such as ISS and Glass Lewis.

Mercer has helped clients to select these service providers by running a formal search/RFP exercise. We have also helped clients to develop proxy voting and engagement guidelines. Voting guideline development typically requires a survey of existing academic and industry research on controversial E, S or G topics and a related discussion amongst decision makers. These guidelines can be very broad or highly detailed (see NYC Comptroller's [guidelines](#) for instance) depending on the circumstances. For engagement strategy development, since resource constraints will typically govern the number and depth of possible engagements, a process for exposure/materiality assessment is necessary to prioritize engagement efforts. These exercises typically follow a process similar to the one outlined in the next figure.

Figure 7: Potential Engagement Strategy Development Process

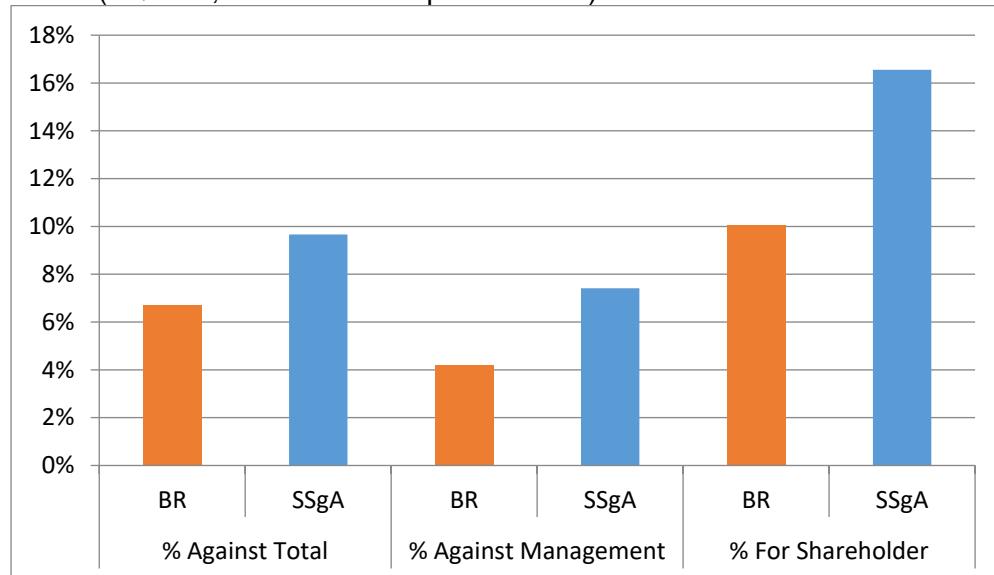


Passive Manager Monitoring

If MoF would prefer to delegate voting and engagement authority to its investment managers, their voting and engagement activity should be monitored to ensure it aligns with initial expectations and the manager's guidelines/positions on controversial topics in particular. To

achieve this vote, data can be requested directly from managers and/or compiled from a variety of third party sources (e.g. Broadridge; ProxyInsight) usually for a fee. Mercer recently conducted a passive manager review for a client which looked at the voting records of BlackRock and State Street Global Advisors in the second quarter of 2016 in non-US developed markets. One of the things we found is, even though the two managers vote for 90%+ of all manager resolutions, their positions differed somewhat dramatically when voting against management or for shareholder proposals.

Figure 8: Votes against Management and For Shareholder Proposals – BlackRock and State Street (2Q2016; non-US Developed Markets)



Using ESG ratings like those offered by Mercer or deeper assessments of manager proxy voting/engagement activity presents a means by which MoF could integrate ESG considerations into its public equity manager selection and monitoring practices without changing existing asset class/style allocations.

Fixed Income

Since this allocation is passively managed as a fixed income investor, focusing an on ESG investment program on this asset class would make sense. However, the ability for passive fixed income investors to address ESG factors in their portfolios is rather limited. First of all, the right to vote proxies and signal a preferred position to company management on a given ESG resolution does not exist for creditors. Moreover, while the wealth of ESG data mentioned in the Public Equity section above may be applicable to corporate bond portfolios, few ESG data providers have succeeded in mapping their issuer-level information to fixed income issuances and comparatively little relevant ESG data exists for non-corporate debt issuers like sovereign or municipal entities and securitizations.

That said, the ability to tilt for ESG quality in passive fixed income portfolios still exists and the evidence base for the potential value added from ESG in fixed income is growing³⁶. In this

³⁶ For example see: <http://www.breckinridge.com/insights/whitepapers/esg-integration-in-corporate-esg/> / http://www.sustainalytics.com/sites/default/files/ri_insight_fixed_income_2014.pdf / <https://www.environmental->

context, the same issue described above for passive investors applies – tilting toward ESG represents something of an active management decision – but the merits of the ESG thesis can be sufficiently compelling to make this sort of decision palatable.

Creditors still also maintain the right (albeit implicit) to engage with issuer counterparts and to advocate for progress on ESG matters. While engagement of this nature is not often utilized by fixed income investors, the potential to do so in a more concerted fashion certainly exists and a growing fringe of investors are putting this practice into use.

Private Markets

ESG investing in private markets is still very much an evolving field. Data on the ESG credentials of private assets is typically non-existent, opaque or irrelevant making arms-length assessments of the ESG merits of investing in this market difficult³⁷. For this reason, and others relating to the structural characteristics of private market investing, most activity in this market segment is either impact-oriented or thematic in nature.

For instance, in Private Equity and Private Debt many “impact-first” investment funds have launched in recent years, most targeting market rate returns. These funds will typically focus on investing in companies looking to capitalize on sustainability trends and/or operating in environmental/social markets. Tesla is a common example of a PE-funded company with a sustainability orientation that has scaled operations taking advantage of new technology, evolving consumer preferences and changing demographics.

Many of these private impact investment vehicles are small and have a (hyper)regional focus and thus may not be appropriate for some institutional portfolios. A subset of larger, more tenured and more diversified funds have garnered some noticeable attention from institutional investors. Historically private impact investment funds have been managed mainly by boutique impact-focused managers though large private equity players like [Bain](#) and [TPG](#) have recently entered the fray speaking to the “mainstreaming” of these concepts.

In Private Real Assets (taken here to include Real Estate, Infrastructure, Agriculture and Timber) opportunities for allocating to sustainable assets are increasing. For instance, in the Real Estate market a growing portion of new builds are seeking LEED certification and/or to align with GRESB criteria. In infrastructure the focus on sustainability of assets in the energy and transportation sectors in particular has resulted in a proliferation of industry initiatives in an attempt to funnel more sustainability-oriented capital into emerging markets where many believe the fight against climate change will be won or lost. For more on sustainable infrastructure in emerging markets including Latin America see Mercer’s recent [report](#) on the subject produced in conjunction with IDB (Appendix U).

To the extent MoF determines to expand its investment program to include exposure to private markets integrating ESG considerations into manager selection and monitoring processes is a relatively low-cost and simple means of achieving this end. Focusing all or a portion of its private

finance.com/assets/files/WP10011.pdf / <http://www.globalevolution.com/artikel/bridging-esg-with-returns-in-frontier-markets.aspx>

³⁷ Mercer’s ESG ratings are an exception to this rule. While most ESG ratings exist for companies/funds trading in public markets, Mercer’s qualitative ratings extend to private market funds as well.

market allocation on environmental or social impact funds/sustainable real assets might also make sense. However, such a decision should be made with a strong foundation of understanding and agreement within the organization about the merits of responsible investment and the potential influence of ESG factors or sustainability themes on risk/return outcomes.

9.3 Conclusion

While the performance case described above is compelling it is by no means definitive and may not be as strong as, say, the performance case behind diversification, small cap, value or other relatively well-understood investment value drivers. This is in part due to the relatively short history of ESG data presently available, though it can also be ascribed to the characteristics of ESG risks many of which have no historical precedent, are expected to unfold over the long term and are systemic in nature (e.g. climate change). All this makes back-testing a challenge and underscores the need for conviction in the prospective ESG thesis in order for an investor to adopt ESG investment practices.

Keeping this in mind, there are varying steps the MoF can take to integrate ESG into its investment processes which do not necessarily entail a drastic shift in portfolio strategy or specific allocations. Specifically, we would suggest the following potential actions as next steps:

1. **Determine the organization's responsible investment beliefs.** To develop these beliefs an educational program to bring relevant decision-makers (e.g. board or committee members) up to speed on the current state of industry practice is suggested. Once a basis of common understanding has been established, beliefs can be drafted and agreed either via a workshop or remotely in consultation with an advisor or as part of a staff-driven exercise (for ultimate board approval). To inform the development of these beliefs, additional information that should be gathered includes:
 - a. **Active ownership assessment.** Analyze the organization's investment managers for their approach to proxy voting and engagement. Mercer's ESG research could be helpful in this regard (we have provided a sample in the Appendix V).
 - b. **ESG peer review.** Assess how other organizations similar to MoF have addressed ESG factors in their investment programs. Mercer could simply add an ESG dimension to the peer review featured previously in this report.
2. **Signal the organization's responsible investment beliefs.** Publishing the agreed beliefs externally achieves this objective. To the extent these beliefs align with the UN Principles of Responsible Investment (PRI), signing up to the PRI may also make sense. This involves a nominal membership fee and an annual reporting requirement though the benefits include access to member events/resources and a venue to learn from other like-minded institutions. Third-party resources can be sought to comply with PRI reporting requirements as needed.
3. **Update Investment Policy Statement (IPS) to reflect ESG considerations.** Once the beliefs have been solidified, MoF can update its IPS to reflect these beliefs. These updates should initially outline general process improvements (consideration of ESG factors or active ownership principles in manager selection and monitoring activities; adding ESG-related benchmarks to monitoring reviews; etc.) and be principles based

rather than overly prescriptive. To comply with any IPS updates made the need for MoF to invest further in ESG data or advice should be considered.

After completing these three steps MoF will be well-positioned amongst its peers and to navigate the evolving ESG investment landscape. These updates will also position MoF well to consider later on the potential evolution of its current entirely passive portfolio to tilt towards ESG or allocate to sustainability.

APPENDIX A

Scope of Project and Timeline

Annex A

MERCER shall provide to FISCO, the following Services:

- i. **Experience of other Pension Reserve Funds:** Analyze the experience of other international pension reserve funds regarding their investment policies. This analysis must compare main elements of those policies, such as, investment objectives, investment horizon, asset classes, type of management (passive/active), type of benchmarks utilized, among others.
- ii. **Investment objectives:** Analyze alternatives for defining the investment objectives of the Pension Reserve Fund (PRF).
- iii. **Theoretical Framework:** Describe the theoretical framework that will be used: (i) to forecast the expected returns, volatility and correlations between the different asset classes and other variables in the long-term; (ii) to model future contributions and liabilities of the fund; (iii) to obtain the Strategic Asset Allocation (SAA) using mean-variance and/or surplus optimization; and (iv) to simulate using Monte Carlo for multi-asset returns.
- iv. **Strategic Asset Allocation:** Recommend different SAA for the PRF for different risk tolerances taking into account investment horizon and restrictions set by the Ministry of Finance (MoF). Evaluate the optimality of the existing SAA of the PRF by assessing its position relative to the efficient frontier.
- v. **Simulations, Back Testing, and Stress Testing:** Simulate using Monte Carlo the behavior of the SAA recommended by the Consultant. Asses its historical behavior and stress test using historical and forward-looking scenarios.
- vi. **Portfolio Construction:** Recommend, following best practices, the best approach to construct and implement the SAA. This includes timeframe required to converge to the new SAA, number of managers by asset class, use of core/satellites managers, passive/enhanced/active, what type of active, if any (quantitative, fundamental, smart beta, minimum volatility, etc.). The Consultant must provide strong evidence to support the use of active management within an asset class in the fund. The Consultant shall also analyze how ESG considerations could be integrated in the portfolio recommended.
- vii. **Investment Policy Statement (IPS):** Provide an IPS which is consistent with the Consultant's recommendations and must be prepared according to best practice for institutional investors.
- viii. **Asset Allocation Model:** Develop a model that must be delivered to the MoF that will be used to carry out the activities iii, iv, v, and vi. The model must be flexible

enough to incorporate new asset classes and new parameters such as expected returns, volatility, correlations, and different investment horizons. The Consultant must deliver a user manual for the model.

- ix. **Training:** The Consultant must train the MoF staff on the theoretical framework used for the model and the use of the model itself. Please consider one week in Santiago, Chile for this purpose.

Annex B

The work program and timetable are the following:

Deliverable	Description	Deadline
1. Draft First Report	It must include activities i), ii) and iii).	4 weeks after signing the Agreement.
2. First Report	It must include comments submitted by MoF to the Draft First Report. ³⁸	5.5 weeks after signing the Agreement.
3. First Presentation to Financial Committee (FC)	Presentation of First Report to the FC in Santiago, Chile.	6 weeks after signing the Agreement.
4. Draft Second Report	It must include First Report incorporating feedback received during First Presentation to FC and activities iv), v), vi), and vii).	12 weeks after signing the Agreement.
5. Second Report	It must include comments submitted by MoF. ³⁹	14 weeks after signing the Agreement.
6. Second Presentation to FC	Presentation of Second Report to the FC in Santiago, Chile.	15 weeks after signing the Agreement.
7. Draft Final Report	It must include Second Report incorporating feedback received during Second Presentation to FC.	19 weeks after signing the Agreement.
8. Final Report	It must include comments submitted by MoF. ⁴⁰	21 weeks after signing the Agreement.
9. Final Presentation to FC	Presentation of Final Report to the FC in Santiago, Chile.	22 weeks after signing the Agreement.
10. Model and Training	Activities viii) and ix).	26 weeks after signing the Agreement.

³⁸ MoF will have four days to submit comments to the Draft First Report.

³⁹ MoF will have 1 week to submit comments to the Draft Second Report.

⁴⁰ MoF will have 1 week to submit comments to the Draft Final Report.

APPENDIX B

Detailed Discussion of Each Fund

Australia Future Fund

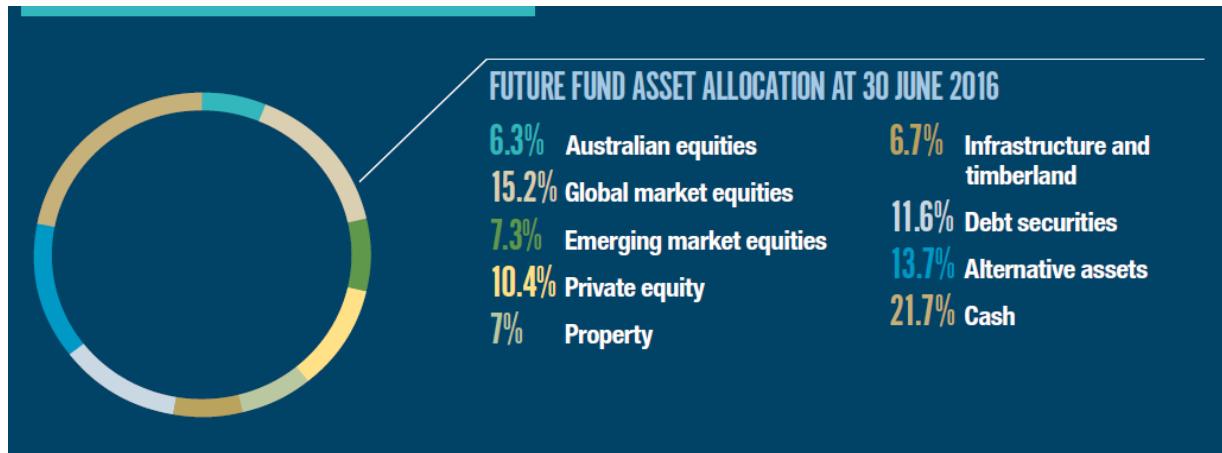
The Australia Future Fund is a sovereign wealth fund established in 2006. It is an independently managed fund that will be used to meet the government's future pension liabilities. Investment of the fund is the responsibility of the Future Fund board of guardians. Their investment aim is to continuously integrate a top-down outlook on the global economy and markets with the opportunities and risks that are identified from the bottom up so that the best total portfolio for each mandate can be built. This approach results in dynamic management and allocation of risk, while targeting the best opportunities for the entire portfolio regardless of sector.

Responsible Investment:	Yes
Domestic Investment:	6.3%
Use of External Managers:	The legislation requires external investment managers to execute investment strategies and work closely with internal managers to ensure they are aligned to strategy and to identify the best opportunities around the globe.
Passive vs Active Mandates:	Both, no explicit numbers.
Liquidity Needs:	From 2020 the government is able to start withdrawals from the fund. Drawing down on the assets has investment implications, both in terms of the level of illiquidity that can be accepted and the returns that can be achieved in a progressively smaller and more liquid portfolio.
Investment Objectives:	Allow the Australian Government to save today to meet the costs of tomorrow by targeting an annual return of the Consumer Price Index plus 4.5%-5.5%.
Investment Horizon:	Long term; entering new phase starting in 2020 when withdrawals start, are reviewing investment policy and asset allocation to account for this.
Cashflows:	Contributions and earnings, but no withdrawals so far. The Future Fund has now been in existence for 10 years. It has had no capital injection since 2008. The Fund has doubled the investment that originated it. From 2020 the Future Fund moves into a new phase because from that year the government is able to start withdrawals. These annual withdrawals are limited to the value of the unfunded superannuation liability payments falling due in the year in question. The Board is engaging with the responsible Ministers to maintain a clear and shared understanding of these issues. This will ensure that the Investment Mandate properly reflects the government's risk and return expectations, the prevailing investment environment and the longer-term ability of the Future Fund to help ease pressure on the budget.

Type of benchmarks used	The Fund's Investment Mandate is to achieve an average annual return of at least the Consumer Price Index plus 4.5%-5.5% per annum over the long term, with an acceptable but not excessive level of risk.
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The asset allocation of the Future Fund over the last two quarters is shown below.

Future Fund asset allocation at 30 September 2016		
Asset class	A\$ million	Percentage of Fund
Australian equities	8,159	6.5%
Global equities		
Developed markets	19,111	15.3%
Emerging markets	9,501	7.6%
Private equity	12,410	10.0%
Property	8,116	6.5%
Infrastructure & Timberland	8,198	6.6%
Debt securities	14,689	11.8%
Alternative assets	16,972	13.6%
Cash	27,494	22.1%
TOTAL	124,650	100.0%

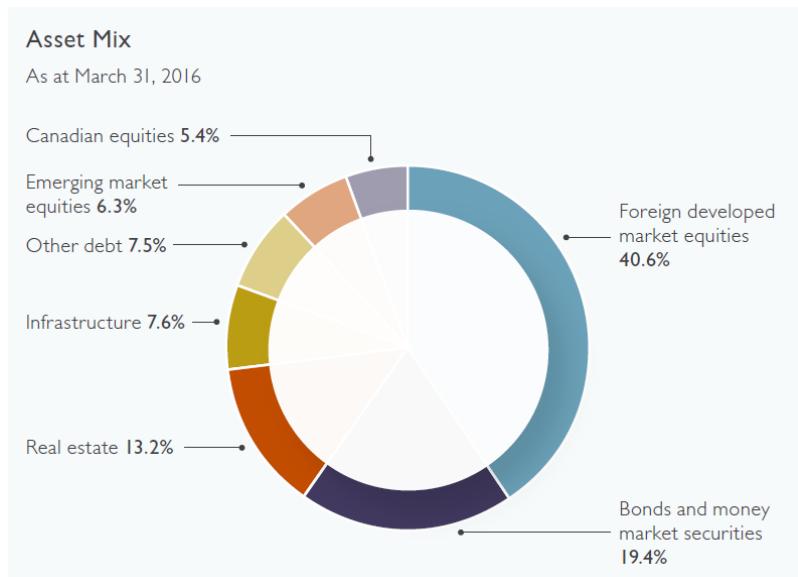


Canada Pension Plan

The Canada Pension Plan is in effect a pension reserve fund established in 1997, although it is generally not regarded as a sovereign wealth fund as it is funded via regular contributions from participants and their employers. The mandate is to maximize investment returns without undue risk of loss by investing in the best interests of the plan beneficiaries and contributors.

Responsible Investment:	Yes
Domestic Investment:	The Investment Portfolio includes 80.9% or \$225.8 billion in non-Canadian investments. The remaining 19.1% or \$53.3 billion is invested in Canada.
Use of External Managers:	External managers are utilized.
Passive vs Active Mandates:	Ten years ago, the investment board made a strategic decision that fundamentally changed how assets are invested and how the organization that manages the assets is run. They moved away from passively managing the CPP Fund's investments to pursue an active management strategy to take advantage of the comparative advantages of scale, certainty of assets and long-term investment horizon.
Liquidity Needs:	Portions of the portfolio are illiquid recognizing the long time horizon for investment.
Investment Objectives:	To maximize returns without undue risk of loss.
Investment Horizon:	Certainty about the amount of CPP net cash flows from contributions means that the investment strategy can be flexible and take advantage of opportunities in volatile markets and also be a liquidity provider. The exceptionally long investment horizon is viewed by the Fund as an important competitive strength.
Cashflows:	Contributions will exceed benefits paid until 2023 (when investment income will be needed to pay pensions). The Chief Actuary of Canada has projected that CPP contributions will exceed annual benefits paid until 2023, providing seven more years in which excess CPP contributions will be available for investment. Starting in 2023, the CPP is expected to begin using a small portion of CPPIB investment earnings to supplement the contributions that constitute the primary means of funding benefits.
Type of benchmarks used:	A Reference Portfolio comprising public market indices that compare the active management strategy to the simple passive investment alternative that the Fund chose not to pursue a decade ago. The Reference Portfolio has been 65% global equities and 35% global bonds, although it is in the process of being revised to 85% global equities and 15% global bonds. It has been estimated the Fund needs annualized real returns of approximately 4% to stay solvent over time.

The actual asset allocation as of March 31 2016 is shown in the following chart.



Denmark ATP

The Denmark ATP is a national pension fund established in 1964. The asset pool has two main parts: the investment portfolio and the hedging portfolio. The largest portion of the contributions – 80 per cent – is guaranteed and hedged to ensure that ATP is always able to deliver on the pension promises issued to members. The average return promised to members over time, across age groups, is currently 3.8 per cent, although this rate is reviewed every 15 years. The remainder – 20 per cent – is included in the bonus potential and invested broadly in equities, real estate etc. The objective of the investment portfolio is to generate a return that is sufficient to raise the guaranteed pensions and thus preserve the long-term purchasing power of the benefits.

Responsible Investment:

Yes

Domestic Investment:

No definitive numbers, large amount of equity in Danish securities, and some real estate and bonds as well.

Use of External Managers:

Both, no definitive numbers, mostly internal

Passive vs Active Mandates:

No definitive numbers, mostly active

Liquidity Needs:

Large liquidity needs – hedging portfolio

Investment Objectives:	Efficient risk diversification and the appropriate risk level relative to size of assets. Insurance against very negative events. Fund is moving to risk based allocation for 2016 and beyond. We have included more information on this in Appendix N.
Investment Horizon:	Long term, though the Fund is paying out benefits. Benefits have been increased for the last three years.
Cashflows:	Contributions taken in and benefits paid out each year. Contributions from employees (1/3) and employers (2/3). Pension payments have been larger than contributions over the last five years. Investment returns have been positive in all years.
Type of benchmarks used:	Strategic portfolio; Return is also assessed against the Supervisory Board's long-term absolute return objective

Investment portfolio return on Equities

Asset type	Return Portfolio, year-end ¹		
	2015		2014
	DKKm	DKKbn	DKKbn
Listed Danish equities	7,486.1	21.6	17.5
Listed international equities	272.3	18.0	8.0
Private equity	3,646.6	34.9	32.1
Total	11,405.0	74.4	57.5

¹ Reflects the portfolio in terms of exposure.

Investment portfolio return on Inflation

Asset type	Return Portfolio, year-end ¹		
	2015		2014
	DKKm	DKKbn	DKKbn
Real estate	2,798.0	34.6	31.3
Infrastructure etc.	2,683.2	14.6	13.8
Index-linked bonds	1.2	0.7	1.1
Other inflation exposure	(295.0)	5.5	8.7
Hedging strategies	2,294.4	39.4	45.3
Total	7,481.8	94.8	100.2

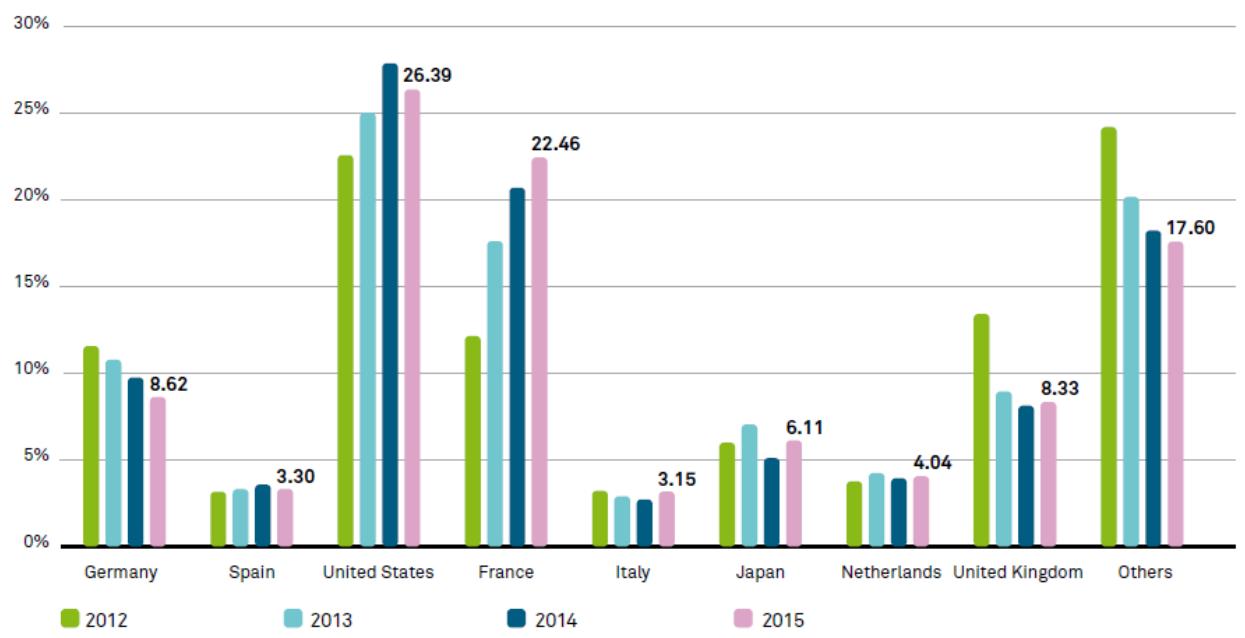
¹ Reflects the portfolio in terms of exposure.

French Pension Reserve Fund – Fonds de Reserve pour les Retraites

The Fonds de Reserve pour les Retraites (FRR) is a pension reserve fund established in 2001 and is generally included within the sovereign wealth fund universe. The FRR must reconcile two investment objectives. The FRR's main objective is to be able to service its liabilities, which consist of annual payments to the Caisse d'Amortissement de la Dette Sociale (CADES), which is a sinking fund established to redeem French social debt, of EUR 2.1 billion until 2024, and a single payment in 2020 to the Caisse Nationale d'Assurance Vieillesse (CNAV1), the national old-age insurance fund, in respect of the Caisse Nationale des Industries Electriques et Gazieres (CNIEG) 2 balance, indexed to the FRR's performance. Under a relatively short liability-based investment model, the ability to comply with this objective can be assessed at any time on the basis of the risk to the surplus.

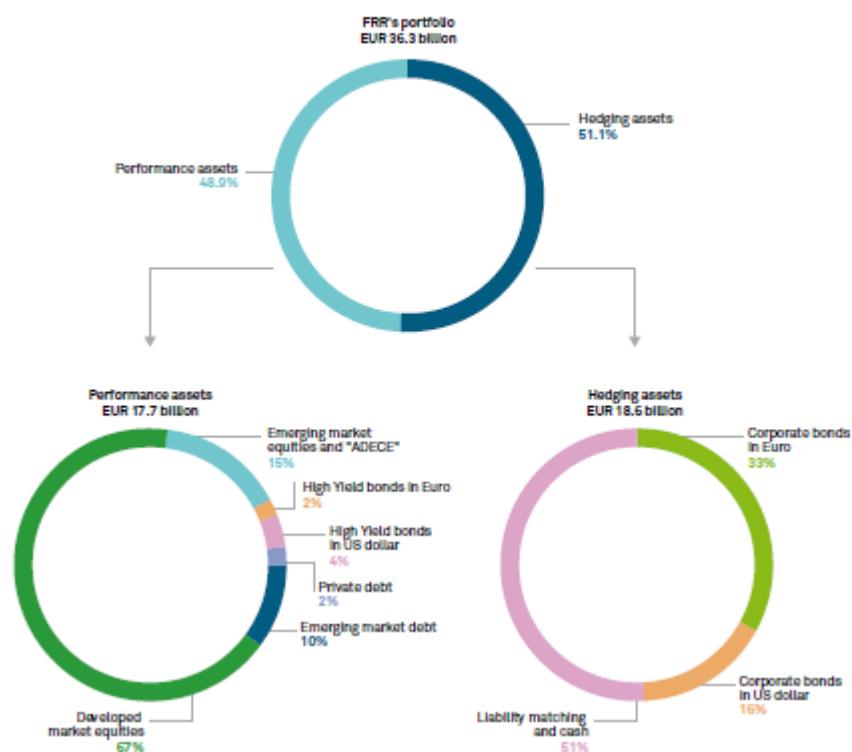
Responsible Investment:	Yes. Decarbonization program.
Domestic Investment:	37%
Use of External Managers:	100%
Passive vs Active Mandates	40% Passive
Liquidity Needs:	Does allow for non-liquid assets in portfolio
Investment Objectives:	Manage sums allocated to build up reserves to help ensure the long-term future of eligible retirement plans.
Investment Horizon:	Compared to previous liability assumptions, the FRR's investment horizon is shorter while remaining sufficiently long term to permit a significant level of exposure to performance assets: up until 2010, the FRR was working on the assumption of 21 payouts between 2020 and 2040. After the reform, the FRR has to pay yearly amounts between 2011 and 2024 (inclusive) and a single payment in 2020.
Cashflows:	Under the terms of the social security financing law of 2011, "the sums allocated to the Fund are held in reserve until 1st January 2011. As from this date and up until 2024, the Fund shall each year, and at the latest by 31 October, pay 2.1 billion euros to the <i>Caisse d'Amortissement de la dette Sociale</i> (national social debt amortization fund) to help finance, between 2011 to 2018" the deficits of the entities that administer the basic old age pension. The text of the law does not specify the CNIEG contribution liability. This will be deemed due in 2020 and the way it is managed may change in the future depending on the further work to be conducted in 2011.
Type of benchmarks used:	Excess of the cost of French public debt.

→ Changes in the geographical breakdown of equity mandates

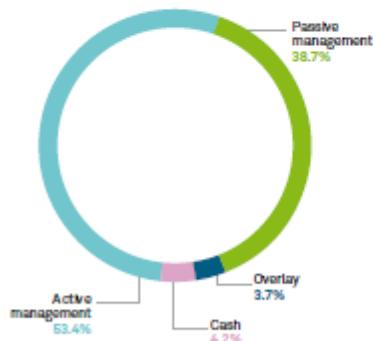


As regards issuers in the hedging component, over 47% of fixed income assets are French government bonds, of which 23% are issued by banks and 30% are corporate bonds.

→ FRR's portfolio at 31/12/2015



→ Breakdown of management types*



→ Breakdown of management types for the base of assets invested in equities (excluding overlay)**



* Corresponding as at 31/12/2015 to EUR 1.3 billion under overlay management, EUR 1.6 billion under current cash management, EUR 14.1 billion under passive management and EUR 19.4 billion under active management.

** Corresponding at 31/12/2015 to EUR 4.9 billion for passive management and EUR 7.2 billion for active management.

Japan Government Pension Investment Fund

The Government Pension Investment Fund is in effect a pension reserve fund established in 1954, although it is generally not regarded as a sovereign wealth fund as it is funded via regular contributions from participants and their employers. Currently, the Fund holds a diversified policy portfolio, to achieve the investment return required for the public pension scheme with minimal risk from a long-term perspective considering that Japan is about to transform itself from an economy of persistent deflation.

Responsible Investment: No

Domestic Investment: 63%

Use of External Managers: Yes, no definitive numbers

Passive vs Active Mandates: Both passive and active investments to attain benchmark returns (i.e., average market returns) set for each asset class.

Liquidity Needs: Nearly all of the assets have liquidity profiles

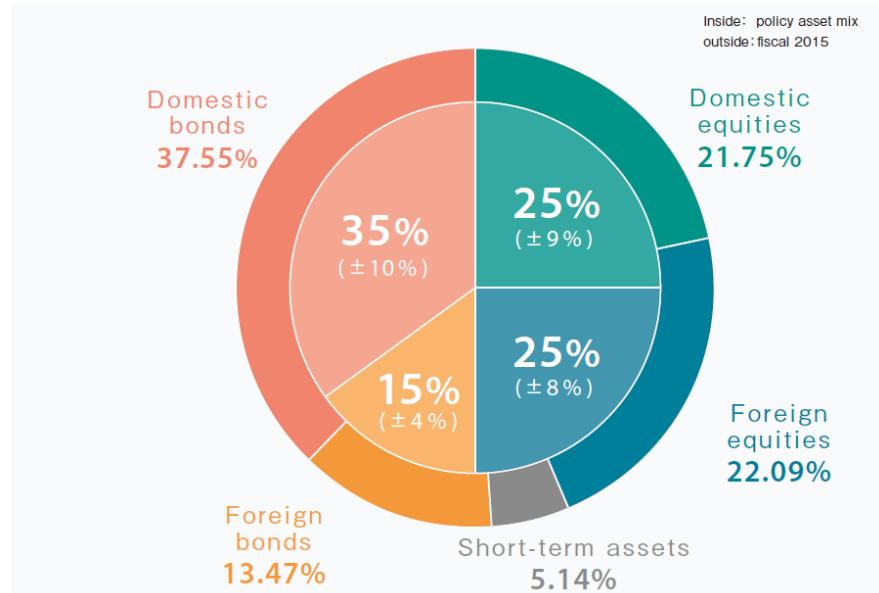
Investment Objectives: The overarching goal is to achieve the investment returns required for the public pension system with minimal risks, solely for the benefit of pension recipients from a long-term perspective, thereby contributing to the stability of the system. The primary investment strategy is diversification by asset class, region, and timeframe. While acknowledging fluctuations of market prices in the short term, the Plan attempts to achieve investment returns in a more stable and efficient manner by taking full advantage of the long-term investment horizon while securing sufficient liquidity to pay pension benefits.

Investment Horizon: Long

Cashflows: Japan's public pension system (Employees' Pension Insurance and National Pension) is fundamentally managed as a pay-as-you-go system that incorporates the concept of intergenerational dependency, whereby contributions paid by working generations support older generations. In the light of a declining birthrate and an aging population, funding pension benefits solely with contributions from working generations would impose upon them an unduly excessive burden, so a fiscal plan has been drawn up to use the reserve assets (GPIF) to fund benefits and achieve fiscal equilibrium within about 100 years. After the fiscal balancing period, the Fund is projected to hold reserve assets equivalent to one year of benefits, and is to be used for the benefit of later generations. The GPIF's mission is to contribute to the stability of the pension system by achieving the investment returns required for the aforementioned pension system. In other words, the most significant risk to the GPIF is a failure to achieve such returns. The goal is to secure the necessary returns required for the pension system from a long-term perspective. The GPIF assigns the highest priority to the benefits of pension recipients and makes investments upon taking into consideration the size of the market in which it invests, while maintaining the value of reserve assets.

Type of benchmarks used: The GPIF's investment target is to secure a long-term real return on investment (return on investment minus rate of increase in nominal wages) of 1.7% with the minimal level of risk, under the Medium-term Plan established by the Minister of Health, Labor and Welfare (MHLW).

⑤ Investment assets and portfolio allocation
(Consolidated with GPIF and the Pension Special Account)



Not captured in the above chart is the fact that GPIF has signaled its intention to start investing in private market asset classes up to a target allocation of 5%.

Korea National Pension Fund

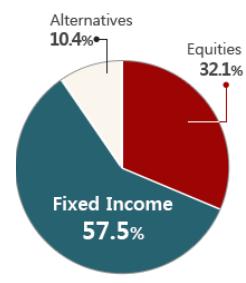
The Korean National Pension Fund is in effect a pension reserve fund established in 1988, although it is generally not regarded as a sovereign wealth fund as it is funded via regular contributions from participants and their employers. The fund's objective is to maximize returns and minimize financial pressure on insured persons, especially the next generation, by following the key principles set out in the investment policy.

Responsible Investment:	No
Domestic Investment:	75.7% of overall portfolio
Use of External Managers:	36.5% of overall portfolio
Passive vs Active Mandates:	Both are used, passive investment mainly in equities
Liquidity Needs:	Allows for limited use of illiquid assets in portfolio
Investment Objectives:	To maximize returns and minimize financial pressure on insured persons, especially the next generation, by following the following Principles: The Principle of stability: To manage the fund within risk tolerance levels while regarding the volatility of gains and losses in invested assets; Principle of public benefit: To accomplish its role in consideration of influence on the nation's economy and financial markets due to its size and its coverage for the whole nation; Principle of liquidity: To secure liquidity for consistent payment of benefits, particularly preemptively to prevent domestic financial markets from being impacted by disposition of invested assets; Principle of independence: To comply with the aforementioned principles which should not be compromised for other purposes.
Investment Horizon:	In pursuing a long term perspective, the asset allocation policy is incorporated into the Mid-term Investment Plan and the Annual Investment Plan. In particular, the Mid-term Investment Plan is outlined as a strategic asset allocation in considering of the Fund's current status and its long-term actuarial assumptions, and the Annual Investment Plan is formulated as a tactical allocation with allowable range to respond to market outlook. By means of the actuarial projection, the Fund's financial soundness and sustainability are assessed every five years by law. Its economic actuarial assumptions, including the long-term expected return and market volatility, are reflected on the strategic asset allocation. The third actuarial report released in 2013 estimated that the fund is projected to grow to a peak of KRW 2,561 trillion by 2043 and run out around 2060.
Cashflows:	Receives contributions and pays out benefits
Type of benchmarks used:	Weighted asset class index (reference portfolio)

The Amount of External Management by Asset Class

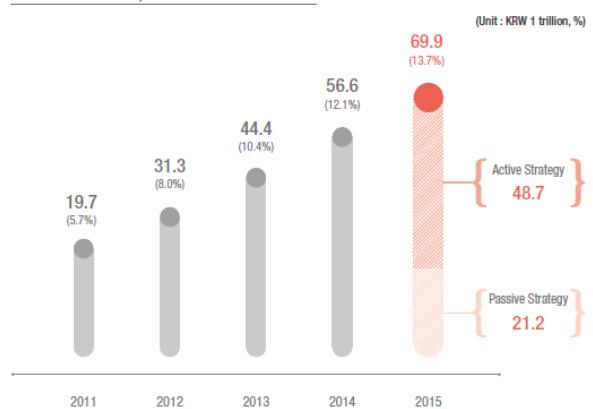
(As of Late 2015, Unit : KRW 1 trillion)

	Total	Equities	Fixed-Income	Alternatives
Total	186.8	95.6	44.4	46.8
Domestic	92.4	45.7	32.2	14.5
Global	94.4	49.9	12.2	32.3



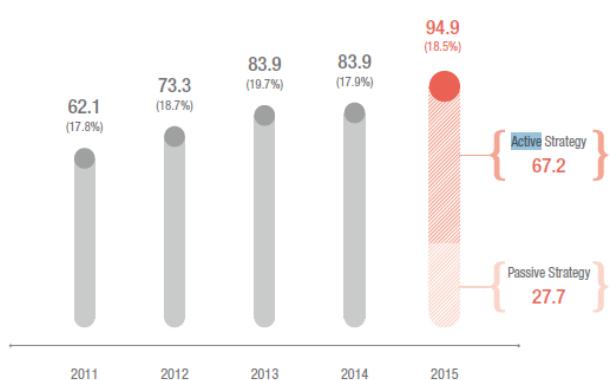
Financial Investments

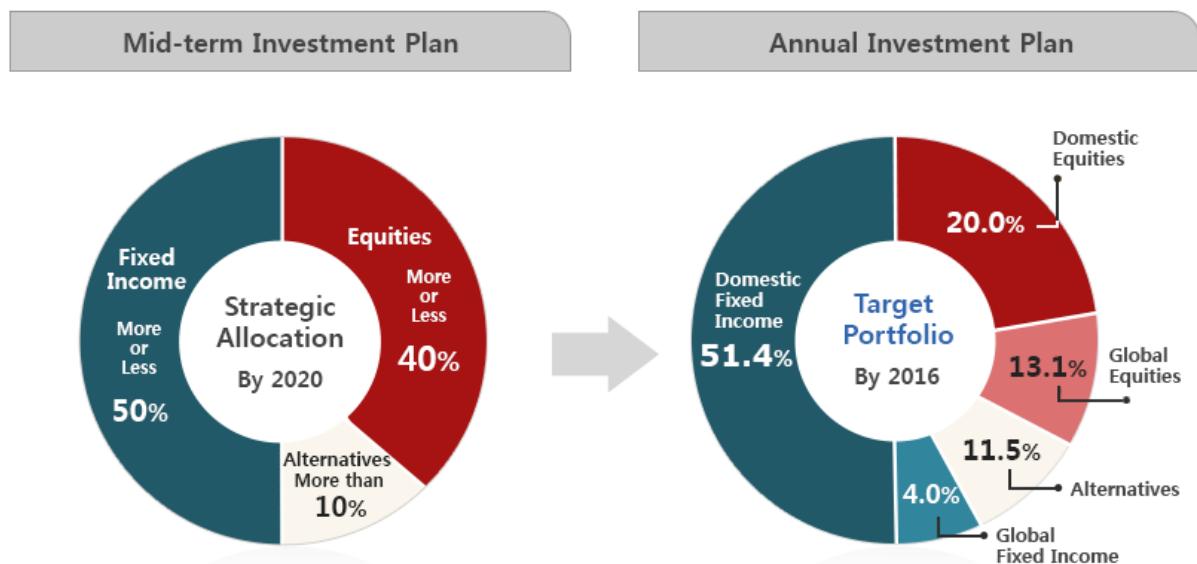
The Ratio of Global Equities Asset in NPF's Portfolio



The Ratio of Domestic Equities Asset in NPF's Portfolio

(Unit : KRW 1 trillion)



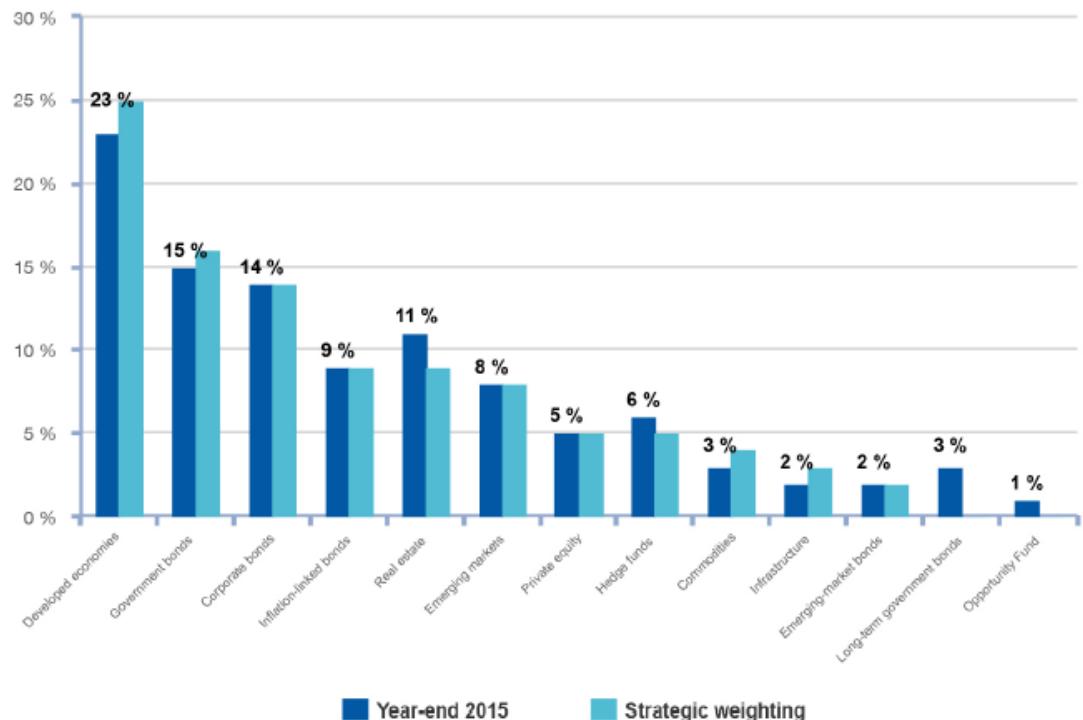


Netherlands Stichting Pensioenfonds ABP

The Netherlands Stichting Pensioenfonds ABP is a government pension fund. For almost 100 years ABP has been the pension fund for people working in the government and education sectors in the Netherlands. The asset allocation is reviewed every three years. Currently, the fund is moving toward long bonds for fixed income and reducing hedge fund exposure. The allocation to alternatives decreased in 2015.

Responsible Investment:	Yes
Domestic Investment:	14%
Use of External Managers:	No definitive percent. Used especially for alternatives.
Passive vs Active Mandates:	Active
Liquidity Needs:	Allows for use of illiquid mandates
Investment Objectives:	A “good” pension at the lowest possible contribution—that is the aim. The Fund seeks to accomplish this by investing in a responsible manner with an appreciation for people, the environment and good governance.
Investment Horizon:	Able to make payouts for the indefinite future. Considering a redesign of system now.
Cashflows:	Contributions from employees and employers as a percentage of income; also ongoing payouts. Currently no indexation for 2016. For the last two years, pension payments out have outpaced contributions in. For the prior three years, contributions were slightly greater than payments.
Type of benchmarks used:	Expect a return of more than 5% per year on invested funds over the long term and also uses strategic portfolio based on asset class weightings.

Allocation of investment portfolio by asset class



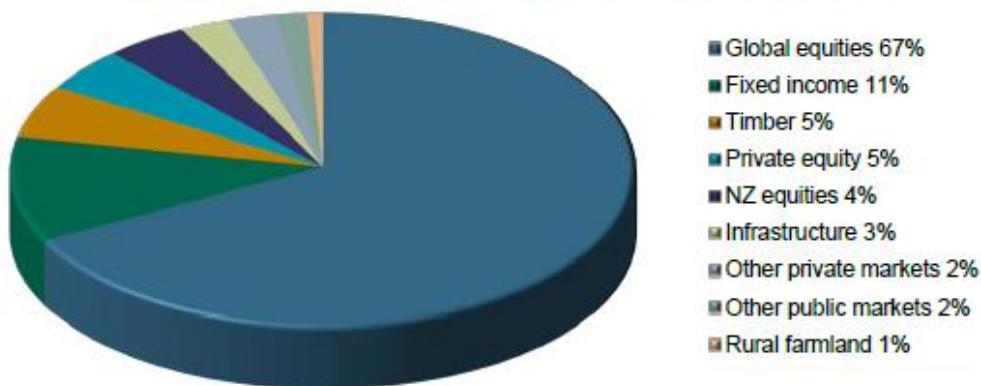
New Zealand Superannuation Fund

The New Zealand Superannuation Fund is a pension reserve fund established in 2001 and is generally regarded as a sovereign wealth fund. It was started in recognition of the aging population of New Zealand. In order to provide a similar level of benefits, the future tax burden for the population would have to be increased. The Government uses the Fund to save now in order to help pay for the future cost of providing universal pension benefits. In this way the Fund helps smooth the cost of social security pension provision between today's taxpayers and future generations.

Responsible Investment:	Yes
Domestic Investment:	Approximately 14%
Use of External Managers:	57%
Passive vs Active Mandates:	67% Passive - Around two-thirds of the Fund is invested passively, in line with global market indices. NZSF only undertakes active investment when they have a high level of confidence that it will, over the long term, be better than investing passively – by either improving the Fund's returns, reducing risk (e.g. through diversification) or both.
Liquidity Needs:	The timing of the flow of cash into and out of the Fund is transparent and clear (it is governed by a public funding formula). This provides the NZSF with relative certainty and confidence to invest in assets where other investors may be more constrained by their own liquidity demands. NZSF believes they can buy assets when other market participants are constrained or have been forced to sell to meet their own liquidity demands.
Investment Objectives:	Maximizing returns without undue risk to the Fund. The long horizon and mandate tilts the Fund's towards growth assets in order to have the best chance of maximizing returns without undue risk and thus reducing the potential future tax burden of New Zealanders.
Investment Horizon:	Long Fund horizon: NZSF aims to take advantage of the Fund's long-term horizon, certain cash flow (thanks to the public funding formula) and limited need for liquidity, to invest in growth assets such as listed company equities in New Zealand and globally. Because of its long investing horizon, the Fund has the ability to ride out and potentially benefit from short term volatility in the markets.

Cashflows:	The New Zealand Government suspended annual capital contributions to the Guardians in July 2009, having made one additional contribution to the Fund of \$250 million. Capital contributions are currently forecast to re-start in 2020/21. The Crown is required to make capital contributions to the Fund in accordance with law. No withdrawal of capital is permitted from the Fund prior to July 1, 2020. In addition, the Minister of Finance must ensure that sufficient money is transferred into the Fund in each financial year to meet the net cost of the superannuation entitlements that are payable out of the Fund during that year. This requirement is additional to and separate from the obligation to make annual capital contributions.
Type of benchmarks used:	NZSF measures investment performance in two ways: against a passive 'Reference Portfolio' benchmark and against the cost of Government debt (as measured by the return on 90-day NZ Treasury Bills + 2.7%). The Reference Portfolio is a shadow or notional portfolio of passive, low-cost, listed investments suited to the Fund's long-term investment horizon and risk profile. It has an 80:20 split between growth and fixed-income investments and its foreign currency exposures, from a policy perspective, are 100% hedged to the New Zealand dollar.

Asset class exposures as at 30/09/16



Norway – Government Pension Fund (Global)

The Global Government Pension Fund is a sovereign wealth fund established in 1990 after a decision by the country's legislature to counter the effects of the forthcoming decline in income and to smooth out the disruptive effects of highly fluctuating oil prices. The purpose of the fund is to invest parts of the large surplus generated by the Norwegian petroleum sector, generated mainly from taxes on companies but also payment for license to explore as well as the State's Direct Financial Interest and dividends from the partly state-owned Statoil. The current revenue from the petroleum sector is estimated to be at its peak period and to decline in the future decades. This fund invests 100% of its assets outside Norway. There is a sister fund that invests entirely within Norway.

Responsible Investment:	Yes
Domestic Investment:	0%
Use of External Managers:	Both, mostly internal – approx. 4% of capital external
Passive vs Active Mandates:	85% Passive
Liquidity Needs:	Large size and long time horizon allow for illiquid investments
Investment Objectives:	The main goal of the fund is to secure a high long-term real return of the fund with an acceptable level of risk, as a responsible investor, and through an efficient organization. The fund uses its long-term approach and its considerable size to generate strong returns and safeguard wealth for future generations. Withdrawals from the fund are subject to a "fiscal rule", which implies that the structural, oil-adjusted budget deficit should over time correspond to the expected real return on the capital of the fund as per the beginning of the budgetary year - the real return is expected to be 4% per annum.
Investment Horizon:	The fund is not dedicated to finance any specific future liabilities, and probability of large withdrawals is limited, making the fund truly long-term.
Cashflows:	The Fund derives its financial backing from oil profits, not pension contributions. In accordance with the management mandate for the GPFG, transfers are made to and from the krone account. When the Norwegian State's petroleum revenue exceeds the use of petroleum revenue in the fiscal budget, deposits will be made into the krone account. In the opposite situation, withdrawals may be made. Transfers to and from the krone account lead to a corresponding change in Owner's Capital. The Government Pension Fund Global turns petroleum revenue into financial wealth. This wealth belongs to the people of Norway, and Norges Bank Investment Management (NBIM) has been tasked by the Ministry of Finance to manage the Fund on their behalf. The objective of the Fund is to achieve the highest possible purchasing power over time with an acceptable level of risk.

Type of benchmarks used:

NBIM has constructed internal operational reference portfolios for equities and bonds. These reflect the types of securities that they believe represent a neutral and appropriate strategy. The reference portfolios are designed to avoid undesirable risk in parts of the markets that do not fit with the Fund's size, long-term outlook and objective. They are based on groups of securities picked because of their return and risk profile.



South Africa – Government Employees Pension Fund

The Government Employees Pension Fund of South Africa is a pension fund established in 1996. The plan is 100% funded, and invests in four main asset classes: Equities, fixed income, properties and the Isibaya Fund. The Isibaya Fund invests in black economic empowerment and infrastructure development projects that help to create jobs, relieve poverty and transform the economy.

Responsible Investment:	Yes
Domestic Investment:	Mostly domestic – 85%
Use of External Managers:	Majority internal
Passive vs Active Mandates:	Predominantly passive
Liquidity Needs:	Allows for some illiquid investment
Investment Objectives:	As the Government Employees Pension Fund is the custodian of a significant portion of the wealth of public servants, the mission is to: ensure the sustainability of the Fund; provide for efficient delivery of benefits; and empower the beneficiaries through effective communication.
Investment Horizon:	Long term
Cashflows:	The Fund receives a percentage of members' pensionable salaries as Contributions; Contributions were greater than benefits for 2006-2013. In 2014, 2015, and 2016, the benefits were greater than contributions. Benefits increased for cost of living in 2015.
Type of benchmarks used:	Strategic portfolio

The strategic asset allocation of the Fund is set out in the table below:

Asset class	Strategic asset allocation %	Asset allocation as at 31 March		Asset allocation as at 31 March 2015 %	Asset allocation range %
		2016 %	2015 %		
Cash and money markets	4	1	2	0 – 8	
Domestic bonds	31	33	32	26 – 36	
Domestic property	5	5	5	3 – 7	
Domestic equity	50	53	54	45 – 55	
Africa equity (ex SA)	5	1	1	0 – 5	
Foreign bonds	2	2	2	0 – 4	
Foreign equity	3	5	4	1 – 5	

Swedish Pension Reserve Funds

Sweden's five-fund structure is unique among global pension reserve funds. The original idea behind the distinct and independently operated entities was to reduce the impact of the Funds on the domestic market, diversify management risk, enhancing performance through competition and to mitigate the risk of political interference, as well as to diversify strategic risks. The over-arching investment mandate of the AP Funds encoded in Swedish law is to provide as high investment return as possible, while not taking undue risk. The Funds must also be in a position to pay out benefits if requested by the Swedish Pensions Agency. The Sixth AP fund is also part of the income pension system, but the fund neither receives nor disburses capital.

Fund name:	AP1	AP2
Responsible Investment:	Yes	Yes
Domestic Investment:	12%	10%
Use of External Managers:	31%	17%
Passive vs Active Mandates:	5% Passive	90% Passive
Liquidity Needs:	Some illiquid investment allowed	Some illiquid investment allowed
Investment Objectives:	There are five buffer funds in the Swedish national income pension system. The capital reserves in the AP funds are used to cover the deficit when disbursements from the pension system exceed contributions to the system. The Fund's mission is to manage the fund capital in such a way as to generate the greatest possible benefit for the pension system. This means that the Fund strives to deliver high long-term returns while maintaining a low level of risk for current and future pensioners.	
Investment Horizon:	The funds are long-term investors and active owners. In its role as owner, the Funds place high demands in the areas of environmental, social and corporate governance.	
Cashflows:	After the first net outflow in 2009 (the difference between national pension contributions, which are paid to the AP Funds, and pension disbursements, which are financed from the Funds' capital assets), the AP funds have disbursed more in pension payments than they have received in the form of contributions. As a consequence of an anticipated high level of new retirees over the next few years, this net outflow is expected to continue for a considerable time. When baby-boomers retire, they create a demand for a buffer in the pension system. The system's disbursements will exceed contributions up to 2050.	
Type of benchmarks used:	Annual real net return after expenses of 4.0% on the total	Weighted asset class index

portfolio measured over rolling ten-year periods.*

United States - CalPERS

The California Public Employees Retirement System (CalPERS) is a pension fund established in

*AP1 owns assets denominated in different currencies. Currency is treated as a separate asset that is managed according to special foreign exchange strategies. The value and return of all foreign assets are translated into Swedish kronor. The majority of the fund's foreign assets are protected, in terms of exchange rate fluctuations, using currency hedges. The return of the Fund's currency positions in 2015 was 2.0%.

verein sustainability, (2) Cultivate a high-performing, risk-intelligent, and innovative organization, and (3) Engage in state and national policy development to enhance the long-term sustainability and effectiveness of fund programs.

Responsible Investment: Yes

Domestic Investment: 9.3% in California

Use of External Managers: 80% global equity internal; 90% of income – No definitive numbers, majority internal.

Passive vs Active Mandates: Mostly active, no definitive numbers, passive is incorporated, mostly active portfolio.

Liquidity Needs: Has a liquidity sleeve to manage benefit payments

Investment Objectives: The overall objective of the CalPERS investment program is to generate returns at an appropriate level of risk to provide members and beneficiaries with benefits as required by law. This is accomplished through a carefully planned and executed long-term investment program that efficiently and effectively allocates and manages the assets of CalPERS. The Policies have been designed to allow CalPERS to achieve a long-term total return. The assets of CalPERS are broadly diversified to minimize the effect of short-term losses within any investment program.

Investment Horizon: Long term, but is paying out. Most of the income from the Fund comes from investment returns (62%).

Cashflows: Contributions from employees and employers as a percentage of income; also ongoing payouts.

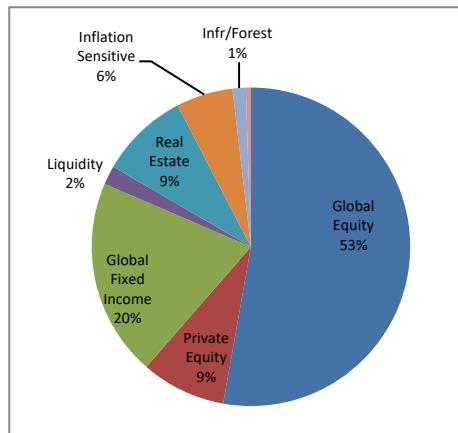
Type of benchmarks used: Strategic Portfolio

Current Total Market Value: \$299.76 Billion

Breakdown by Asset Class as of Jul 31, 2016	Total Value (\$ Billion)
Global Equity	\$159.99
Private Equity ¹	\$26.09
Global Fixed Income	\$60.79
Liquidity ¹	\$5.79
Real Estate ¹	\$27.30
Inflation Sensitive ¹	\$17.45
Infrastructure & Forestland ¹	\$4.06
Other ²	\$1.57

¹ Private Equity and Real Estate market values reflect values reported on a quarterly basis. These values are lagged one quarter.

² Other includes multi-asset class; and overlay, transition, and plan level assets.



APPENDIX C

Example of Global Market Portfolio

The “Global Market Portfolio” seeks to represent the broad opportunity set of potential investments. Some estimates of this portfolio focus only on the listed markets given that quantifying alternative asset classes presents boundary problems. For example, real estate, infrastructure, private equity and timber are all portions of a larger universe. Significant portions of these assets are either held by the public sector, or else by fragmented private interests. There is unavoidable double counting below given these boundary problems. The following table summarizes Mercer’s estimate of the “Global Market Portfolio” as of December 2015.

Broad Risk Exposures	Sub Asset Class	Size (US\$m)	%	%	Source
Equities	Public Equities (developed)	37,239,021	35.6	44.8	MSCI World + MSCI World Small Cap as at Dec 2015
	Public Equities (emerging)	6,061,620	5.8		MSCI Emerging Markets + MSCI EM Small Cap + MSCI Frontier Markets + MSCI China A Share as at Dec 2015
	Private Equities	3,595,880	3.4		Mercer estimate based on universe sizes
Defensive Fixed Income	Global Investment Grade	42,952,269	41.0	43.4	Barclays Global Aggregate as of Dec 2015
	Global Inflation-Linked	2,489,167	2.4		Barclays World Inflation-Linked Index as of Dec 2015
Growth-Oriented Fixed Income	Global High Yield	1,568,843	1.5	2.9	Barclays US High Yield & Pan-European High Yield Indices as of Dec 2015
	Private Debt	441,000	0.4		Estimate as of 2014 from Brown Brothers Harriman
	Emerging Market Debt	1,007,890	1.0		Barclays EM High Yield + Barclays EM Local Currency (ex Global Aggregate)
Real Assets	Real Estate	2,028,870	1.9	5.9	Mercer estimate based on size of listed market (FTSE EPRA/NAREIT Developed) and Preqin estimate of capital invested in unlisted real estate funds
	Infrastructure	1,872,400	1.8		Mercer estimate based on size of listed market (FTSE Macquarie) and Preqin estimate of total capital invested in unlisted infrastructure
	Timberland / Farmland	270,000	0.3		Timberland Investment Resource estimate of investible timberland in established markets / investible farmland estimate from Hardman & Co
	Natural resource companies	2,021,244	1.9		Market capitalization of S&P Global Natural Resources Index plus an estimate to make some allowance for unlisted investments
Hedge Funds	Hedge Funds	3,197,000	3.1	3.1	Preqin 2016 Global Hedge Fund report
	Total	104,745,204	100.0	100.0	

APPENDIX D

Example of International Purchasing Power Maximization

To illustrate the potential concepts relating to international purchasing power, we have conducted the following simplified analysis from the perspective of a country with a sovereign wealth fund (SWF) that has no clearly defined liabilities and whose objectives are related to maximising international purchasing power. For illustration purposes, we have used Singapore:

- We assume that the initial fund value is S\$1 billion, which is intended to cover future imports
- The assumed investment period is 25 years, with no drawdowns assumed in the interim period
- The fund is assumed to be invested in either a globally diversified portfolio or a global ILB portfolio, with the portfolio country weights being either based on import weights or Full Market Portfolio weights as a proxy for a diversified portfolio
- We ignore the fact that not all the countries being included in this analysis actually issue ILBs, let along for a 25 year maturity

In reality, the SWF's assets would be expected to cover many years of future imports rather than a single year as assumed in this example.

The table below shows the results, if we assume the fund is invested in accordance with import weights. The analysis assumes currencies move in line with Relative Purchasing Power Parity (based on inflation differentials) over the 25 year period with each country assumed to achieve a 4% real return over time.

	Initial Values		Values after 25 Years			Initial Portfolio Values		Diversified Portfolio after 25 Years		ILB Portfolio after 25 Years	
	Imports SGD (mil)	Imports LC (mil)	Imports LC (mil)	Exchange Rate	Imports SGD (mil)	Portfolio SGD (mil)	Portfolio LC (mil)	Portfolio LC (mil)	Portfolio SGD (mil)	Portfolio LC (mil)	Portfolio SGD (mil)
China	196	897	1,545	4.7271	327	196	897	4,119	871	1,545	327
Euroland	153	99	162	0.6343	256	153	99	432	681	162	256
US	203	143	251	0.7425	339	203	143	670	903	251	339
UK	54	26	44	0.4804	91	54	26	116	242	44	91
Japan	108	9,109	12,538	69.8673	179	108	9,109	33,425	478	12,538	179
Malaysia	159	482	908	3.4214	265	159	482	2,420	707	908	265
Indonesia	84	816,374	2,509,831	18009.0176	139	84	816,374	6,690,799	372	2,509,831	139
India	43	2,023	6,594	91.2681	72	43	2,023	17,578	193	6,594	72
	1,000				1,668	1,000			4,447		1,668

This highlights that the theoretical "least risk" position is an ILB portfolio with a maturity equivalent to that of the fund and weights in line with assumed import weights. Irrespective of how currencies actually move, this portfolio would have sufficient assets in each currency to acquire the expected imports.

While the expected value of the diversified portfolio (with a 4% real return) is substantially higher, there is the risk that returns disappoint such that the fund value ends up lower than that required to acquire the expected imports.

The following table shows the results if we assume the fund is invested in accordance with market portfolio weights (including for the ILB portfolio). The analysis again assumes currencies move in line with Relative PPP over the 25 year period.

	Initial Values		Values after 25 Years			Initial Portfolio Values		Diversified Portfolio after 25 Years		ILB Portfolio after 25 Years	
	Imports SGD (mil)	Imports LC (mil)	Imports LC (mil)	Exchange Rate	Imports SGD (mil)	Portfolio SGD (mil)	Portfolio LC (mil)	Portfolio LC (mil)	Portfolio SGD (mil)	Portfolio LC (mil)	Portfolio SGD (mil)
China	196	897	1,545	4.7271	327	76	347	1,595	337	598	127
Euroland	153	99	162	0.6343	256	185	120	521	822	195	308
US	203	143	251	0.7425	339	509	359	1,680	2,262	630	849
UK	54	26	44	0.4804	91	78	37	167	348	63	131
Japan	108	9,109	12,538	69.8673	179	133	11,250	41,282	591	15,486	222
Malaysia	159	482	908	3.4214	265	3	10	52	15	19	6
Indonesia	84	816,374	2,509,831	18009.0176	139	3	30,361	248,830	14	93,340	5
India	43	2,023	6,594	91.2681	72	13	607	5,279	58	1,980	22
	1,000				1,668	1,000			4,447		1,668

It will be noted that the portfolio values at the end of 25 years from a SGD perspective are the same as in the earlier table, which illustrates the point that under the assumptions of the same expected real returns and Relative PPP, the outcomes are indifferent to the assumed weights. While the ILB portfolio has increased in value in aggregate to the same level as required to meet the expected imports, there are now considerable ‘asset/liability’ mismatches as would be expected. This might not be an issue in this example where Relative PPP is assumed to apply, but would be in the event that it did not apply. This reinforces the point made above about the import-weighted ILB portfolio being the theoretical “least risk” portfolio.

The assumption has been that the eventual use of the sovereign wealth funds will mainly be to help meet future costs of imports, especially if the country were to be in a sustained trade deficit position. However, how might the considerations change if instead the assets of the funds were eventually distributed to the public in some form?

For example, such an approach could involve an amount paid in perpetuity (or to some fixed date) and linked to inflation and, potentially, population growth. However, to the extent that the general public would be using the amounts to purchase goods and services, then this does not change the situation significantly, although strictly some of those goods and services will be domestic in nature.

Therefore, the use of import weights (or some estimate of what they would likely be when fund capital starts to be drawn down) would be appropriate as a basis for defining “global” inflation from an asset-liability perspective.

APPENDIX E

Mercer Stochastic Simulation Model

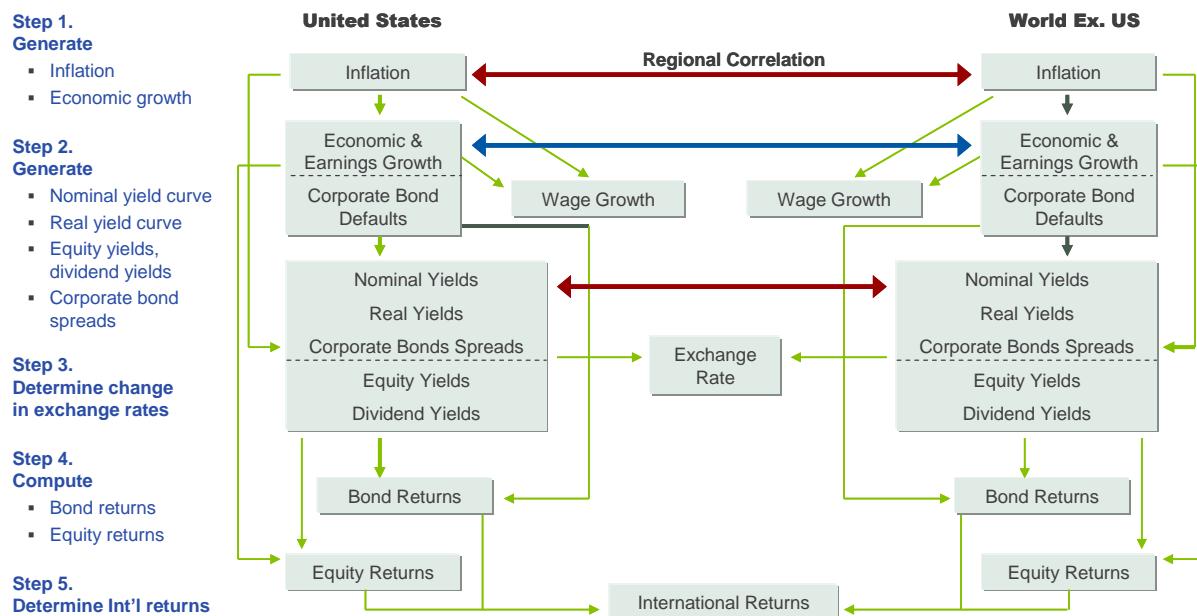
The Capital Market Simulator is a stochastic economic and capital market simulation system. It produces a data set of many trials of future economic and capital markets scenarios. It uses a fundamental approach to simulating economic and asset returns. It starts with the most basic independent economic variables and builds the dependent economic variables and asset returns from that small set of initial conditions combined with error terms, some of which are correlated, some of which are not. The most fundamental economic variables are inflation and economic growth. Most other economic variables have a relation with these fundamental variables. Yields, PE ratios, defaults, currency movements, etc, are all related to inflation and/or economic growth. So these variables are simulated using inflation and/or economic growth as one of the inputs, usually with other variables and error terms as well. From these fundamentals, asset returns can be calculated.

The core simulation process is a mean reversion model. The mean reversion component of the model relies on an assumed reversion rate and an assumed mean level for each variable. In addition, the model allows a sensitivity to inflation and GDP to be added to the reversion process.

The system allows for multiple regions to be modelled, with correlation across the regions.

An Outline

The following presents a general schematic for understanding how the model works.



In general, the model follows these broad steps.

Step 1 Generate Inflation

Inflation is calculated simultaneously across regions. A correlation assigned as an input is taken into account between the regions.

Step 2 Generate Economic/Earnings Growth

The purpose of this step is to project real (net of inflation) economic growth, which is determined by inflation variables, expected long run growth, and lagged growth. Growth across regions is determined simultaneously with a correlation provided as an input taken into account between the regions.

Earnings growth for the different equity asset classes is determined directly from economic growth. It is normally set up as a linear function of economic growth and an error term, the error terms can be handled by a correlated random variable.

Step 3 Generate Real Wage Growth

Real wage growth is determined as a function of inflation and real economic growth. This can be correlated across regions.

Step 4 Generate Real, Nominal, Equity, and Corporate Bond Yields

Real, nominal, and equity yields are generated taking into account correlations between these rates, as well as correlations with rates in other countries. For each category, one key yield is generated and other related yields are built as a function of the key yield. For the U.S., these key yields are the 30-year Treasury bond yield (nominal), the 30-year inflation-indexed bond yield (real), and the S&P 500 equity yield (equity).

Note that the equity yield is the inverse of the P/E. Hence, we are modeling an important component of the equity market. As a side calculation, dividend yields are calculated based upon the errors terms used for the equity yields.

Also as a side calculation, corporate bond yields are set as a function of earnings growth. As earnings growth rise above their expected averages, corporate spreads over treasuries decline; when earnings growth subsides, corporate spreads rise. Once corporate bond yields have been determined, returns for corporate bonds can be calculated.

Step 5 Construct Yield Curves

The nominal and real yield curves are constructed. Starting with the key rate calculated above, the expected long-term values and relative volatility for each maturity point on the yield curve are used to calculate the curve. It is possible to generate inverted yield curves.

Step 6 Calculate government bond returns

The returns for government bonds can be calculated precisely given the beginning-of-year yields and end-of-year yields. We also model corporate bond defaults (relating them to the economic cycle) and adjust corporate returns appropriately.

Step 7 Calculate Equity Returns

Equity returns are calculated as a function of earnings growth, changes in equity yields, and the shareholder yield (dividend plus net issuance).

Step 8 Determine Exchange Rates

We allow for three approaches to determine exchange rates.

- The most basic approach is interest rate parity theory. This means that exchange rates are expected to change to equalize expected returns across regions. A random variable is added to this change.
- Another method of modeling exchange rates is purchasing power parity, in which exchange rates change around a predefined amount. An extreme case of this is purely random exchange rates.
- The third and default model is a combination of the purchasing power parity approach with productivity differentials and starting valuations included as additional drivers. This is the standard model adopted globally within Mercer.

Step 9 Compute international returns

Given the local returns of equity and fixed income in each region and the changes in exchange rates, we can compute the returns of foreign investments for each region.

Yield Curve

Yield curves are modeled by using the stochastic yield equation above to generate a key yield curve point, and then the rest of the yield curve is generated from this key point. We generally use the longest maturity point, the 30 Year point for most regions, as the key point, but could also use any of the other points for a particular region. The 30 Year has been more consistent with reasonable yield levels in recent years, so we use it as the key currently. With the 3m yield close to or below zero, its behavior is less appropriate for a long term model.

The yield curve model uses a principal components model to create random adjustments to the shape of the yield curve. For each region, principal component factors describing the first 4 principal components are provided as inputs. These can be calculated from the actual yield curve history if it is provided. Correlated error terms are added to these principal components to adjust the shape of the yield curve. This new shape is then applied in a mean reversion formula to the beginning yield curve. This allows us to have a baseline shape to the yield curve but allow dynamic adjustments to its shape.

Credit Spread Curve

The credit spread curve is modeled using a single key spread, with the other points modeled as proportions of that key spread rate. The key spread is calculated as a yield function with assumed sensitivities to sovereign yields and economic growth and an error term related to equity earnings yield (P/E).

We normally produce 5 yield curves for each region, Real Sovereign, Nominal Sovereign, AA Corporate, Investment Grade Corporate and High Yield.

Regime Switching

Coming out of the Global Financial Crisis, we wanted to ensure that our simulation model was capable of capturing the extreme events we had just witnessed. There are a number of approaches to generating extreme events in a simulation, all of them relatively complex. The approach we selected is Regime Switching. This approach is attractive because it is a relatively simple adjustment to the standard model we had been using for many years.

Essentially, the regime switching approach achieves non-normally distributed outcomes by changing the inputs to the equations as the model iterates through the years. For each regime:

we define a set of means, volatilities, reversion coefficients, and correlation assumptions for the major economic variables.

There are three key characteristics for the variables that underlie much of the base model: mean expected level, volatility, reversion rate from current to mean. The regime switching model allows these items to shift over time in as the model moves from one regime to another. The level and volatility of yield variables, economic growth rates, defaults, etc can all achieve a much wider range of values than is possible under almost any single probability distribution.

Model Variables

Many of the variables generated in our model are mean-reverting, serially correlated, lognormally distributed variables. What this means is that a variable is determined by the following factors:

- Long-term mean: This is the long-term trend to which the variable reverts to when it deviates from the long-term mean. For example, the 30-year treasury yield may be set to have a long-term mean of 5.50%. If interest rates go up to 7.0%, then the equation is designed to make it move back to 5.50% over time.
- Lagged value: Last year's value partially determines this year's value.
- Error term: an additional random value added to the mean reversion model, this error term may be independent or correlated with other error terms of variables.

There are two key formulas of this type that are used extensively in CMS. They are closely related but with some important differences.

Yield equation:

$$\ln(Y_t) = b_1 \cdot \ln\left(\frac{1+AI_t}{1+\mu_{AI}}\right) + b_2 \cdot \ln\left(\frac{1+AI_t}{1+AI_{t-1}}\right) + b_3 \cdot \ln\left(\frac{1+EG_t}{1+\mu_{EG}}\right) + b_4 \cdot \ln\left(\frac{1+EG_t}{1+EG_{t-1}}\right) + (1-r_Y) \cdot \ln Y_{t-1} + r_Y \cdot \ln \mu_Y + \varepsilon_{Y,t}$$

where AI_t = actual inflation at time t,

EG_t = real economic growth at time t,

r_Y = mean reversion coefficient for Y

$\varepsilon_{Y,t}$ is a random distributed normal random variable Y at time t

coefficients b_1, b_2, b_3, b_4 which define the direction and speed of adjustment to inflation and economic growth relative to mean or lagged inflation and growth.

The above equation is called a yield equation because in its particular form, no negative values can result. A slightly different form of this equation is called a “growth function” and it allows for negative values of the variable. This form of the equation is suited to modeling actual inflation, economic growth, earnings growth, and wage growth, since these could all be negative.

Growth equation:

$$\ln(1+G_t) = b_1 \cdot \ln\left(\frac{1+AI_t}{1+\mu_{AI}}\right) + b_2 \cdot \ln\left(\frac{1+AI_t}{1+AI_{t-1}}\right) + b_3 \cdot \ln\left(\frac{1+EG_t}{1+\mu_{EG}}\right) + b_4 \cdot \ln\left(\frac{1+EG_t}{1+EG_{t-1}}\right) + (1-r_G) \cdot \ln(1+G_{t-1}) + r_G \cdot \ln(1+\mu_G) + \varepsilon_{G,t}$$

Economic growth is modeled using essentially the growth function shown above, with the b_3 and b_4 economic growth sensitivity factors removed.

Modeling Inflation

There are several ways to model inflation. Each has features that are appealing, but each individually cannot generate all inflation regimes. Two specific models of inflation are:

- Mean-reverting, serially correlated growth function similar to those shown above. In this process, this year's inflation is determined by last year's inflation and the long run expected value (mean) of inflation. Inflation generated by this process produces very symmetric inflation series with correct serially correlated values. Since inflation typically exhibits high serial correlation, this process exhibits attractive properties for modeling stable inflation environments. However, this process never produces huge jumps in inflation or hyper-inflation which can occur in the emerging markets.
- Actual inflation as a random variable around expected inflation. Expected inflation is measured by the difference between nominal and real interest rates at the beginning of the year. Theoretically, this process has a great deal of economic appeal, as it stipulates that investors use the capital markets to reveal expected inflation. In practice, this process can easily produce hyper-inflations. However, the problems of using such an approach are that inflation typically loses any serial correlation and when a hyper-inflation occurs, it never stops (there is no mean-reverting process to inflation).

Each of these methods for modeling inflation has its advantages and disadvantages. The growth function process produces very predictable ranges of inflation, but fails to ever simulate a hyperinflation. The second method listed above can produce episodes of hyperinflation, but these hyperinflations never revert back to normal inflation levels.

Our approach to solving these competing issues is the use of a regime switching model, as described above. By changing the long term mean that the models revert towards, we are able to induce hyperinflation, bring it back down to recession levels, and achieve a full range of other inflation states. We use the first inflation process above, the growth process, as the default model with regime switches in the means, volatilities and reversion periods.

APPENDIX F

Summary of Capital Market Assumptions as of December 2016

Economic Variables

Consensus Economics long-term forecasts are the starting point for our ‘steady state’ inflation assumptions and economic growth forecasts – specifically, the average of the second five years of their ten-year forecasts, which at present, is the period 2022-2026. For countries not covered by Consensus Economics, reference is made to average of any other long-term forecasts that might be available for these countries.

In the case of inflation, reference is also made to either explicit inflation targets or mid-point of explicit target ranges.

In the case of economic growth, it is also necessary to have assumptions for long-run labour force and productivity growth. For labour-force growth, reference is made to UN population projections in the working age group and any other sources of such projections. Productivity growth is established as the difference between the overall growth assumption and the labour-force assumption.

For emerging markets, our ‘steady state’ growth estimates are based on the average over the ten year period covered by Consensus Economics and then we combine this with our assessment of the level of economic growth likely at the end of 20 years.

Allowance is made for initial conditions to move towards our assumed ‘steady state’ estimates. Initial conditions have been proxied as a 50/50 combination of the most recent annual inflation/growth figures and the current 1 year inflation/growth forecasts from Consensus Economics. A ten year period has been assumed for reversion.

The breakdown of the ‘steady state’ inflation and economic growth forecasts for the major developed market countries/regions is shown below.

Country	Inflation Forecast	Growth Forecast	MSCI World Adjusted Weight
Australia	2.5%	2.8%	2.7%
Canada	2.0%	2.0%	3.7%
Eurozone	1.9%	1.3%	13.4%
Japan	1.3%	1.1%	8.9%
Switzerland	1.0%	1.5%	3.2%
United Kingdom	2.0%	2.2%	6.8%
United States	2.2%	2.1%	61.3%
Weighted Average	2.0%	1.9%	100.0%

The breakdown of the 'steady state' inflation and economic growth forecasts for the major emerging market countries is shown below:

Country	Inflation Forecast	Growth Forecast	MSCI EM Adjusted Weight
Brazil	4.4%	2.9%	7.9%
Chile	3.0%	3.3%	1.2%
China	2.4%	4.6%	27.3%
Colombia	3.3%	3.4%	0.5%
Hungary	2.6%	2.1%	0.3%
India	4.9%	6.2%	8.6%
Indonesia	4.4%	4.9%	2.7%
Korea	1.9%	2.1%	14.8%
Malaysia	2.5%	4.0%	2.6%
Mexico	3.3%	3.0%	3.6%
Philippines	3.4%	4.8%	1.2%
Poland	2.4%	2.6%	1.2%
Russia	4.4%	1.8%	4.6%
South Africa	4.5%	2.8%	7.3%
Taiwan	1.7%	2.1%	12.6%
Thailand	2.7%	2.9%	2.4%
Turkey	5.5%	3.5%	1.1%
Weighted Average	3.0%	3.5%	100.0%

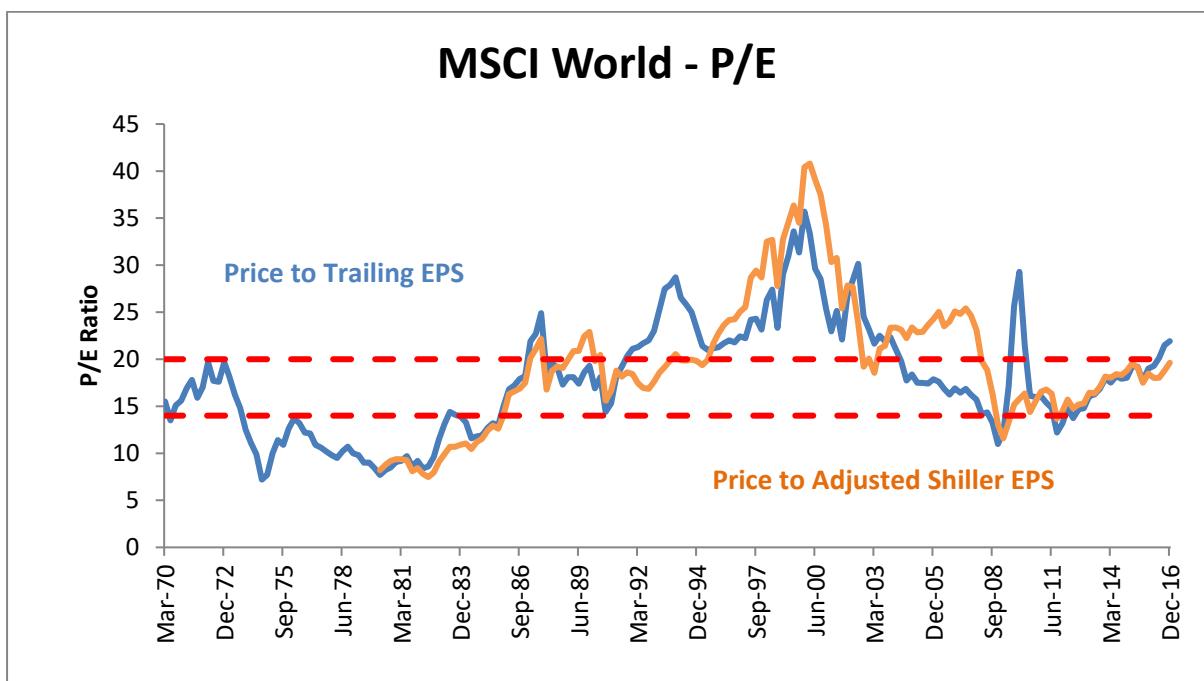
We note that our assumptions for Chile inflation and growth correspond exactly with the longer-term assumptions used in the central scenario for the cash flow projections we have been provided with in respect of the PRF.

Equity Returns

Below, we summarize the development of global equity expected returns as of end December 2016 under the approach outlined above.

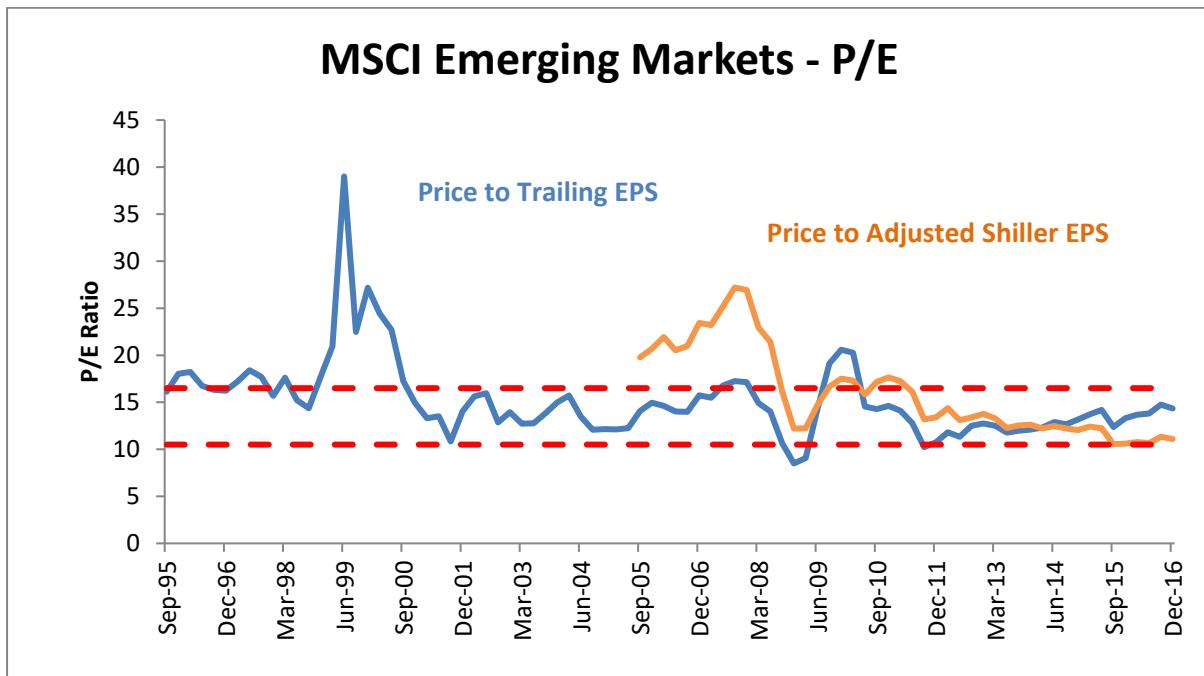
The following chart shows the situation in respect of developed markets as of the end of September 2016. While the actual trailing P/E remains outside the band, normalized P/E remains inside the band. The normalized P/E (as calculated using the adjusted Shiller approach) was 19.6x as opposed to the upper band of 20.0.

On this basis, no allowance for P/E reversion for developed markets is assumed as of December 2016.



The adjusted Shiller approach for the MSCI World Index reflected in the above chart uses a trend real growth rate for developed markets of 1.2%, which has been derived based on the compound average rate for the Index since its inception at the end of 1969.

The situation in respect of emerging markets is shown below:



The adjusted Shiller approach for emerging markets reflected in the above chart uses a trend real growth rate for emerging markets of 2.1%, which has been derived based on the compound

average rate for the MSCI Emerging Markets Index since September 1995, which is the earliest date for which data is available.

Both the actual trailing P/E and normalized P/E remain inside the band. On this basis, an allowance for P/E reversion for EM has been assumed as of December 2016.

We derive the following comparisons of Developed Market and Emerging Market equity expected returns as of end of December 2016 – these are shown in local currency terms:

	Developed Markets	Emerging Markets		
	Steady State	Market Aware	Steady State	Market Aware
(a) P/E ratio at equilibrium	17x	17x	13.5x	13.5x
(b) Earnings yield at equilibrium (1/(a))	5.9%	5.9%	7.4%	7.4%
(c) Payout Ratio	45%	45%	35%	35%
(d) Dividend Income ((b) x (c))	2.6%	2.6%	2.6%	2.6%
(e) Real Economic Growth	1.9%	1.9%	3.5%	3.5%
(f) Allowance for 'Dilution'	0.0%	0.0%	0.8%	0.9%
(g) Real Earnings Growth ((e) - (f))	1.9%	1.9%	2.6%	2.7%
(h) P/E reversion	n/a	0.0%	n/a	0.0%
(i) Expected Real Return in local currency ((1+(d)) * (1+(g)) * (1+h)) - 1	4.6%	4.6%	5.3%	5.3%
(j) Inflation	2.0%	2.0%	3.0%	3.0%
(k) Expected Nominal Return in local currency ((1+(i)) * (1+(j)) - 1	6.7%	6.6%	8.5%	8.5%

In respect of the MSCI AC World, our assumptions are based on an 89.5% weighting to Developed Markets and 10.5% to Emerging Markets – these are the respective weightings in the MSCI AC World Index as of end December 2016. This leads to a market aware assumption of 6.8% in local currency terms.

Fixed Income Returns

Global Government Bond Returns

The following outlines the derivation of a global government bond return in local currency terms, based on a weighted-average of the returns for each of the markets:

	Steady State Local Currency Return	Market Aware Local Currency Return	Bloomberg/Barclays Global Treasury Weights
Australia	4.4%	3.5%	1.4%
Canada	3.6%	2.6%	1.5%
Eurozone	2.9%	1.3%	27.9%
Japan	2.1%	0.9%	31.3%
Switzerland	2.1%	0.6%	0.0%
UK	3.8%	2.1%	7.4%
USA	4.0%	3.2%	30.6%
Weighted Average	3.1%	1.8%	100.0%

The expected Market Aware return in local currency terms is 1.8%pa.

Global Corporate Returns

The following outlines the derivation of a global corporate bond return in local currency terms, based on a weighted-average of the returns for each of the markets:

	Steady State Local Currency Return	Market Aware Local Currency Return	Bloomberg/Barclays Global Corporate Weights
Australia	4.9%	4.2%	3.0%
Canada	4.6%	3.6%	4.8%
Eurozone	4.0%	2.2%	18.9%
Japan	2.5%	1.4%	3.5%
UK	4.3%	3.0%	9.0%
USA	4.7%	4.0%	60.8%
Weighted Average	4.4%	3.5%	100.0%

The expected Market Aware return in local currency terms is 3.5%pa.

Global Inflation-Linked Bonds

The following outlines the derivation of a global inflation-linked bond returns in local currency terms, based on a weighted-average of the returns for each of the markets:

	Steady State Local Currency Return	Market Aware Local Currency Return	Bloomberg/Barclays World Inflation- Linked Weight
Australia	4.6%	3.5%	1.2%
Canada	3.7%	2.5%	2.1%
Eurozone	3.0%	1.7%	19.8%
UK	3.6%	0.5%	29.5%
USA	3.8%	3.2%	47.4%
Weighted Average	3.6%	2.1%	100.0%

The expected Market Aware return in local currency terms is 2.1%pa.

USD & CLP Returns

The following table updates our approach for currency translation to USD in respect of developed market currencies based on exchange rates as of end December 2016

			B	A+B		C	A+B-C
Country	MSCI World Weights (Adjusted)	Misalignment (Reversion to Adjusted PPP Estimate)	Contribution from Misalignment p.a. (Reversion Over 20 yrs)	Expected Market Aware Real Appreciation vs. USD	Inflation Estimate (20 Yr)	Estimated Relative Inflation vs. US	Expected Market Aware Nominal Appreciation p.a. vs USD (20Y)
Australia	2.7%	3.6%	-0.2%	-0.2%	2.4%	0.14%	-0.3%
Canada	3.7%	-2.6%	0.1%	0.1%	2.0%	-0.27%	0.4%
Eurozone	13.4%	-9.3%	0.5%	0.5%	1.7%	-0.50%	1.0%
Japan	8.9%	-5.4%	0.3%	0.3%	1.0%	-1.22%	1.5%
Switzerland	3.2%	0.2%	0.0%	0.0%	0.8%	-1.45%	1.4%
UK	6.8%	-8.6%	0.4%	0.4%	2.0%	-0.22%	0.7%
USA	61.3%	0.0%	0.0%	0.0%	2.2%	0.00%	0.0%
Weighted Total	100.0%	-2.3%	0.1%	0.1%	2.0%	-0.2%	0.4%

The application of the currency translation approach for emerging market currencies as of end December 2016 is as follows:

Country	MSCI EM Weights	Real GDP Growth Per Capita Estimate	Estimated Real GDP Growth Differential vs. US (Factor 1)	Contribution from Productivity Growth (Factor 1 * 0.35)	Misalignment (Factor 2)	Current A/C Balance End 2021	Adjustment Factor	Contribution from Misalignment p.a. (- Factor 2 * Adjustment Factor/20 yrs)	Expected Real Appreciation vs. USD	Inflation Estimate (20Y)	Estimated Relative Inflation vs. US	Expected Market Aware Nominal Appreciation p.a. vs USD (20Y)
												A+B-C
Brazil	7.9%	2.2%	0.8%	0.3%	-4.0%	-1.1%	40%	0.1%	0.4%	4.7%	2.47%	-2.0%
Chile	1.2%	2.9%	1.5%	0.5%	-26.7%	-2.7%	30%	0.5%	1.0%	3.0%	0.78%	0.2%
China	27.3%	4.4%	3.0%	1.0%	-22.0%	0.8%	50%	0.6%	1.7%	2.3%	0.06%	1.6%
Colombia	0.5%	2.4%	1.0%	0.3%	-38.9%	-3.3%	20%	0.5%	0.8%	3.7%	1.48%	-0.6%
India	8.6%	4.7%	3.3%	1.1%	-40.0%	-2.2%	30%	0.8%	1.9%	4.8%	2.54%	-0.6%
Indonesia	2.7%	3.7%	2.3%	0.8%	-40.0%	-2.3%	30%	0.8%	1.6%	4.2%	2.02%	-0.4%
Korea	14.8%	2.1%	0.7%	0.2%	-22.3%	5.2%	50%	0.6%	0.9%	1.8%	-0.46%	1.3%
Malaysia	2.6%	2.6%	1.2%	0.4%	-40.0%	1.5%	50%	1.3%	1.7%	2.4%	0.21%	1.5%
Mexico	3.6%	1.8%	0.4%	0.1%	-40.0%	-2.7%	30%	0.8%	0.9%	3.3%	1.10%	-0.2%
Philippines	1.2%	2.8%	1.4%	0.5%	-31.1%	0.2%	50%	0.9%	1.4%	3.2%	1.02%	0.4%
Poland	1.2%	2.8%	1.4%	0.5%	-40.0%	-2.6%	30%	0.8%	1.3%	2.0%	-0.23%	1.5%
Russia	4.6%	2.1%	0.7%	0.2%	-40.0%	6.5%	50%	1.3%	1.5%	4.7%	2.47%	-0.9%
South Africa	7.3%	1.8%	0.4%	0.1%	-34.5%	-4.0%	10%	0.2%	0.3%	4.8%	2.59%	-2.1%
Taiwan	12.6%	2.3%	0.9%	0.3%	-40.0%	14.0%	50%	1.3%	1.6%	1.5%	-0.68%	2.3%
Thailand	2.4%	2.9%	1.5%	0.5%	-40.0%	1.4%	50%	1.3%	1.8%	2.4%	0.14%	1.7%
Turkey	1.1%	3.0%	1.6%	0.5%	-40.0%	-4.6%	10%	0.3%	0.8%	5.0%	3.73%	-2.7%
Weighted Total	100.0%	3.1%	1.7%	0.6%	-28.9%	2.3%		0.7%	1.3%	3.0%	0.8%	0.6%

That is, we assume that over the 20-year horizon, the CLP will appreciate, on average, by 0.2% per annum relative to the USD.

The following table summarizes the unhedged geometric returns from both a USD and CLP perspective on the basis of the currency translation approach.

Asset Class	Geometric Return in Local Currency	Impact from Growth Differentials	Impact from Valuation Misalignments	Impact from Inflation Differentials	Currency Return	Geometric Return in USD	Currency Return to CLP	Geometric Return in CLP
Global Equities	6.8%	0.1%	0.2%	-0.1%	0.4%	7.2%	-0.2%	7.0%
Global REITS	6.7%	0.0%	0.0%	0.0%	0.0%	6.7%	-0.2%	6.5%
Global Real Estate Private	7.9%	0.0%	0.0%	0.0%	0.0%	7.9%	-0.2%	7.6%
Global Listed Infrastructure	6.5%	0.0%	0.0%	0.0%	0.0%	6.5%	-0.2%	6.3%
Global Private Infrastructure	8.1%	0.0%	0.0%	0.0%	0.0%	8.1%	-0.2%	7.8%
Global Sovereign Bonds	1.8%	0.0%	0.3%	-0.5%	0.8%	2.7%	-0.2%	2.4%
Global Investment Grade Credit	3.5%	0.0%	0.1%	-0.2%	0.3%	3.7%	-0.2%	3.5%
Global Inflation-Linked Bonds	2.1%	0.0%	0.2%	-0.2%	0.4%	2.5%	-0.2%	2.3%
Global High Yield	4.8%	0.0%	0.0%	0.0%	0.0%	4.8%	-0.2%	4.6%
Agency MBS	3.6%	0.0%	0.0%	0.0%	0.0%	3.6%	-0.2%	3.3%

On a hedged basis, we expect that higher interest rates from a USD perspective relative to the global sovereign markets will increase the 1.8% local currency return for global sovereign bonds to a hedged to USD nominal return of 2.8% pa. In turn, higher CLP interest rates relative to the USD would result in a hedged to CLP nominal return of 3.7%pa. A similar process applies in relation to the derivation of the other hedged asset class returns.

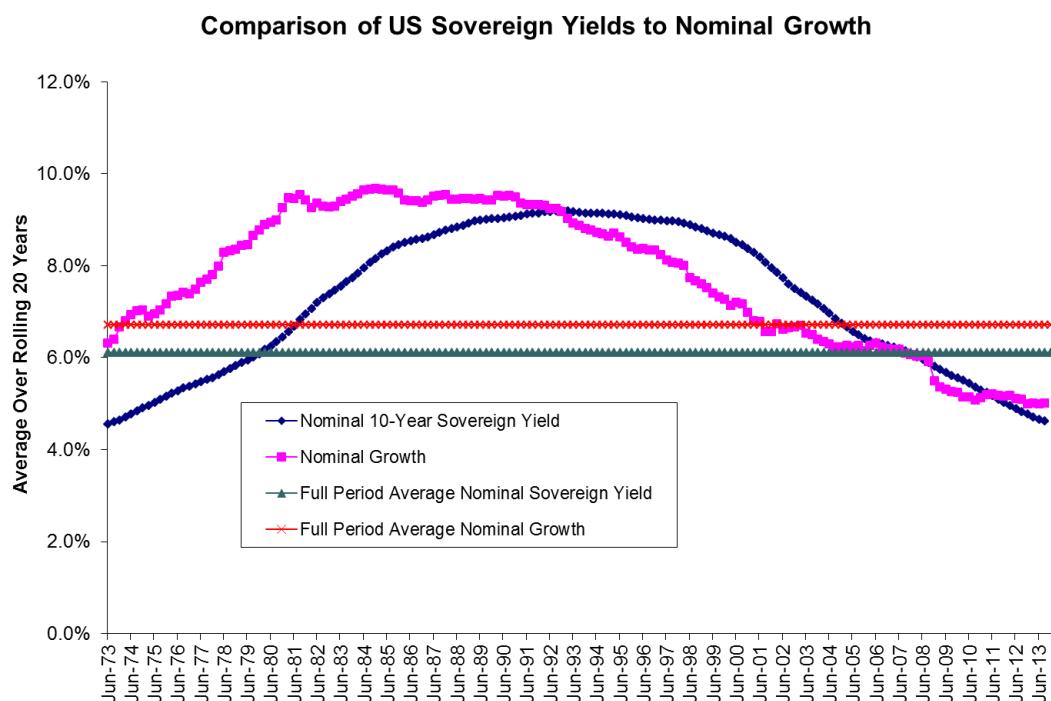
APPENDIX G

Rationale for Steady State Sovereign Yield Curves

Despite a lengthy review of academic literature, there is no general consensus as to what an ‘equilibrium’ or ‘steady state’ yield is and what it should be. In this respect, one way to look at the issue is that, in economic theory, the real long-term interest rate is the market clearing price at the intersection of the supply and demand for capital. With reference to a Goldman Sachs Asset Management article⁴¹, the equilibrium real interest rate should be the long-term rate consistent with output at potential and stable inflation. In effect, the equilibrium rate of real economic growth should be the real interest rate.

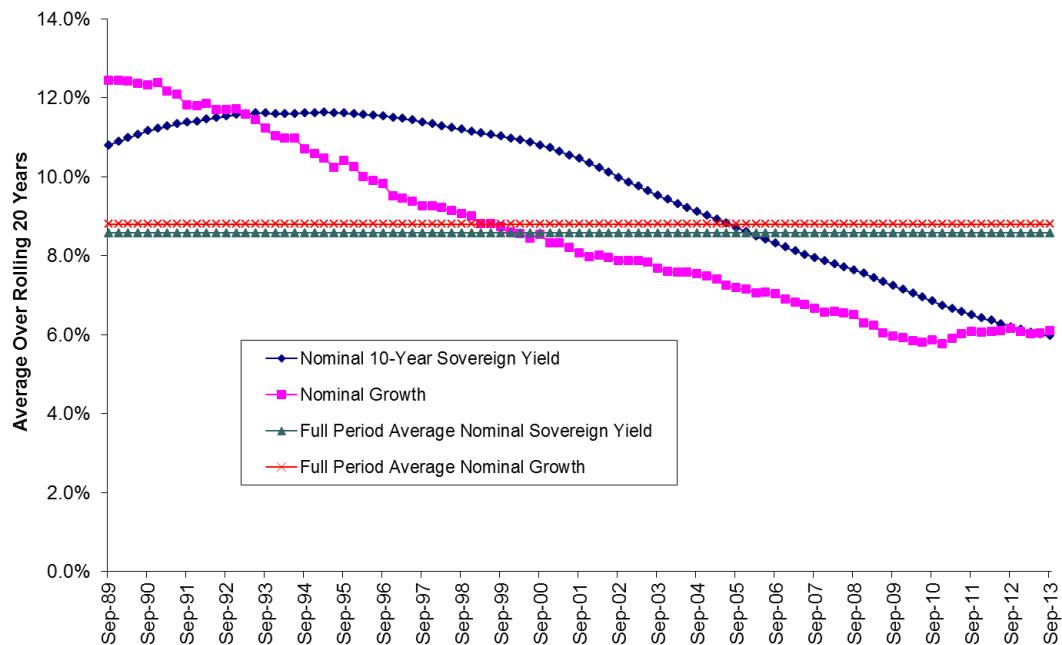
To assess the basis for the establishment of a steady state yields, Mercer has used the 10-year yield as the anchoring point given that most countries have a 10-year sovereign bond. The relationship between economic growth and long-end government yields was tested from a long-term perspective using US and Australian data:

- The analysis for the US went back to 1953 (which is the earliest period that we were able to obtain data on US 10-year treasury yields); and
 - For Australia to 1969, which again was the earliest period for Australian 10-year yields



⁴¹ "The Prospects for Global Equilibrium Real Interest Rates". GSAM Monthly Insights. March 2011.

Comparison of Australia Sovereign Yields to Nominal Growth



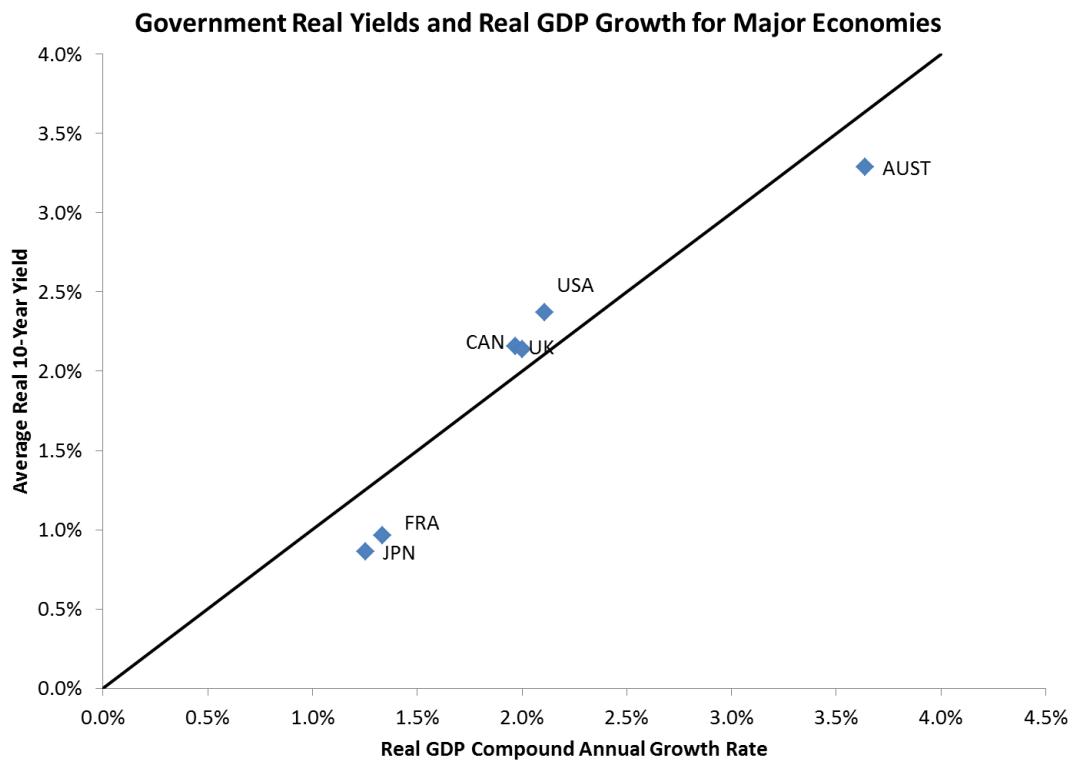
Clearly, even over 20-year time frames, the relationship from the charts between nominal growth and treasury yields is not that strong with growth being higher than yields in some periods and the opposite being the case in others. However, from the US analysis, we concluded that a reasonable approach was to set the 'steady state' 10-year sovereign bond yield at a level that is 90% of assumed level of 'steady state' nominal growth, which has been the average ratio over time.

The following table also examines this relationship from a UK perspective, based on information obtained from the Excel file "threecenturiesofdata.xls" downloaded from the Bank of England website. We show the relationship between average nominal bond yields and nominal GDP over various time periods, including 1953 (to coincide with the data for the US analysis) and 1969 (to coincide with the data for the Australian analysis).

Period	Nominal GDP	Average Long-Dated Yield	Ratio
Since 1900	6.3%	5.8%	92.3%
Since 1953	8.2%	7.8%	95.3%
Since 1969	8.8%	8.7%	98.8%

This analysis broadly supports the 90% figure derived for the US.

Finally, the following chart looks at the historical relationship between the average historical real yields on inflation-linked bonds and real GDP. This relates to the full period for which yield data is available for these markets and as such the time periods represented by the chart are different.



This chart generally supports a close relationship between long-dated real yields and real GDP.

APPENDIX H

Rationale for Currency Translation Approach

Purchasing Power Parity (PPP) is a theory of long-term equilibrium exchange rates based on relative price levels of two countries.

In its "absolute" version, the purchasing power of different currencies is equalized for a given basket of goods. For example, absolute PPP is used as a measure for comparing price levels (e.g. the Big Mac index). Absolute PPP is also used by the IMF and OECD to compare GDP and other variables between countries.

In the "relative" version, the difference in the rate of change in prices at home and abroad – the difference in the inflation rates – is equal to the percentage depreciation or appreciation of the exchange rate.

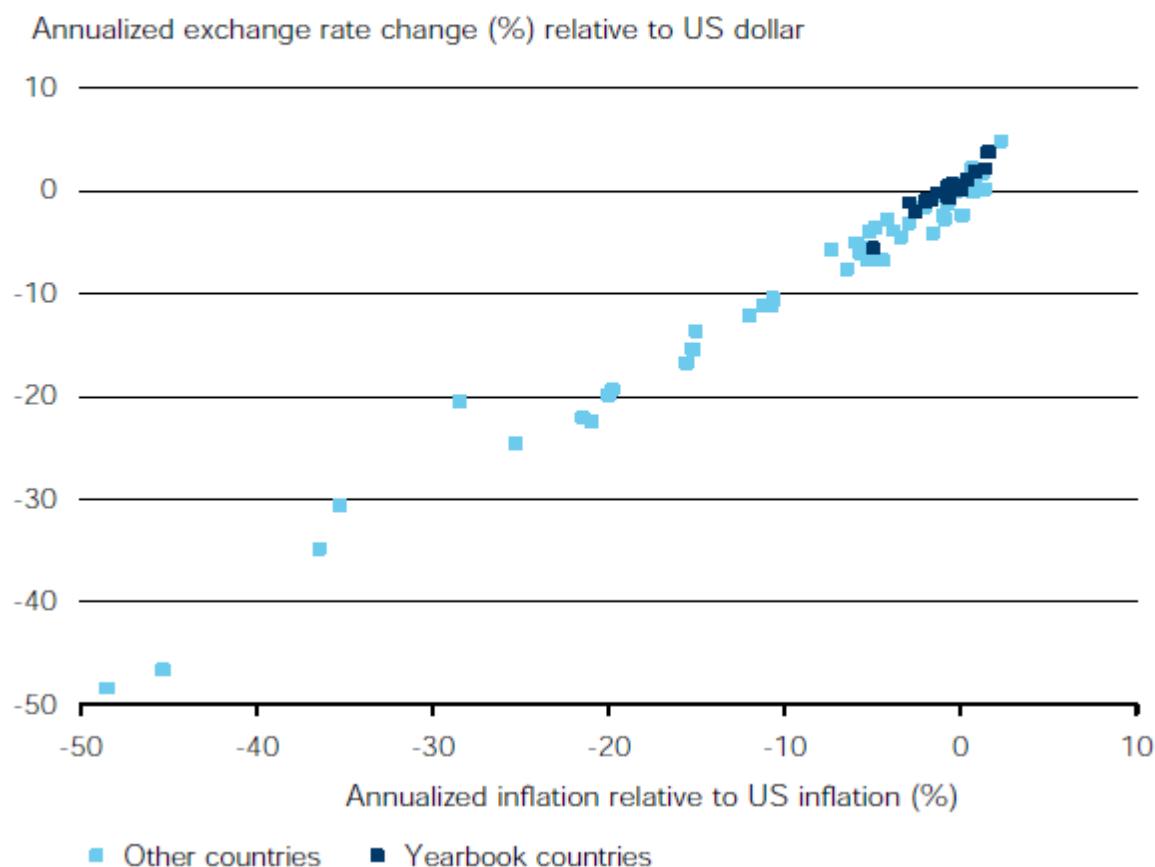
While Relative PPP often does not hold true over shorter periods of time, the historical linkage between currencies and inflation over the long term is compelling. A study⁴² of 20 currencies from 1900 to 2011 showed that for each of the 19 non-US countries, the exchange rate change versus the US dollar (whether positive or negative) was less than 1% per annum when measured in real terms (e.g., the inflation adjusted fall in the USD/GBP exchange rate over this period was only 0.05% per annum).

Similar results were observed in analyzing the currencies from 83 countries over the period from 1970 to 2011. This is shown in the following extract from that paper.

⁴² Elroy Dimson, Paul Marsh and Mike Staunton (all of the London Business School), *Currency Matters*, Credit Suisse Global Investment Returns Yearbook 2012

Exchange rates and inflation: 83 countries, 1970–2011

Source: Elroy Dimson, Paul Marsh, and Mike Staunton; Global Financial Data and IMF



The PPP approach essentially relies on the concept of a single price for each good whereas it has long been known that consumer prices tend to be significantly higher (in our terms, it tends to have appreciated) in wealthier nations. The theory behind this, known as the Balassa-Samuelson effect (also attributed to David Ricardo and Jacob Viner), relies upon a distinction between tradable goods (whose prices should be more or less equalized by international trade flows) and non-tradable goods (whose prices are determined by local supply and demand conditions alone).

Therefore, from the perspective of EM currencies, there is the issue that PPP ignores the potential impacts on currencies based on productivity differences – that is, leaving aside current “valuations”, the currencies of EM countries might be expected to appreciate in **real** terms over time based on differences in relative productivity growth as those economies continue to grow.

This approach has also been considered in several papers as a basis for considering Emerging Market currencies; including:

- “The Balassa-Samuelson Relationship and the Renminbi”, Jeremy Frankel, December 2006
- “*FX Valuation and Outlook: An absolute approach*”, Barclays Capital FX & EM Strategy paper, February 2011
- “The Case for Emerging Market Currencies in the Long Run”, Allianz Global Investors, November 2012
- “The Purchasing Power Parity Puzzle”, Kenneth Rogoff, 1996

Developed Market Currencies

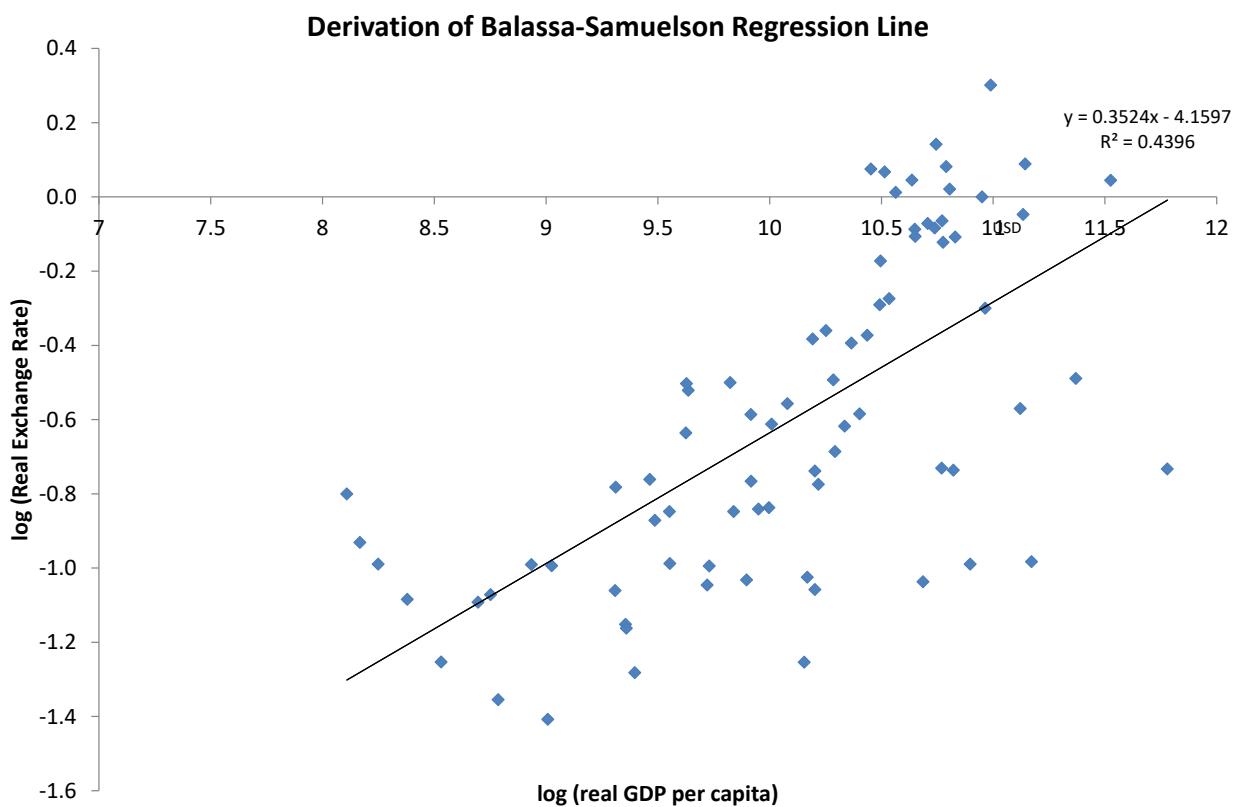
Our approach for Developed Market currencies of making reference to an adjusted PPP estimate seeks to reflect currencies such as the CHF, having a ‘safe haven’ aspect and may have a tendency to systematically deviate away from absolute PPP.

Our assumptions make allowance for currencies to move halfway towards the Adjusted PPP estimate over a 20-year time horizon.

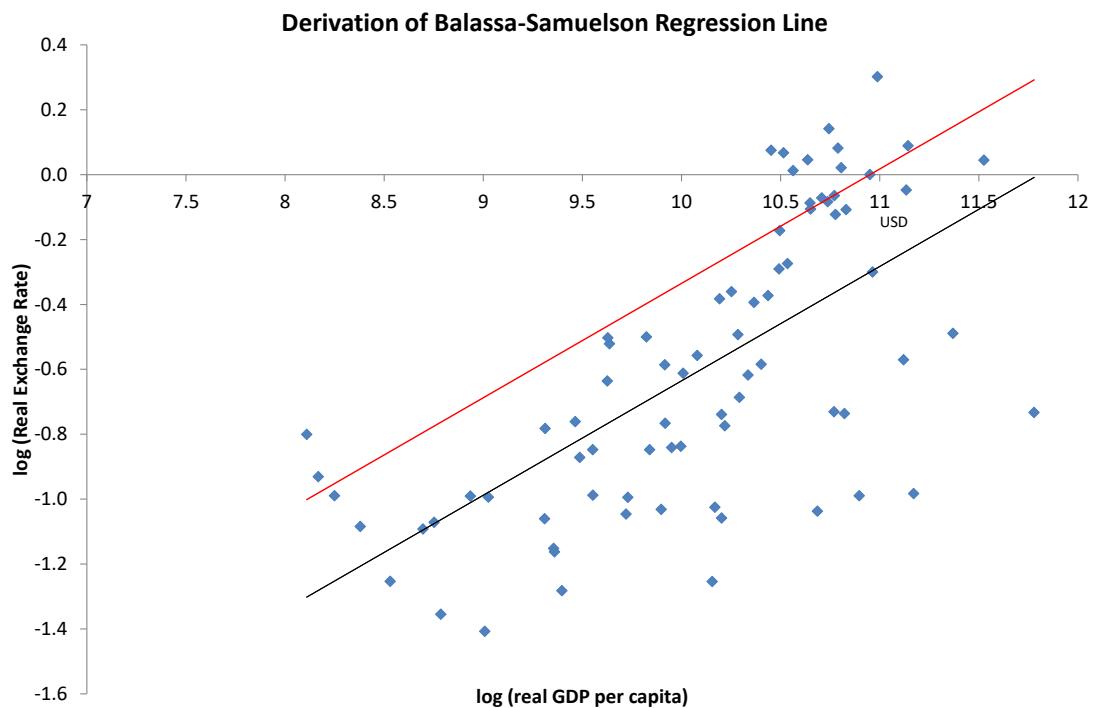
Emerging Market Currencies

The following chart seeks to establish the basis for the Balassa-Samuelson (B-S) regression line:

- This uses GDP per capita figures and PPP estimates as of December 2016 from the latest IMF WEO (based on interpolation of 2015 and 2016 estimates), together with actual exchange rates as of 31 December 2016
- The analysis covers countries in the MSCI ACWI, together with those countries that are categorized as frontier markets by at least two index providers – this results in 76 countries



One issue with some of the other applications of this approach is that they do not force the B-S line to go through the USD. This is illogical since the USD cannot appreciate nor depreciate with respect to itself. As such, our approach makes an adjustment such that the B-S line goes through the USD, which is shown in the following chart – the revised line is in red:



The regression co-efficient is shown to be 0.35. That is, a 1% growth differential in income per capita relative to the US is expected to add 35 bps per annum to the real exchange rate appreciation. Allowance is made in our assumptions for real exchange rates to move towards the B-S regression line. In particular, we assume that currencies move halfway towards the B-S line over a 20-year time horizon.

However, consideration is also given to the extent of any persistent current account deficits such that these deficits might be expected to preclude a currency from appreciating in real terms to the extent implied by the B-S relationship. In this regards, we make reference to the IMF forecasts for current account deficits at the end of their 5-year forecasts in the latest World Economic Outlook.

APPENDIX I

Currency Forwards and the Mechanics of Currency Hedged Returns

Foreign currency trading – for both hedging and active management purposes – is typically accomplished by utilizing forwards or exchange-traded futures contracts:

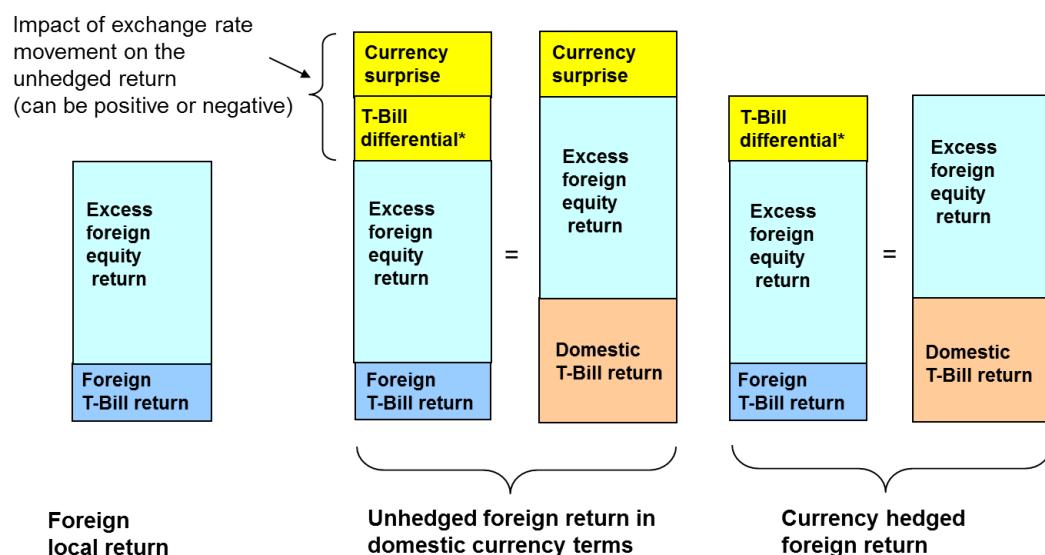
- Forward and futures contracts add counterparty risk.
- Currency hedged indices generally involve either 1-month or 3-month forwards in the methodology.

Due to the arbitrage arguments underlying **Covered Interest Rate Parity**, a forward exchange rate is very closely related to the current spot rate adjusted for the interest rate differentials. That is, hedging foreign currency exposure can be thought of as taking a short position in T-Bills of the foreign market and a long position in T-Bills of the domestic market.

A currency **hedged foreign return** can be decomposed into the following two components:

- Foreign local currency return of the investment instrument; and
- The impact of the current interest rate differential which is embedded in forward rates (which will be positive if the domestic interest rate exceeds the foreign interest rate and vice versa)

An **unhedged foreign return** has currency surprise as an additional component of the return. **Currency surprise** is the difference between the forward rate and the spot rate at maturity.



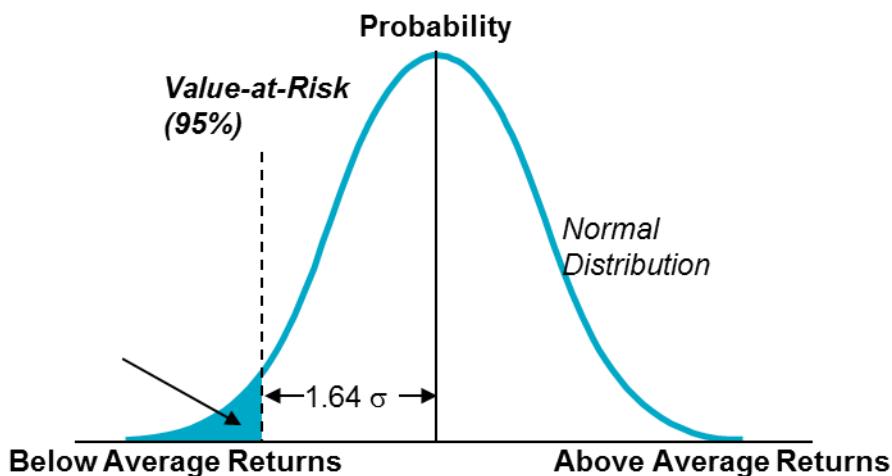
* Domestic T-Bill return less the foreign T-Bill return (can be positive or negative)

APPENDIX J

Downside Risk Measures

Value-at-Risk, or VaR, is defined as the potential loss of a portfolio at a specific confidence limit over a specific time horizon"

- **Time horizon = 1 year**; intuitive and appropriate for an institutional investor
- **Confidence level = 95%**; reflects extreme but plausible market conditions

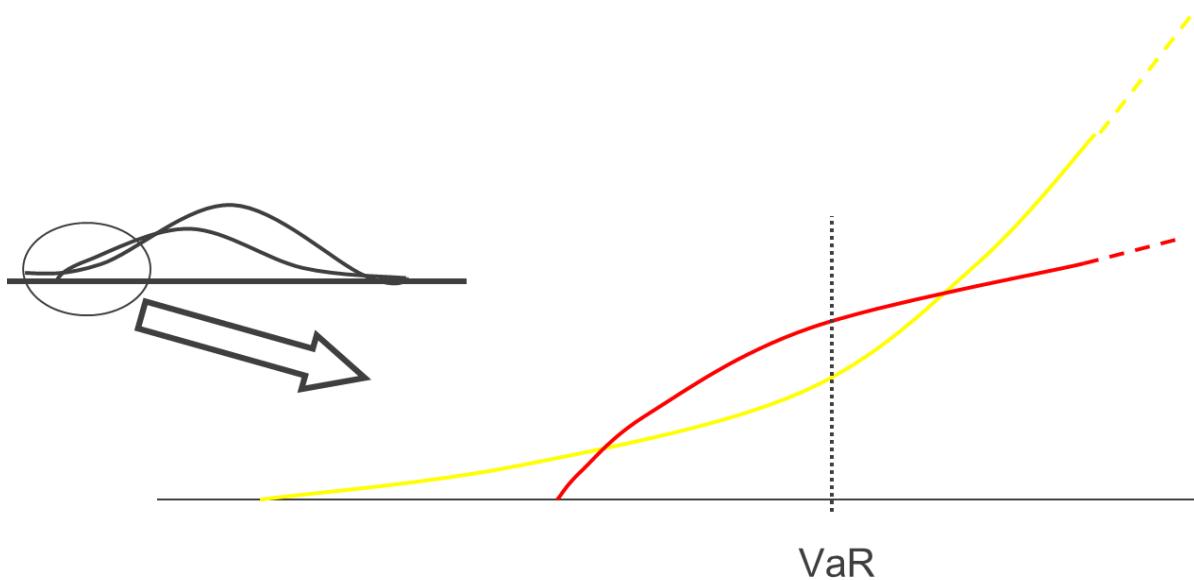


Value-at-Risk (VaR) is measure of the uncertainty in future market value returns, but with the emphasis being on **worse** than expected outcomes. While a normal distribution has been used for illustration purposes, asset class returns do not necessarily follow a normal distribution.

For example in the above diagram, there would be a 5% chance that the PRF will lose the VaR amount, *or more*, any one year; or the PRF should expect to lose *at least* the VaR amount in one out of 20 years. This might be regarded as a "worst case" outcome.

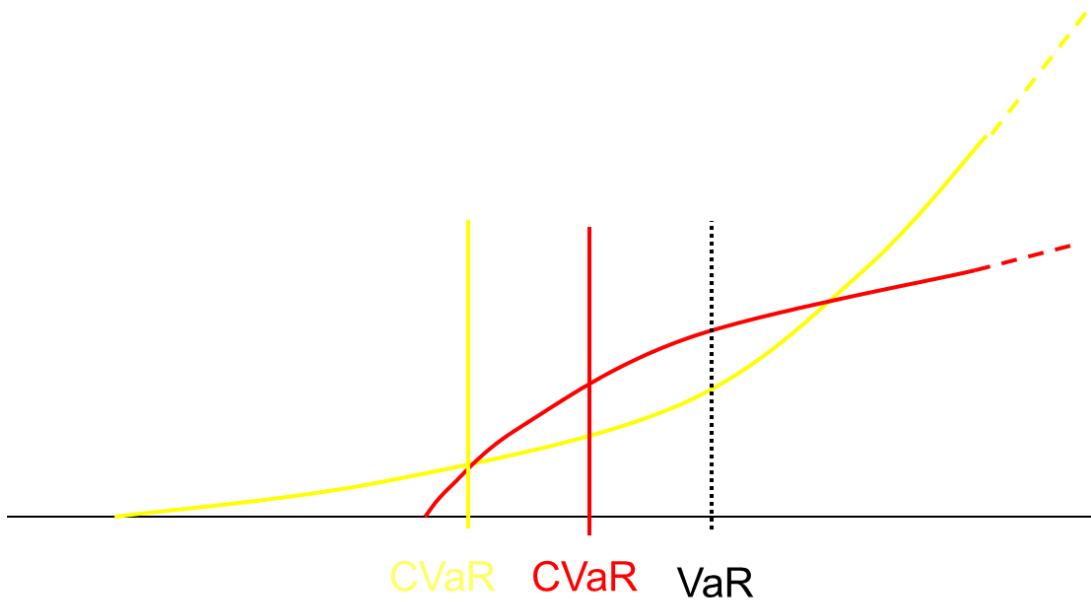
Conditional Value-at-Risk, or CVaR, is the average return of the bottom 5% of the trials (the trials below the VaR level) assuming a 95% confidence level as above. This is also down as Expected Shortfall and is a more useful measure of downside (or "tail") risk, as discussed below.

The following chart illustrates two possible distributions of expected returns, with an emphasis on the extreme downside. Which distribution is the riskier?



Clearly the portfolio with the yellow distribution is the riskier. However, VaR in this example would suggest both distributions have the same “risk”.

When CVaR is included, as below, we can see that CVaR highlights the higher risk of the yellow distribution.



APPENDIX K

Regional Equity Considerations

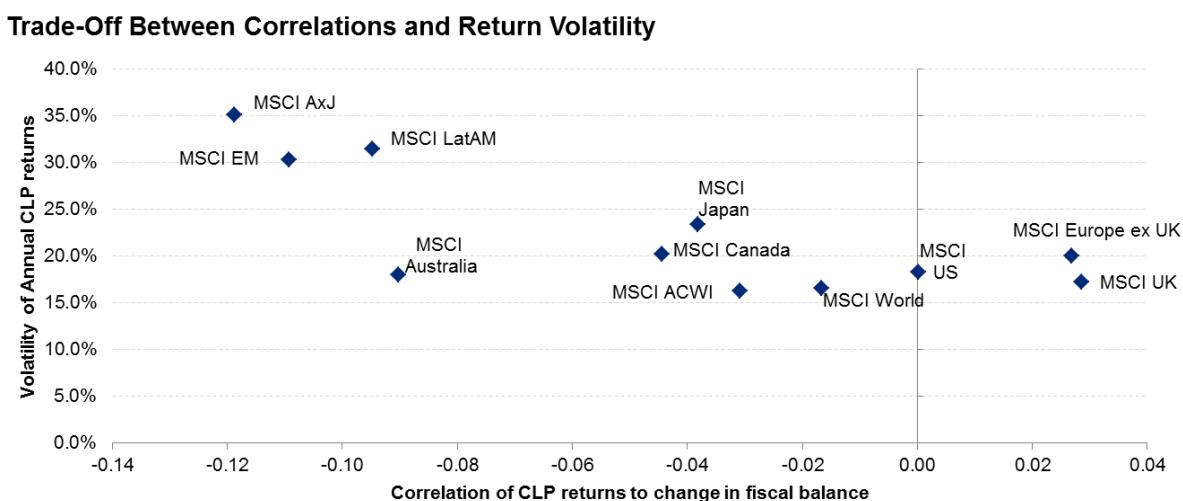
We have been requested to consider the possibility of breaking down the global equity asset class, by region or degree of development to see if some subsets could provide hedging benefits (from a CLP perspective).

In this respect, we have undertaken an analysis of the potential trade-offs in respect of the impact on the volatility of equity market returns from a CLP perspective relative to the correlation of those returns to changes in the fiscal balance. In particular, we have analyzed the historical relationships over the 25 year period to the end of 2016.

The regional equity markets that we have assessed in this analysis are:

- MSCI All Countries World Index (MSCI ACWI)
- MSCI World Index (MSCI World)⁴³
- MSCI Emerging Markets Index (MSCI EM)
- MSCI All Countries Asia ex Japan Index (MSCI AxJ)
- MSCI Latin America Index (MSCI LatAM)
- MSCI US Index (MSCI US)
- MSCI Europe ex UK Index (MSCI Europe ex UK)
- MSCI UK Index (MSCI UK)
- MSCI Japan Index (MSCI Japan)
- MSCI Canada Index (MSCI Canada)
- MSCI Australia Index (MSCI Australia)

The results of the analysis are summarized in the following chart:



⁴³ The MSCI World Index comprises the countries that MSCI considers to be Developed Markets whereas the MSCI ACWI comprises both Developed and Emerging Markets

In general, the larger developed markets have lower volatility from a CLP perspective, but provide less diversification, while the emerging markets provide better diversification but represent much higher volatility from a CLP perspective.

The analysis suggests that higher allocations to emerging markets within the equity portfolio could potentially enhance the diversification benefits to the PRF in an overall context. However, this would come with higher return volatility.

The current weighting to emerging markets in the MSCI All Countries World Index is around 10%. While an increased allocation to emerging markets would marginally increase the diversification benefits with a marginal increase in volatility, it will also marginally increase the complexity due to either:

- A need to utilize a customized benchmark comprising a higher weighting to emerging markets; or
- To have an additional mandate to manage the additional emerging markets exposure

On balance, we consider that the MSCI All Countries World Index provides the most appropriate basis for the global equity exposure for the PRF.

APPENDIX L

Derivation of Candidate Portfolios – Unhedged Asset Classes

Candidate Asset Allocations – Current Asset Classes

The following table shows the results from our optimization model on the basis that all asset classes continue to be managed on an unhedged basis. It should be noted that unlike MVO where volatility is the risk measure that is optimized, our model uses Conditional Value-at-Risk (CVaR) at a 5% level. That is, for a particular level of target expected return, the optimizer generates the portfolio with the best CVaR.

Asset Class	Asset Allocation						
	Current %	A %	B %	C %	D %	E %	F %
Broad Market Equities	15.0	36.7	41.0	49.9	59.3	67.7	74.0
Sovereign Bonds (Nominal)	48.0	30.9	28.7	27.3	32.9	25.2	0.0
Investment Grade Corporates	20.0	0.0	0.0	0.0	0.0	7.1	26.0
Inflation-Linked (Sovereigns)	17.0	32.5	30.3	22.8	7.7	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	1.3	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	9.9	10.1	10.5	11.1	12.0	13.1

Table M-1: Optimal Portfolios under Mercer Optimizer – Unconstrained Current Asset Classes

At lower volatility levels, the optimization approach prefers to balance the equity allocations with sovereign bonds and inflation-linked bonds, while corporate bonds only being preferred with higher equity allocations. While a bias towards sovereign bonds is logical at lower volatility levels, given these diversify more effectively against equities, we consider the above outcomes represent too extreme a bias. Equally, at higher volatility levels, an allocation to sovereign bonds should provide better diversification to equities than corporate bonds especially in down markets for equities.

As such, we have revised the optimization process by introducing a constraint that the global bond allocation should be 70% sovereign bonds and 30% corporate bonds.

The following table shows the results from our optimization model with this constraint. It should be noted that this model is unable to establish a portfolio to achieve a 3.5% real geometric return with the constraints on the global fixed income allocation.

Asset Class	Asset Allocation						
	Current %	A %	B %	C %	D %	E %	F %
Broad Market Equities	15.0	34.8	39.4	48.1	57.3	66.9	74.0
Sovereign Bonds (Nominal)	48.0	20.5	17.4	19.5	21.1	22.4	0.0
Investment Grade Corporates	20.0	8.8	7.5	8.4	9.1	10.6	26.0
Inflation-Linked (Sovereigns)	17.0	35.9	35.7	24.0	12.5	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	1.2	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	10.0	10.1	10.5	11.1	12.0	13.1

Table M-2: Optimal Portfolios under Mercer Optimizer – Constrained Current Asset Classes

Given that the risk/return statistics are similar to those derived under the unconstrained analysis we propose to use this constrained frontier as it is better diversified. As such, as we consider the impact of adding additional asset classes, we will incorporate this constraint on the global bond allocation.

Candidate Asset Allocations – All Asset Classes

We now extend the analysis to include the additional asset classes. Especially in respect of the private market asset classes (real estate and infrastructure) being considered, an unconstrained approach to these asset classes is likely to lead to them being heavily favored by quantitative optimizer since the quantitation process cannot capture all the risks inherent in these asset classes. This reflects the fact that the returns for these asset classes tend to be smoothed, primarily as a result of the appraisal-based nature of the valuations of private investments.

As such, we have incorporated the following constraints for the additional asset classes:

- Maximum of 10% for total real estate exposure, public and private
- Maximum of 10% for total infrastructure exposure, public and private
- Maximum of 10% for global high yield exposure
- Maximum of 10% for Agency Residential MBS

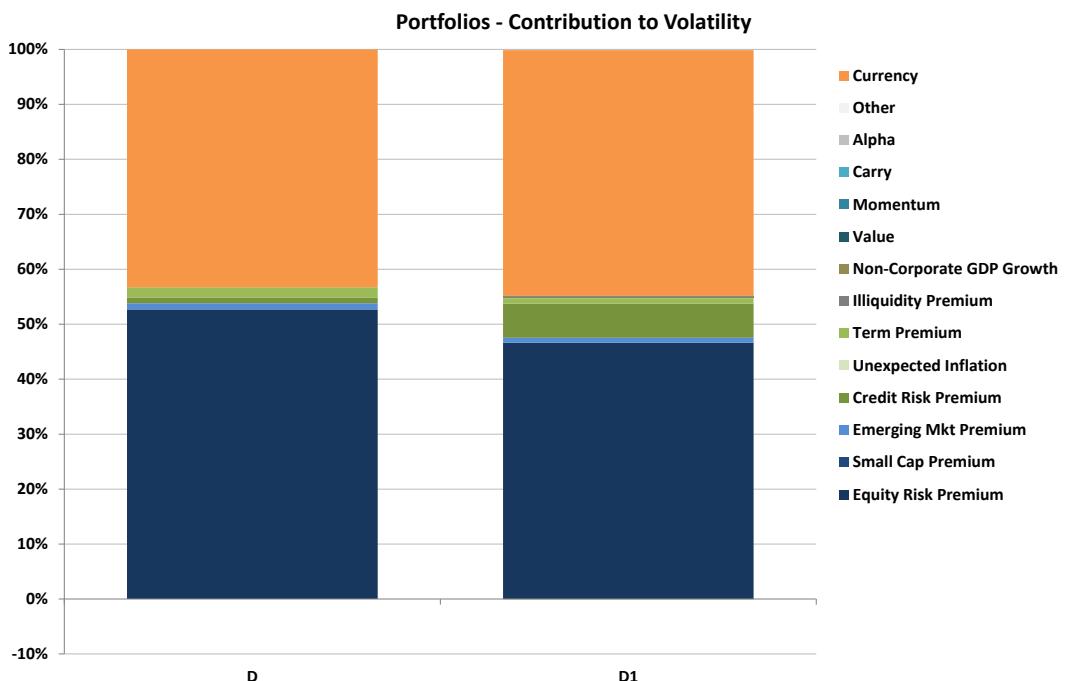
The following table is based on the results from our optimization model.

Asset Class	Asset Allocation						
	Current %	A %	B %	C %	D %	E %	F %
Broad Market Equities	15.0	24.0	34.3	39.0	45.4	54.8	65.6
Real Estate - Listed		2.0					
Real Estate - Core		9.4	4.3	7.5	10.0	10.0	10.0
Infrastructure - Listed							
Infrastructure - Core							
Sovereign Bonds (Nominal)	48.0	18.0	13.8	8.8	12.7	14.8	10.1
Investment Grade Corporates	20.0	7.7	5.9	3.8	5.5	6.3	4.3
Inflation-Linked (Sovereigns)	17.0	38.7	37.0	31.0	16.5	4.0	
High Yield							
Agency Residential MBS			4.6	10.0	10.0	10.0	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	1.2	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	10.1	10.1	10.4	11.0	11.7	12.7

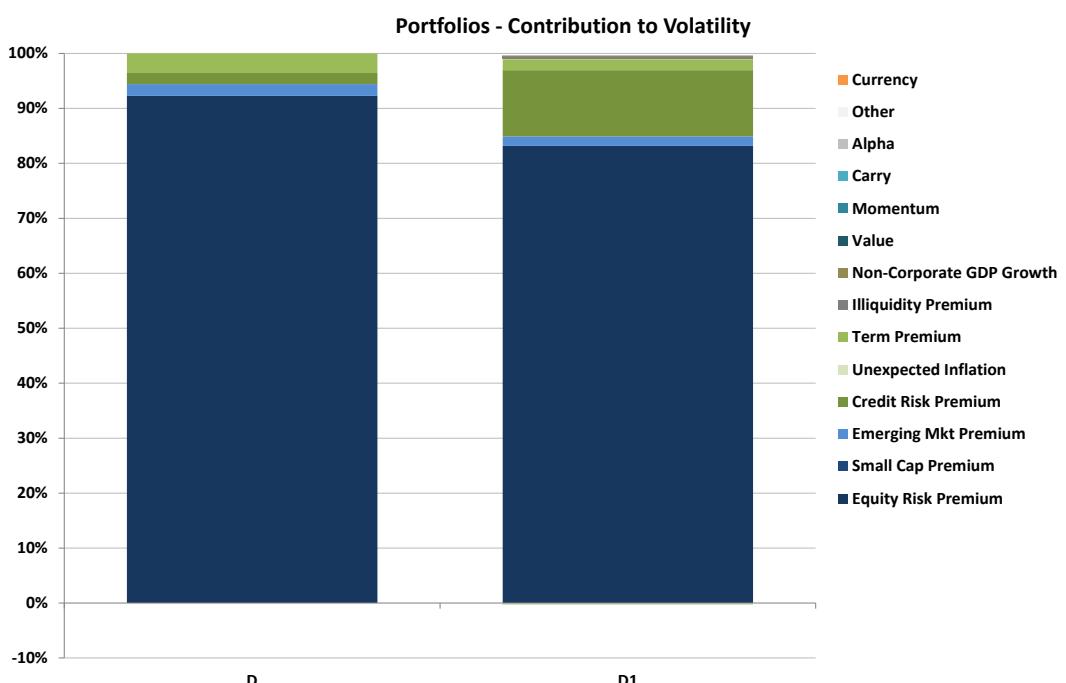
Table M-3: Optimal Portfolios under Mercer Optimizer – Constrained Additional Asset Classes

The optimizer prefers private real asset classes over the public ones, which is not unexpected given the superior risk/return characteristics of the former. However, while these portfolios have lower volatility than those derived with the existing asset classes, the results are not that material. For example, with Portfolio D, the volatility only reduces from 11.1% to 11.0% with respect to Table M-2 relative to Table M-3. As such, while the inclusion of the private asset classes does improve the outcomes and represents a better diversification, the impact is relatively minor especially given the greater complexity that the exposures to the private assets would introduce.

The diversification enhancement is relatively modest, as the following chart from our Global Portfolio Tool shows. The charts show the contribution to portfolio volatility on a risk factor basis – D is the portfolio from the constrained efficient frontier for the existing asset classes (ie in Table M-2) and D1 the comparable portfolio from Table M-3.



In this case, currency risk and the equity risk premium dominate – currency risk contributes 43% to portfolio volatility for Portfolio D and 45% for D1. The following chart is similar, but shows the impact if currency exposures were assumed to be hedged. In this case, the equity risk premium dominates the contributions to portfolio volatility – 92% for D and 84% for D1.

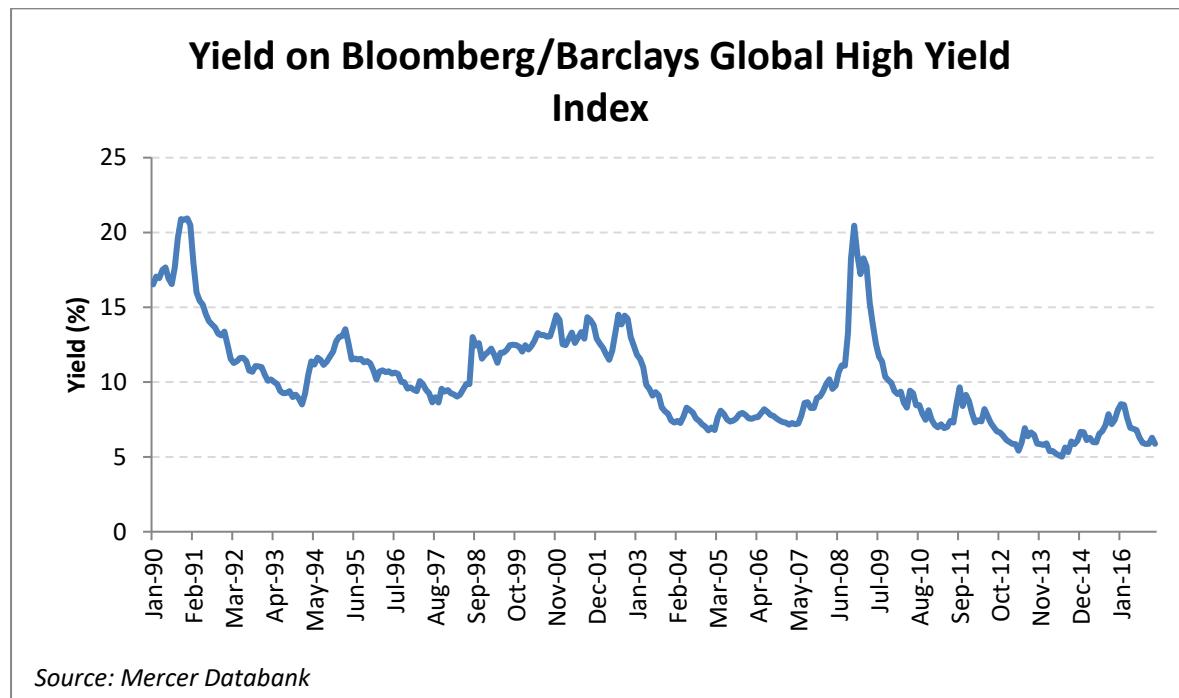


From a practical perspective, achieving a 10% allocation to the private market asset classes will involve some challenges. The exposures to these asset classes can potentially be implemented

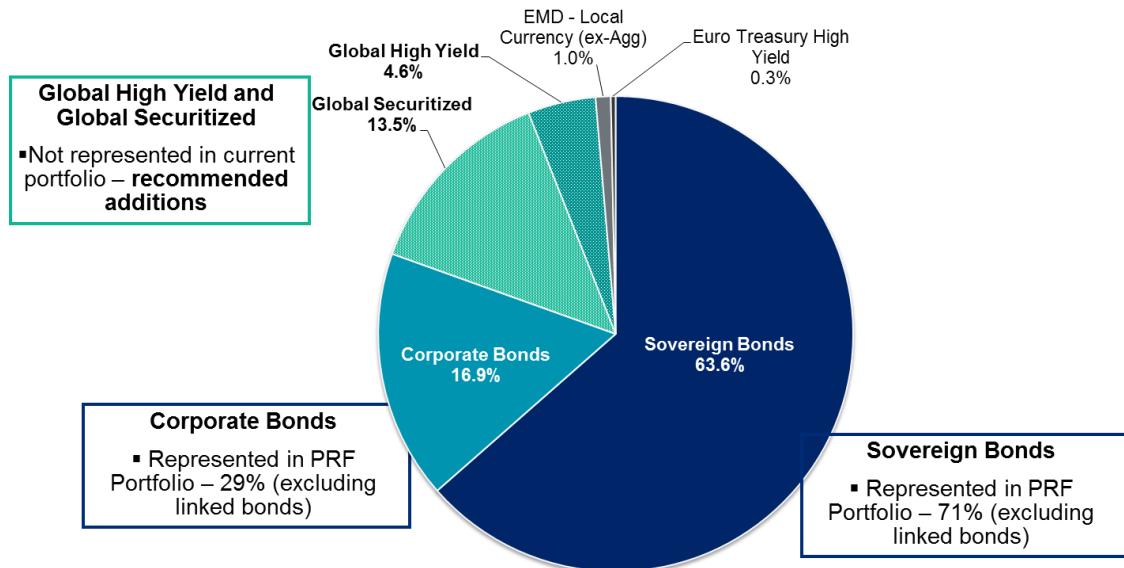
through direct investments or, more realistically through fund investments given the size of the allocations. With fund investments, it is necessary to make a commitment to invest into the fund, but the timing of the calls for such capital commitments is unknown. As such, it is impractical to achieve the target allocation and most investors tend to be under-allocated to these asset classes. The need to ensure that sufficient liquid assets are available to meet such unknown capital calls creates additional administrative issues for investors allocating to these asset classes.

Therefore, from this perspective, we suggest that the optimization be further constrained to a maximum of 2.5% each for real estate and infrastructure. We have chosen this approach rather than just having an overall limit to real assets in aggregate to maximize the diversification benefits that any real assets exposure would bring.

While the optimizer likes the diversification provided by Agency Residential MBS, the allocations appear relatively high compared with other fixed income asset classes, especially at higher volatility levels. The lack of exposure to global high yield, except at high volatility levels, is also partly a function of where the yields on such securities are at present since these yields result in lower expected returns than we would normally see from these securities. This is illustrated in the following chart:



In this respect, the Bloomberg Barclays Multiverse Index, the broadest available benchmark for global fixed income exposure, is currently composed of the following sectors:



Benchmark data from Bloomberg/Barclays

An alternative approach would be to structure the nominal fixed income exposure in a manner broadly consistent with the weights of the Multiverse Index since this represents the full universe of global fixed income securities. Therefore, we have rerun the optimizer assuming the following revised constraints:

- Maximum of 2.5% for both private real estate and infrastructure
- Nominal fixed income exposure to be approximately 65% sovereigns, 20% investment grade corporates, 10% Agency Residential MBS and 5% High Yield

The following table shows the results from our optimization model.

Asset Class	Asset Allocation						
	Current %	A %	B %	C %	D %	E %	F %
Broad Market Equities	15.0	32.2	36.5	45.0	53.8	63.5	75.2
Real Estate - Listed							
Real Estate - Core		2.4	2.5	2.5	2.5	2.5	2.5
Infrastructure - Listed							
Infrastructure - Core							
Sovereign Bonds (Nominal)	48.0	16.1	15.0	17.7	21.0	22.1	14.5
Investment Grade Corporates	20.0	5.0	4.6	5.4	6.4	6.8	4.5
Inflation-Linked (Sovereigns)	17.0	40.7	37.9	25.4	11.5		
High Yield		1.2	1.2	1.4	1.6	1.7	1.1
Agency Residential MBS		2.5	2.3	2.7	3.2	3.4	2.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.1	1.3	1.5	2.0	2.5	3.0	3.5
Standard Deviation (Risk) (%pa)	10.7	10.0	10.1	10.5	11.1	11.9	13.1

Table M-4: Optimal Portfolios under Mercer Optimizer – Revised Constrained Additional Asset Classes

Final Candidate Asset Allocations

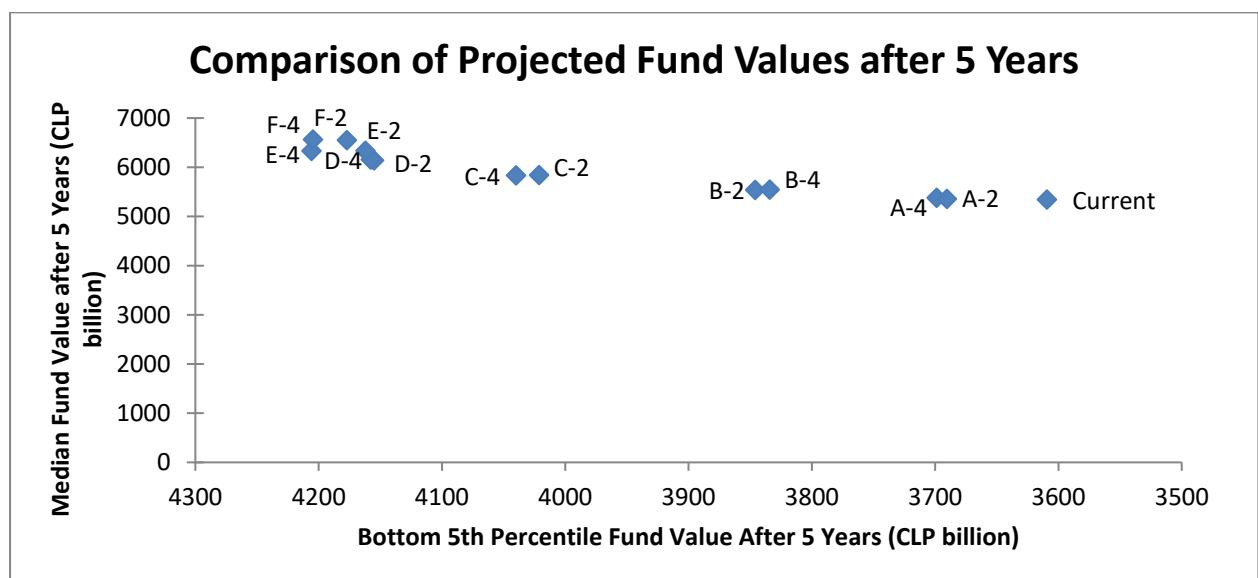
Based on the above discussion, the candidate asset allocations we will examine in the next section are as follows:

Asset Class	Asset Allocation												
	Current %	A-2 %	A-4 %	B-2 %	B-4 %	C-2 %	C-4 %	D-2 %	D-4 %	E-2 %	E-4 %	F-2 %	F-4 %
Broad Market Equities	15.0	30.7	30.4	36.5	36.1	45.9	43.0	56.4	52.5	69.7	62.7	84.1	77.5
Real Estate - Listed													
Real Estate - Core							2.5			2.5		2.5	
Infrastructure - Listed													
Infrastructure - Core												2.5	2.5
Sovereign Bonds (Nominal)	48.0	19.5	16.4	23.1	20.0	28.9	24.7	30.8	29.2	21.4	21.0	11.2	11.4
Investment Grade Corporates	20.0	8.1	5.1	9.6	6.2	12.0	7.6	12.8	9.0	8.9	6.5	4.7	3.5
Inflation-Linked (Sovereigns)	17.0	41.7	44.3	30.8	33.1	13.2	16.5			0.0			
High Yield				1.3		1.5	1.9		2.3		1.6		0.8
Agency Residential MBS				2.5		3.1	3.8		4.5		3.2		1.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Expected Geometric Real Return (%)	0.5	1.2	1.2	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.5	3.5
Standard Deviation (Risk) (%pa)	10.4	9.8	9.8	9.9	9.9	10.2	10.2	10.8	10.8	11.9	11.8	13.5	13.3

Analysis of Candidates

Projected Fund Values

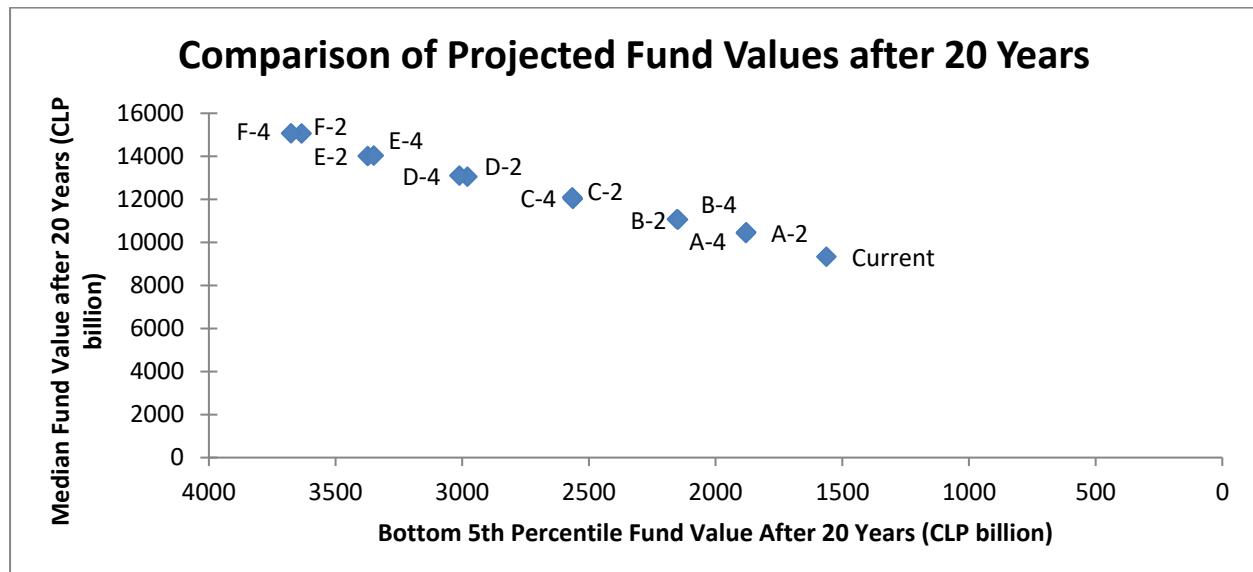
The following chart shows the projected position for the candidate portfolios after five years. The horizontal axis represents the bottom 5th percentile of the distribution for the projected fund value after 5 years while the vertical axis is the median of that distribution.



In general as the allocation to risky assets increases, the risk/return position from the perspective of “worst-case” outcomes improves. That is, the more conservative portfolios

represent a higher risk position in the sense that these lead to lower projected fund value levels even in the “worst-case” situations. The outcomes for portfolios D, E and F in their various forms are not that different from each other, either in terms of the median outcomes or the “worst-case” ones.

The next chart is similar, but looks at a 20-year horizon. In this case, the variations are much more significant as we go from portfolio A to portfolio F. However, the differences between the portfolios generated from the two frontiers are not that significant, although generally those produced from the more diversified Frontier 4 are slightly superior.



Probability of Not Achieving Real Return Targets

One important risk assessment is the likelihood of not achieving investment objectives. The following table shows, for each of the candidate portfolios, the probability of not achieving the various real return investment objectives over various time horizons.

Objective	Time Horizon	Current %	A-2 %	A-4 %	B-2 %	B-4 %	C-2 %	C-4 %	D-2 %	D-4 %	E-2 %	E-4 %	F-2 %	F-4 %
1% pa real return	3	52.7	47.4	47.2	45.6	45.3	42.8	42.5	40.3	40.2	38.0	37.9	36.2	36.1
	5	53.5	46.4	46.2	44.1	43.9	40.4	40.0	37.2	37.2	34.1	34.1	32.4	32.1
	10	53.9	43.0	42.8	39.8	39.5	35.1	34.7	30.8	31.0	26.0	26.2	22.7	22.5
1.5% pa real return	3	56.1	51.0	50.9	48.9	48.8	46.0	45.8	43.4	43.3	40.8	40.8	38.9	38.8
	5	57.6	50.8	50.7	48.5	48.3	45.0	44.6	41.3	41.2	38.0	37.8	35.7	35.6
	10	59.8	49.6	49.3	46.2	46.0	41.6	41.2	36.9	37.0	31.6	31.6	27.6	27.3
2% pa real return	3	59.0	54.2	54.3	52.4	52.3	49.3	49.3	46.5	46.6	43.9	43.9	41.5	41.4
	5	61.6	55.2	55.1	53.1	52.7	49.5	49.0	45.6	45.5	41.8	41.7	39.1	38.8
	10	65.6	56.3	56.0	53.3	53.0	48.5	47.7	43.2	43.2	37.5	37.4	32.8	32.7
2.5% pa real return	3	62.2	57.9	57.7	55.9	55.9	53.1	52.7	50.2	50.1	46.9	46.8	44.3	44.2
	5	65.7	59.6	59.5	57.7	57.5	54.2	53.9	50.2	50.2	45.9	46.0	42.7	42.5
	10	70.9	62.6	62.4	59.5	59.2	54.6	54.2	49.6	49.6	43.5	43.5	38.4	38.3
3% pa real return	3	65.3	61.1	61.1	59.3	59.2	56.3	56.0	53.3	53.3	49.9	49.9	47.0	47.1
	5	69.2	64.0	63.9	61.7	61.6	58.4	58.1	54.6	54.7	50.2	50.1	46.5	46.4
	10	76.2	68.9	68.7	66.0	65.7	61.2	60.6	56.0	56.0	49.7	49.6	44.0	43.9

It should be noted that, while these portfolios have in general being established to achieve a specific expected real geometric return, by their nature, they will tend to have around a 50% chance of actual returns being higher than expected and 50% chance of being lower.

In this respect, we consider that one important criterion for an investment objective is that it must be achievable. In general, we would advocate that the probability of achieving an investment objective should be at least 67% - in other words, from the perspective of a risk measure, the probability of **not** achieving the objective should be no more than 33%. However, in the above table, we have highlighted those portfolios than would have a probability of not achieving the relevant real return objective of not more than 40%.

With reference to the above table, the proposed real return objectives would need to be accompanied by an appropriate time horizon. For example, if the investment objective were to be a real rate of return of at least 2% per annum, the time horizon would need to be at least 10 years. This would necessitate consideration being given to E-2, E-4, F-2 and F-4 portfolios.

It will be noted that the inclusion of equities for shorter horizons still reduces the probability of not achieving the investment objectives even though the asset class could face considerable losses in the short-term. However, this outcome is a function of the following factors:

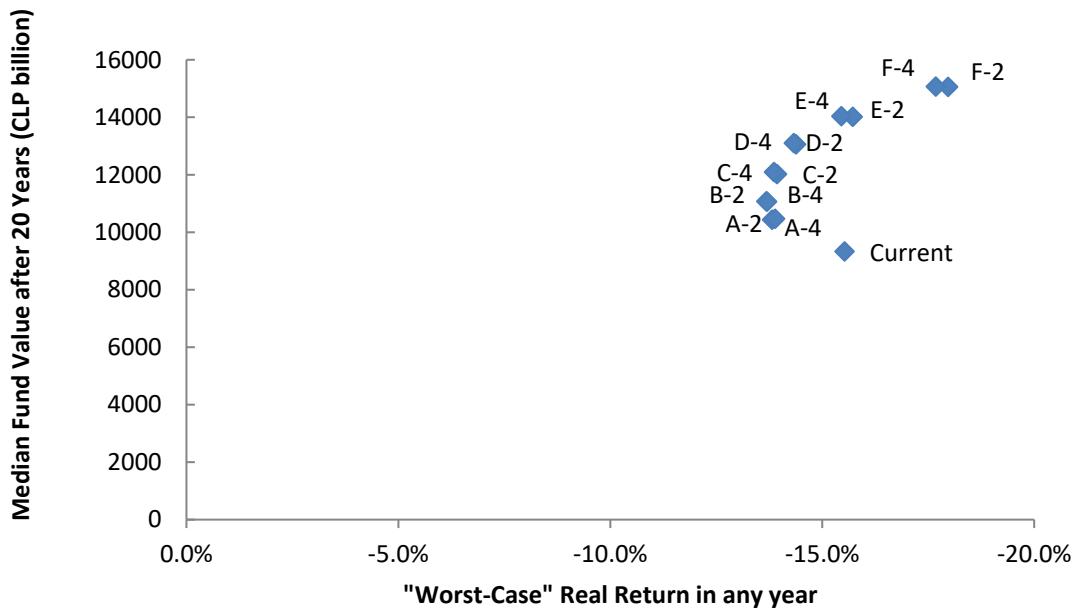
- The negative correlation between movements in the CLP and equity markets; and
- The low expected real returns on the fixed income asset classes and the unhedged nature of those asset classes such that, as discussed in Section 4.1, the differences in volatility between equities and fixed income is not as great as might be expected.

Other Considerations

The above analysis has focused on analyzing the portfolios from a longer-term perspective. Another consideration will be concerns on extremely negative returns in the short-term – for example, at present, the approach has been to have a 95% probability that the Fund would not lose more than 10% of its value in USD terms in a given year.

The following chart compares the projected fund value after 20 years with “worst-case” returns in any year – that is, the bottom 5th percentile of the distribution of the simulated real returns in any year. This is similar to the current risk tolerance, except that the figures below are in real terms (rather than nominal) and in CLP terms (rather than USD).

Comparison of Projected Fund Value and Short-Term Downside Risk



The situation is similar to the efficient frontier analysis in the current SAA is not optimal. The “least risk” position in this instance is associated with portfolios B although there is not much difference in the outcomes for portfolios A and C. The lack of significant variation in the outcomes is primarily a function of the asset classes being considered on an unhedged basis and the resulting impact the CLP currency movements will have on the “worst-case” outcomes for all portfolios.

The following table shows the CVaRs for the candidate portfolios – CVaR is a more useful risk measure when tail risk is the risk being considered. It is the average return of the bottom 5% of the trials (the trials below the VaR level). Therefore, CVaR @ 5% confidence is the average return in the bottom 5% of the trials. This measure captures the non-normal extreme tail events that are present in the simulations.

Portfolio	CVaR @ 5%
Current	-19.3%
A-2	-17.7%
A-4	-17.7%
B-2	-17.5%
B-4	-17.5%
C-2	-17.8%
C-4	-17.8%
D-2	-18.7%
D-4	-18.6%
E-2	-20.4%
E-4	-20.1%
F-2	-23.3%
F-4	-22.9%

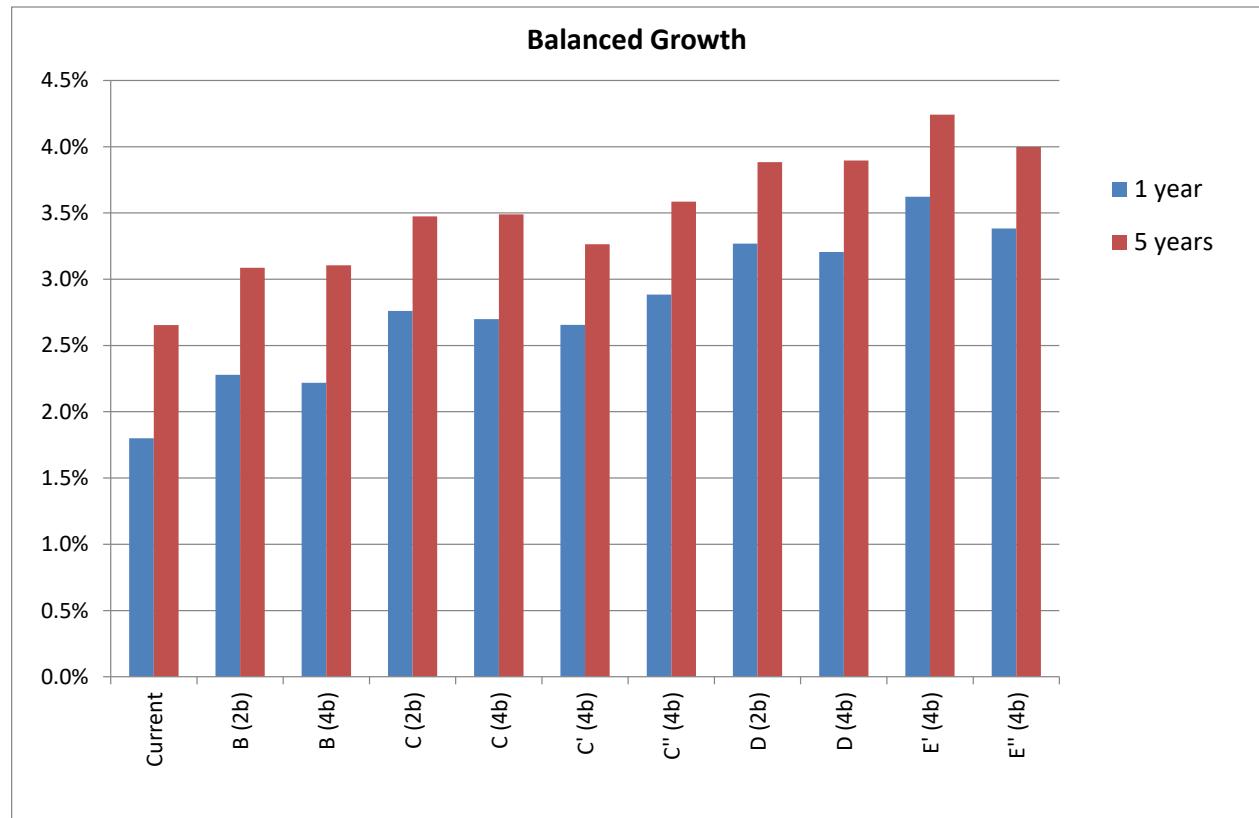
We have also analyzed the correlation between real portfolio returns and the expected movement in the fiscal position in order to assess how different candidate portfolios might improve diversification from an overall perspective. All the candidate portfolios exhibit modest negative correlation but the figures do not vary significantly from one portfolio to another. This suggests that it is the unhedged nature of the asset classes that is the key determinant of the diversification rather than the exposure to the asset classes themselves.

APPENDIX M

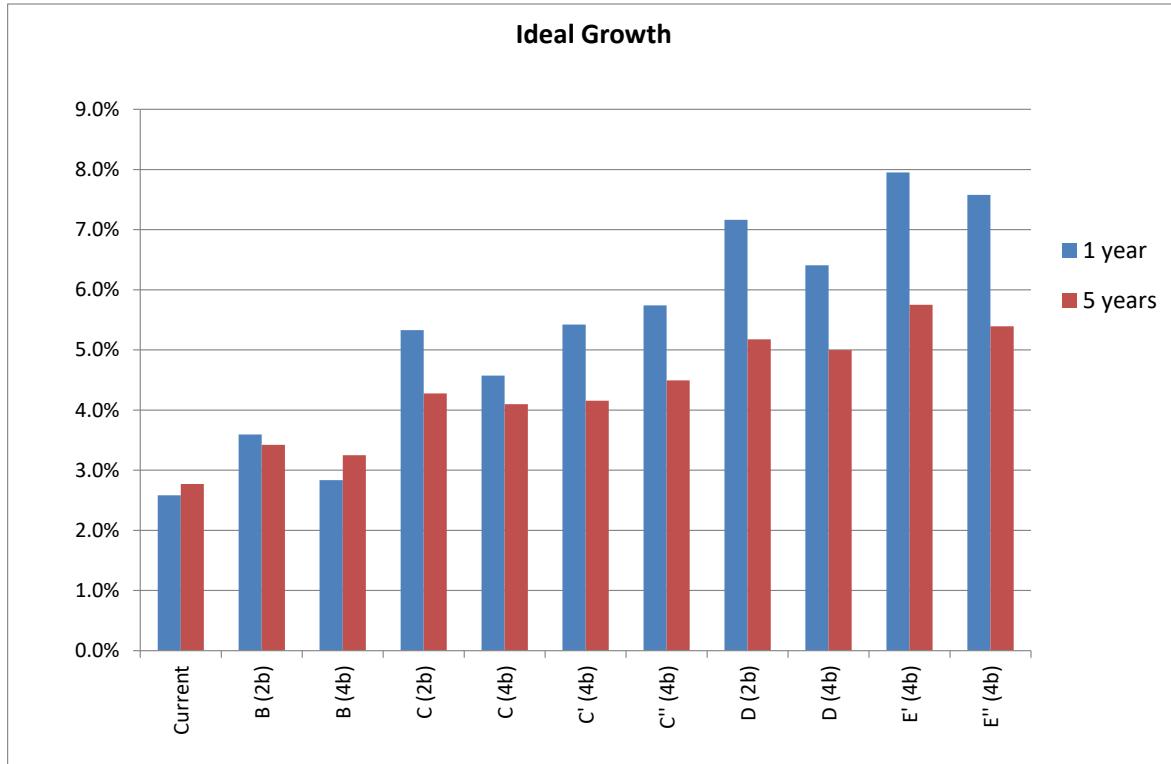
Detailed Output from Scenario Analysis

In this appendix we include the detailed results for the various portfolios under the different scenarios. The returns are shown over a one-year and a five-year horizon from a CLP perspective.

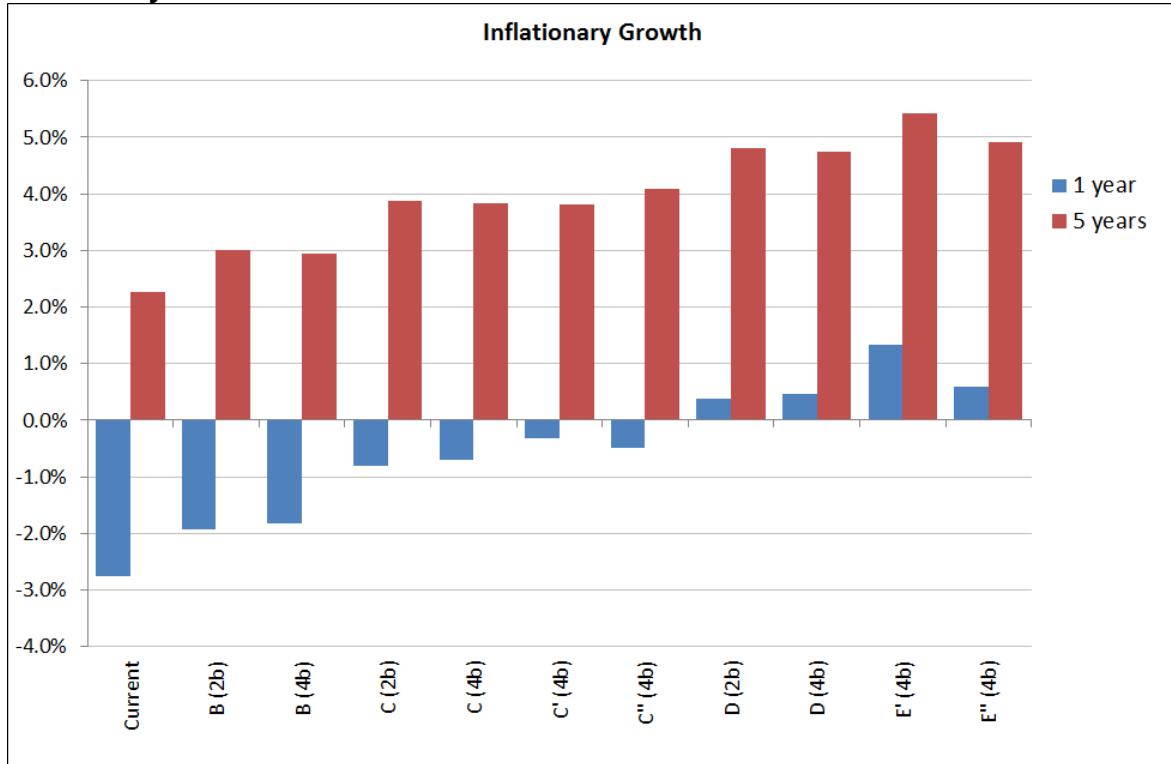
Balanced Growth



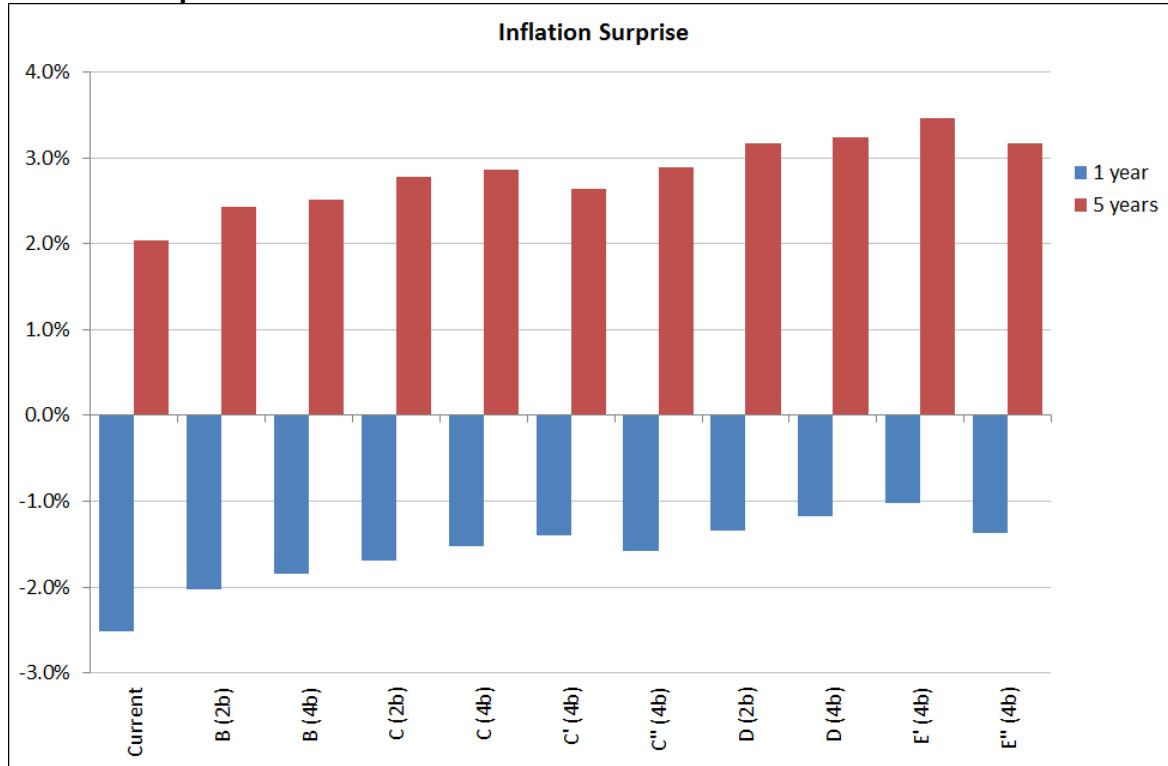
Ideal Growth



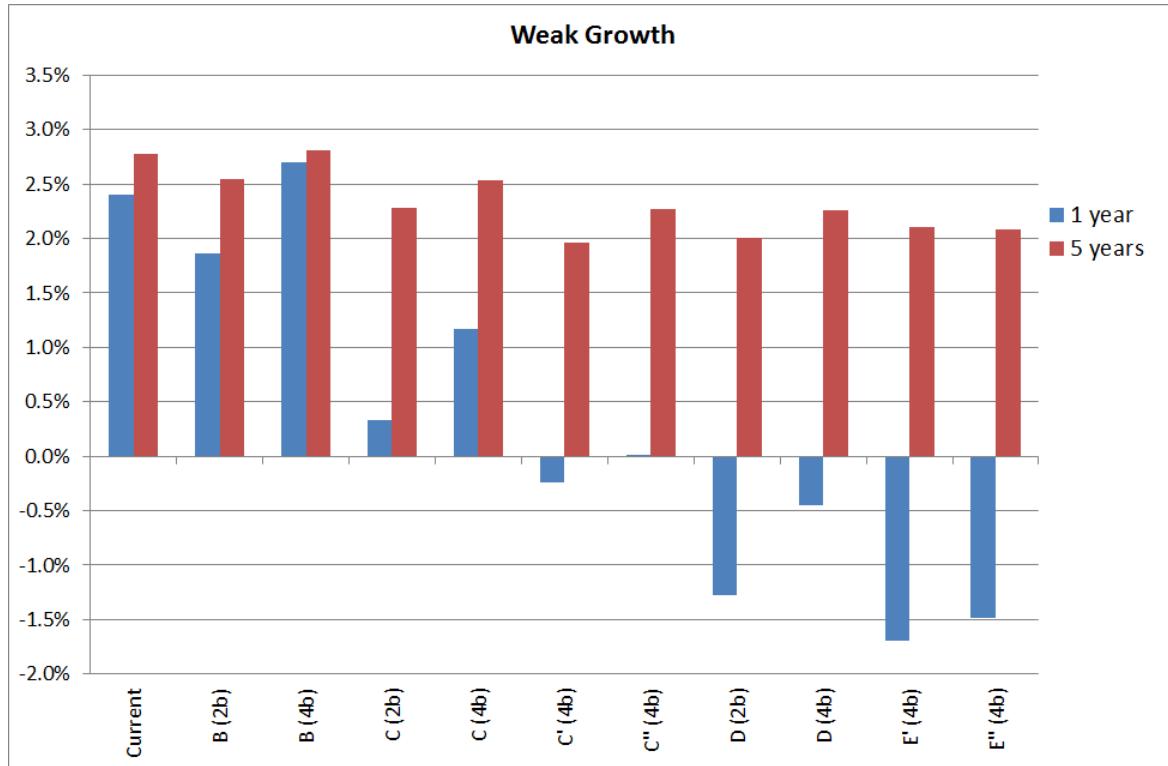
Inflationary Growth



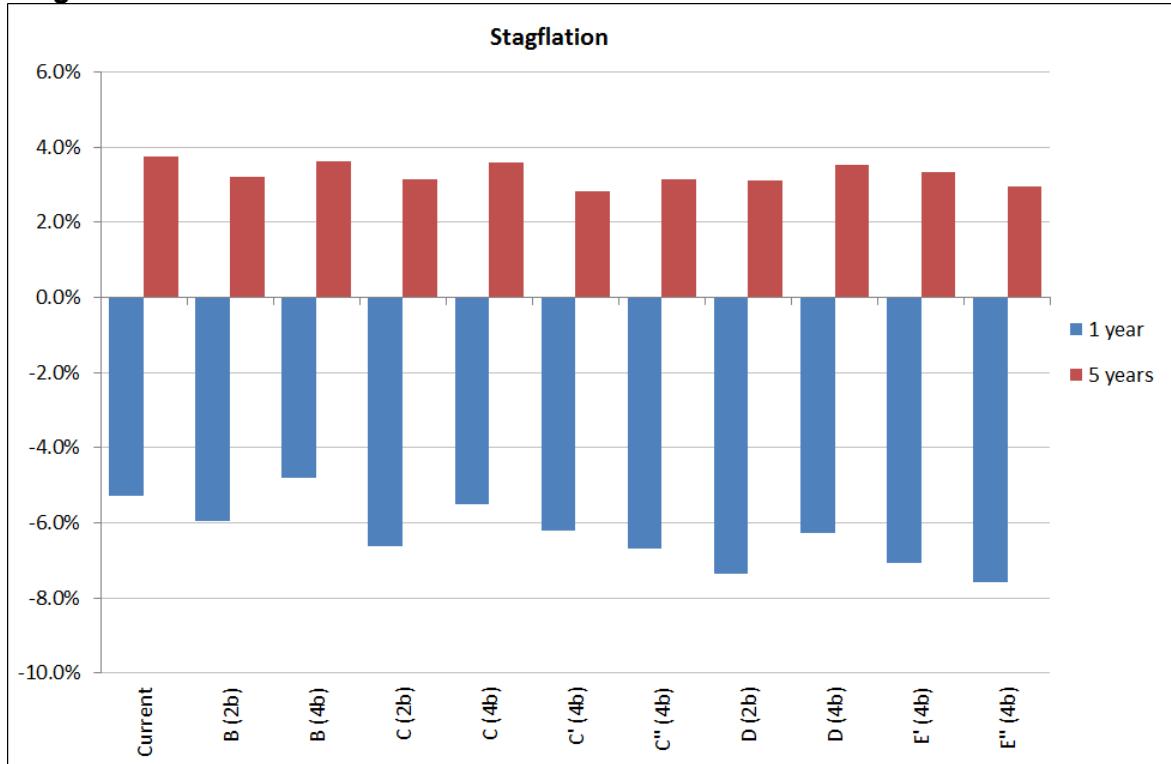
Inflation Surprise



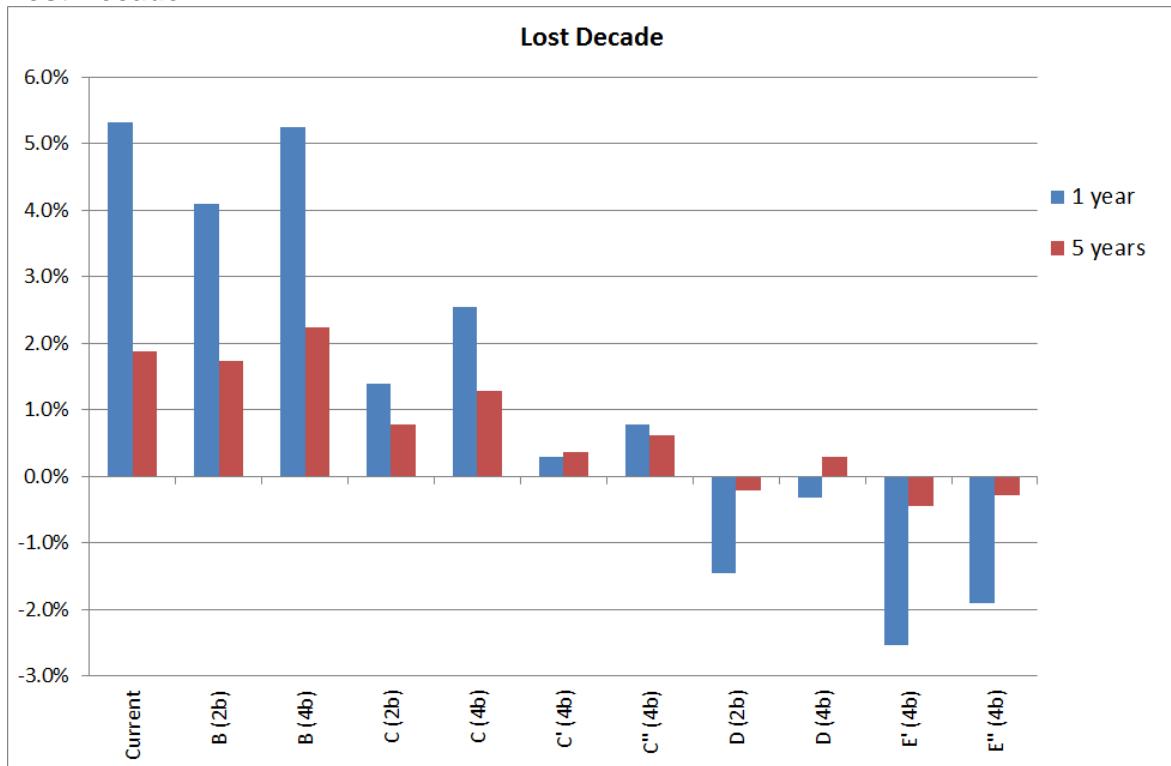
Weak Growth



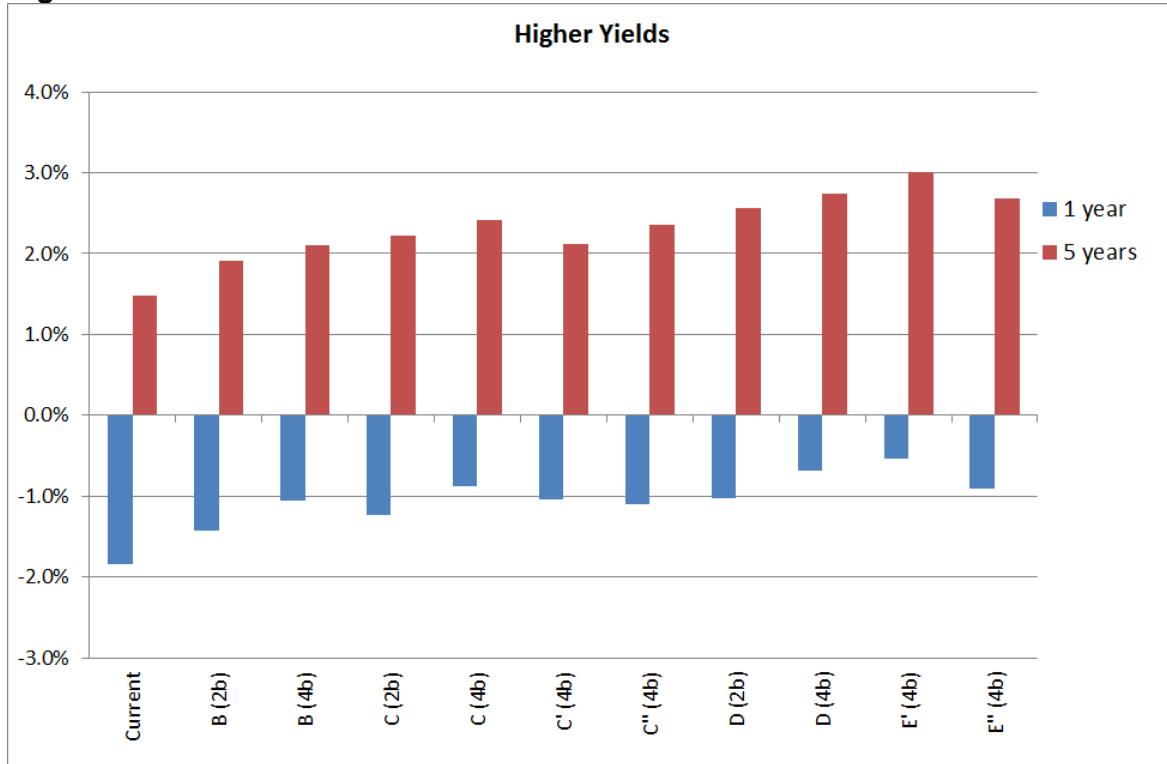
Stagflation



Lost Decade



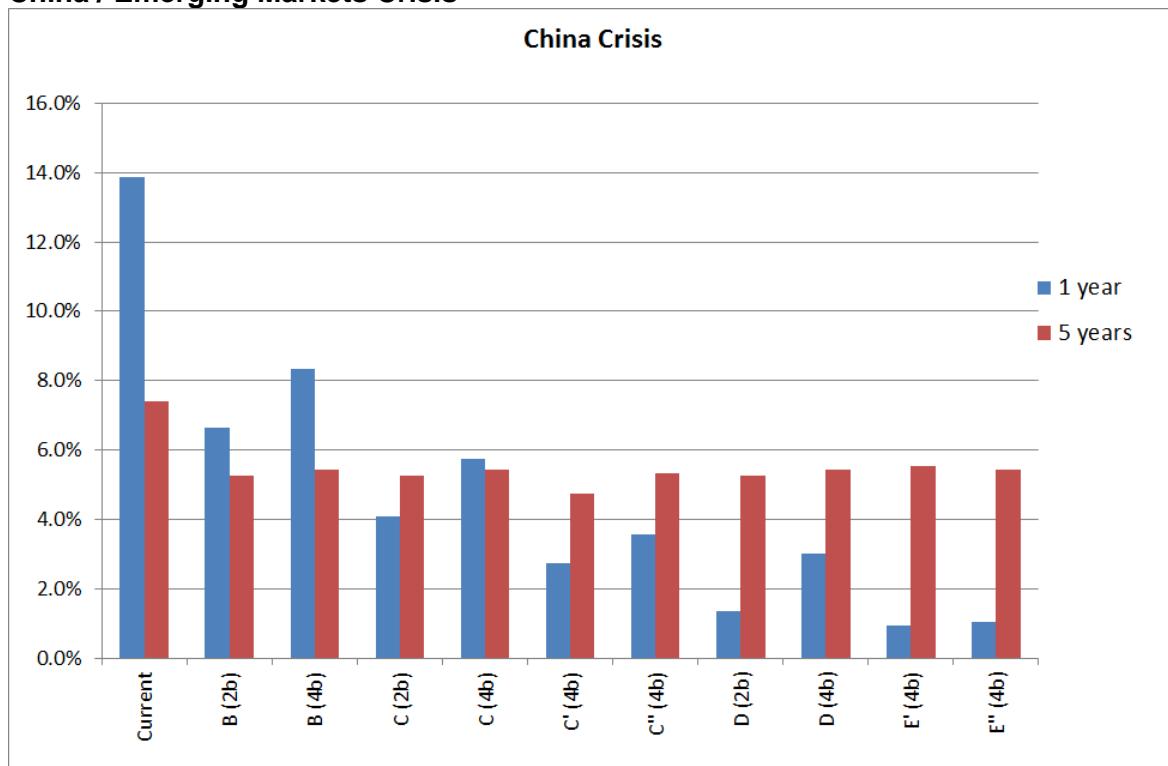
Higher Yields



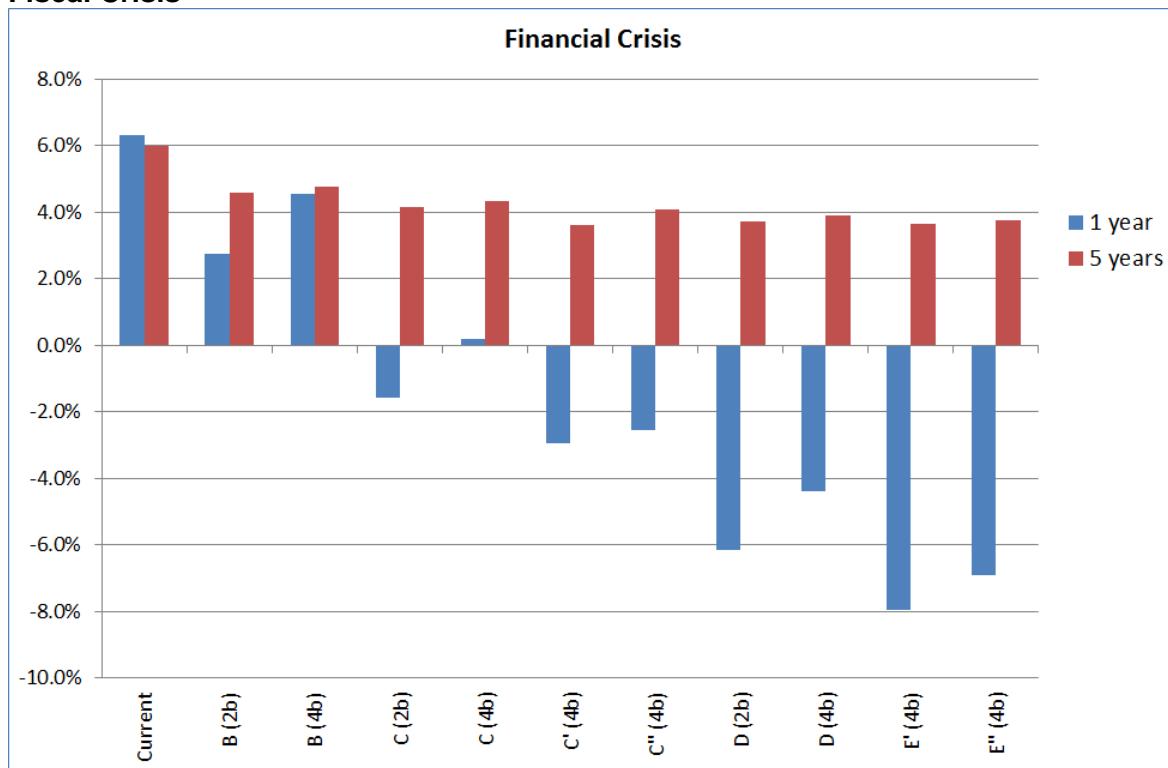
Lower Yields



China / Emerging Markets Crisis



Fiscal Crisis

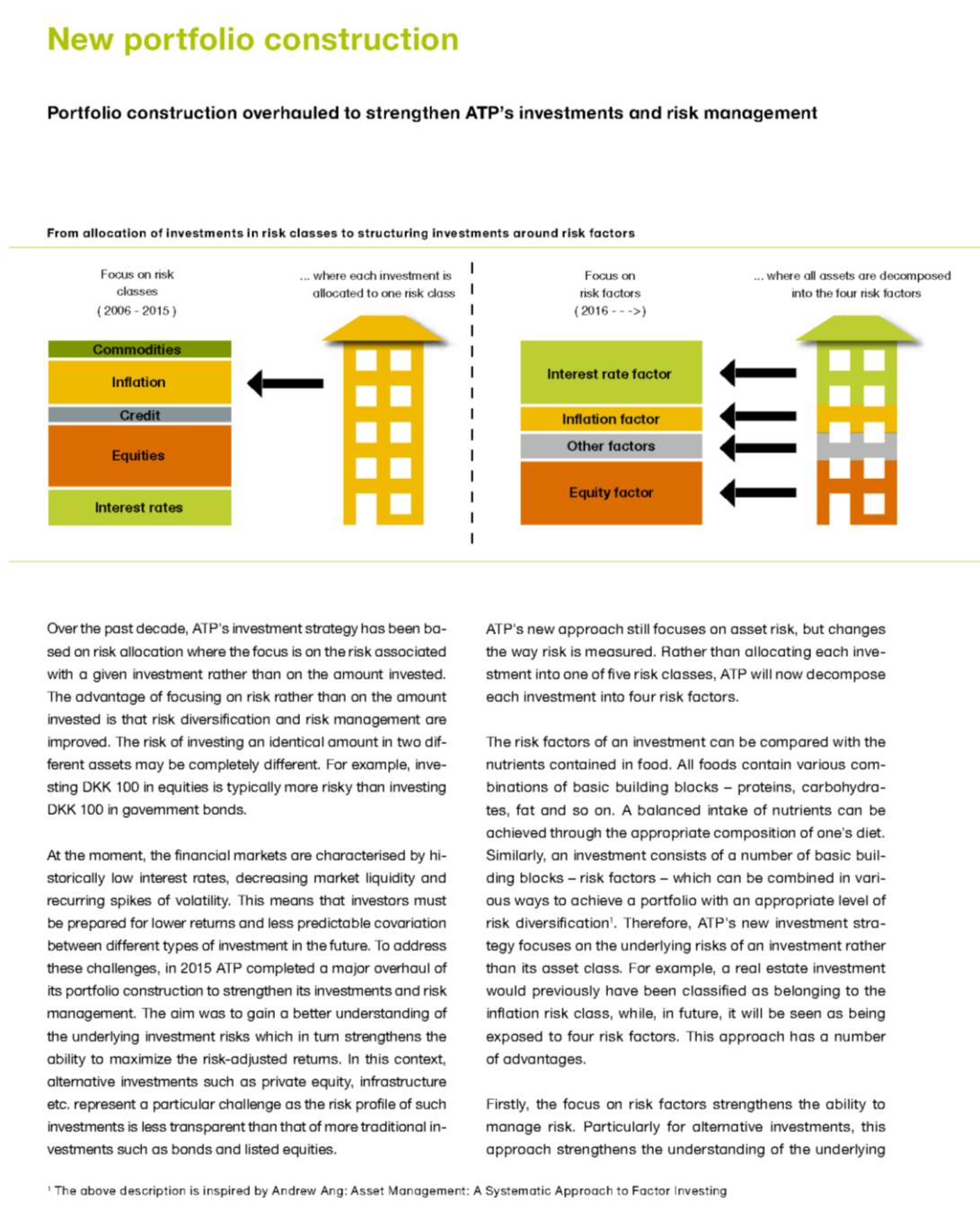


APPENDIX N

Further information on Denmark ATP

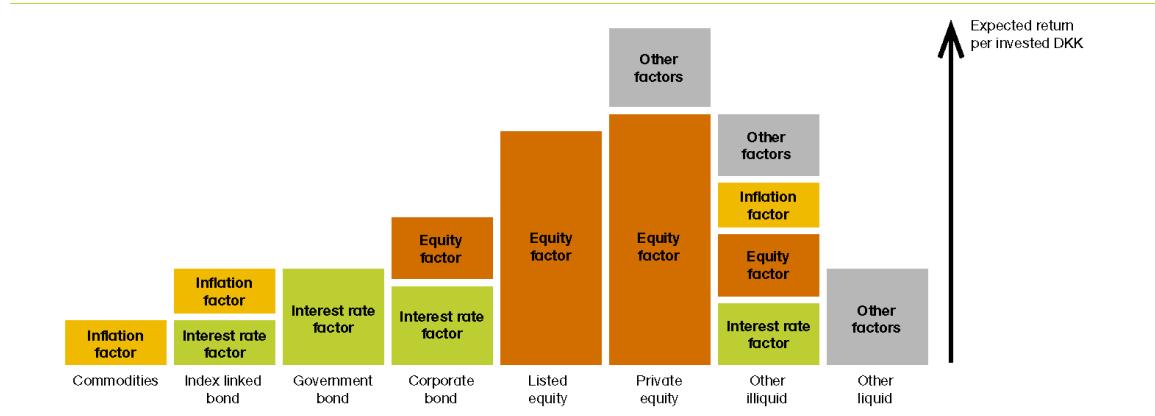
New portfolio construction

Portfolio construction overhauled to strengthen ATP's investments and risk management



¹ The above description is inspired by Andrew Ang: Asset Management: A Systematic Approach to Factor Investing

Illustrative breakdown of assets into risk factors



risks. Through an understanding of the underlying risk factors, ATP will be able to better assess the actual risk and diversification contributed by each investment.

Secondly, risk factors provide a better basis for making informed investment decisions. The factor investing approach increases investment flexibility by allowing analysis and comparison of investments without reference to asset type. The expected return on an investment can be determined based on a comparison with the return on other investments with the same underlying risks. This is also relevant for alternative investments where the required returns on investments in, say, complex infrastructure investments are not easily quantifiable.

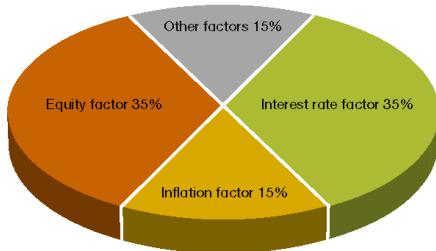
Allocation of investment to four risk factors

The new strategy is the result of an extensive process to identify the most appropriate risk factors. The four risk factors are: 'Equity factor', 'Interest rate factor', 'Inflation factor' and 'Other factors'. 'Other factors' include two risk categories, i.e. risks from alternative liquid factors (also known as alternative risk premiums) and risks from alternative illiquid investments. Alternative liquid factors include a group of well-documented investment strategies seeking to cre-

ate value through exposure to specific segments in liquid markets, e.g. equities with low market value relative to book value. Alternative illiquid investments comprise less traditional investments which are typically not traded in established markets, for example investments in private equity funds, real estate, infrastructure, forestry and certain types of credit.

Under the new investment strategy, the risk associated with each investment is determined on the basis of the four risk factors, depending on the types of risks to which the investment is exposed. Real estate is an example of an investment that is exposed to all four risk factors. Future rental income from rental properties is typically fully or partially inflation-adjusted. Therefore, the risk calculation includes both an interest rate element (interest rate sensitivity of future rental income) and an inflation risk element (inflation risk of future rental income). To this should be added the risk associated with cyclical factors, making re-letting difficult. This risk is closely connected with the equity factor. Finally, real estate is relatively illiquid, and the risk of loss if illiquidity makes real estate particularly difficult to sell is classified as 'other factors'.

New long-term guideline for risk allocation in the investment portfolio



This real estate example illustrates how the underlying investment risks are embedded in the new investment strategy using the four risk factors.

The factor investing approach places considerable demands on risk management systems etc. Thus, a key element in the process has been the adjustment of ATP's risk modelling and return reporting to the factor investing principles.

New long-term guideline for the investment portfolio

In connection with the transition to the new investment strategy, the Supervisory Board also reassessed the long-term composition of ATP's portfolio.

The basic elements of a broadly diversified investment portfolio are equities and interest-bearing instruments such as bonds. This is due, not least, to the fact that, between them, these two factors contribute to risk diversification because equity and bond prices typically move in opposite directions in a number of economic scenarios. Thus, the two risk factors 'Equity factor' and 'Interest rate factor' are the primary constituents of the long-term guideline. The 'Inflation factor' is to provide some measure of protection against inflation, which is usually accompanied by low or negative returns on

equities and interest-bearing instruments.

Finally, exposure to other types of risks may improve the risk-adjusted returns. This is the rationale for including 'Other factors', which include both liquid and illiquid elements. Alternative liquid factors are used to isolate niche risks in liquid financial markets, producing a high risk-adjusted return. The purpose of alternative illiquid factor is, among other things, to isolate the compensation which must be achieved in return for tying up capital in investments for longer periods of time.

Against this backdrop, the ATP Supervisory Board has adopted a new long-term guideline for ATP's investments with 35 per cent of the risk allocated to the 'Equity factor', 35 per cent to the 'Interest rate factor', 15 per cent to the 'Inflation factor' and 15 per cent to 'Other factors'. This guideline should be seen as a long-term 'anchor' for risk allocation. Thus, the actual portfolio allocation may deviate from the guideline at any one time due to market conditions. The guideline is not a benchmark for ATP's investments. Instead, the return is assessed against the Supervisory Board's long-term absolute return objective.

APPENDIX O

CMO Report

CAPITAL MARKET OUTLOOK

JANUARY 2017

CONTENTS

1. Executive Summary	2
2. Current Conditions	7
3. Fixed Income Returns	9
4. Outlook for Equity Returns	14
5. Alternative Asset Classes and Other Observations	18
6. Factor Scores	22
7. Asset Class Standard Deviations and Correlations	25
8. Appendix	33

Executive Summary

Mercer officially reviews its forward-looking capital market assumptions every quarter or when conditions warrant. We constantly check whether our assumptions are consistent with market conditions.

We lowered our assumption for long-term US GDP growth from 2.3% to 2.1% to reflect slower expected productivity growth. This revised growth expectation is consistent with long-term consensus forecasts from economists. As a result of expecting lower GDP growth, our assumption for earnings growth for US equities declined as did our assumptions for equilibrium bond yields. This caused expected equilibrium returns on US stocks and US bonds to fall.

We adjusted the expected standard deviation on fixed income to better reflect the underlying volatility of the asset classes in response to interest rate movements.

Equities posted solid gains during the fourth quarter with the S&P 500 returning 3.8%. As a result of higher valuations and lower expected earnings growth, return assumptions for US stocks declined.

Interest rates spiked during the quarter with the yield on the 10-Year Treasury jumping from 1.60% to 2.45%. Expected 20-year returns on US bond asset classes rose by around 40 basis points on average due to higher initial yields.

CAPITAL MARKET OUTLOOK

Jan 2017 Capital Market Outlook: Expected Returns for the Next 20 Years

Asset Class	Nominal Annual Terms			Previous Nominal Expected Returns			
	Geometric Return Equivalent	Arithmetic Expected Return	Annual Standard Deviation	Oct 2016 Geometric Annual Returns	July 2016 Geometric Annual Returns	April 2016 Geometric Annual Returns	Jan 2016 Geometric Annual Returns
Domestic Equity							
US All Cap	6.3%	7.8%	18.4%	6.7%	6.9%	6.9%	6.9%
US Large Cap	6.3%	7.8%	18.1%	6.7%	6.8%	6.9%	6.8%
US Mid Cap	6.5%	8.2%	19.6%	6.7%	7.0%	7.1%	7.2%
US Small Cap	6.5%	8.6%	22.1%	7.0%	7.2%	7.3%	7.1%
US Micro Cap	6.6%	9.0%	23.4%	7.0%	7.3%	7.3%	7.3%
US Small/Mid Cap (Smid)	6.5%	8.4%	20.5%	6.8%	7.1%	7.1%	7.2%
US Defensive Equity	6.3%	7.2%	13.7%	6.8%	6.9%	6.9%	7.1%
International Equity							
Non-US Developed All Cap Unhedged	7.7%	9.6%	20.5%	7.5%	7.3%	7.4%	7.4%
Non-US Developed All Cap Hedged	7.4%	8.9%	18.4%	7.3%	7.3%	7.3%	7.2%
Non-US Developed Large Cap Unhedged	7.6%	9.4%	20.3%	7.4%	7.2%	7.3%	7.3%
Non-US Developed Large Cap Hedged	7.3%	8.8%	18.2%	7.2%	7.2%	7.2%	7.1%
Non-US Developed Small Cap Unhedged	8.0%	10.2%	22.4%	7.9%	7.6%	7.7%	7.8%
Non-US Developed Small Cap Hedged	7.7%	9.6%	20.7%	7.6%	7.6%	7.7%	7.6%
Emerging Markets Unhedged	9.1%	12.1%	26.4%	9.2%	9.1%	9.1%	9.0%
AC World ex-US All Cap Unhedged	8.0%	10.1%	22.2%	7.8%	7.6%	7.7%	7.6%
AC World ex-US All Cap Hedged	7.7%	9.3%	19.2%	7.6%	7.6%	7.6%	7.5%
AC World ex-US Large Cap Unhedged	7.9%	10.0%	22.1%	7.8%	7.5%	7.6%	7.6%
AC World ex-US Large Cap Hedged	7.6%	9.2%	19.1%	7.5%	7.5%	7.5%	7.4%
Global AC All Cap Unhedged	7.3%	8.9%	18.9%	7.5%	7.4%	7.4%	7.4%
Global AC All Cap Hedged	7.1%	8.5%	18.1%	7.3%	7.3%	7.3%	7.3%
Global AC Large Cap Unhedged	7.3%	8.8%	18.6%	7.4%	7.3%	7.3%	7.3%
Global AC Large Cap Hedged	7.0%	8.5%	17.8%	7.2%	7.3%	7.3%	7.2%
Global AC Small Cap Unhedged	7.5%	9.5%	21.4%	7.8%	7.8%	7.8%	7.7%
Global AC Small Cap Hedged	7.3%	9.2%	20.7%	7.6%	7.7%	7.8%	7.7%
Global Developed Large Cap Unhedged	7.0%	8.4%	17.8%	7.2%	7.2%	7.2%	7.2%
Global Developed Large Cap Hedged	6.9%	8.3%	17.4%	7.1%	7.2%	7.2%	7.2%
Global Developed Small Cap Unhedged	7.2%	9.2%	21.2%	7.6%	7.6%	7.7%	7.6%
Global Developed Small Cap Hedged	7.0%	9.0%	20.9%	7.4%	7.5%	7.6%	7.5%
Global Defensive Equity Unhedged	7.1%	8.0%	13.7%	7.1%	7.2%	7.2%	7.5%

CAPITAL MARKET OUTLOOK

Jan 2017 Capital Market Outlook: Expected Returns for the Next 20 Years

Asset Class	Nominal Annual Terms			Previous Nominal Expected Returns			
	Geometric Return Equivalent	Arithmetic Expected Return	Annual Standard Deviation	Oct 2016 Geometric Annual Returns	July 2016 Geometric Annual Returns	April 2016 Geometric Annual Returns	Jan 2016 Geometric Annual Returns
Domestic Fixed Income							
US Govt/Credit	3.6%	3.7%	5.4%	3.1%	3.1%	3.3%	3.6%
US Govt/Credit (Downgrade Tolerant)	3.7%	3.8%	5.4%	3.2%	3.2%	3.4%	3.7%
US Aggregate	3.6%	3.8%	5.3%	3.2%	3.2%	3.5%	3.8%
US Short G/C	3.5%	3.6%	4.5%	3.2%	3.2%	3.3%	3.5%
US Intermediate G/C	3.6%	3.7%	5.0%	3.2%	3.2%	3.3%	3.6%
US Long G/C	3.5%	3.9%	9.6%	2.8%	2.9%	3.2%	3.7%
US Long G/C (Downgrade Tolerant)	3.7%	4.2%	9.7%	3.1%	3.2%	3.4%	4.0%
US Very Long Govt (20+ STRIPS)	2.6%	4.2%	18.1%	1.3%	1.3%	1.8%	2.5%
US Government	3.2%	3.4%	5.2%	2.7%	2.7%	2.9%	3.2%
US Credit	4.0%	4.2%	6.9%	3.6%	3.6%	3.9%	4.2%
US Credit (Downgrade Tolerant)	4.2%	4.4%	6.8%	3.8%	3.9%	4.1%	4.4%
US Intermediate Government	3.3%	3.4%	4.5%	2.9%	2.8%	3.0%	3.2%
US Long Government	3.0%	3.8%	12.9%	2.1%	2.1%	2.5%	3.0%
US Intermediate Credit	4.0%	4.2%	6.0%	3.7%	3.7%	4.0%	4.2%
US Long Credit	3.8%	4.3%	10.1%	3.3%	3.5%	3.9%	4.2%
US Long Credit (Downgrade Tolerant)	4.2%	4.6%	9.9%	3.7%	3.8%	4.2%	4.6%
US Mortgage-Backed	3.6%	3.7%	5.6%	3.1%	3.1%	3.2%	3.5%
US High Yield	4.7%	5.2%	10.0%	4.8%	5.4%	5.8%	6.2%
US Municipal	3.3%	3.7%	8.7%	2.9%	2.9%	3.1%	3.4%
US Inflation Indexed	3.2%	3.4%	5.6%	2.9%	3.0%	3.1%	3.3%
US Intermediate Inflation Indexed	3.3%	3.4%	3.3%	3.1%	3.1%	3.2%	3.3%
US Long Inflation Indexed	2.9%	3.2%	6.9%	2.6%	2.7%	2.8%	3.3%
US Senior/Leveraged Loans	4.7%	4.9%	6.5%	4.5%	5.0%	6.2%	6.4%
US Cash	2.8%	2.8%	2.0%	2.6%	2.5%	2.5%	2.7%
International Fixed Income							
Non-US Govt Unhedged	2.0%	2.5%	10.3%	1.7%	1.5%	1.8%	2.5%
Non-US Govt Hedged	2.1%	2.3%	6.9%	2.0%	1.9%	1.9%	2.6%
Non-US Broad Unhedged	2.2%	2.7%	9.9%	2.0%	1.8%	2.1%	2.7%
Non-US Broad Hedged	2.3%	2.5%	6.1%	2.2%	2.1%	2.2%	2.8%
Emerging Markets - Hard Currency	5.3%	5.9%	11.6%	4.8%	5.1%	5.4%	5.7%
Emerging Markets - Local Currency	6.4%	7.0%	11.2%	6.0%	6.1%	6.5%	7.1%

CAPITAL MARKET OUTLOOK

Jan 2017 Capital Market Outlook: Expected Returns for the Next 20 Years

Asset Class	Nominal Annual Terms			Previous Nominal Expected Returns			
	Geometric Return Equivalent	Arithmetic Expected Return	Annual Standard Deviation	Oct 2016 Geometric Annual Returns	July 2016 Geometric Annual Returns	April 2016 Geometric Annual Returns	Jan 2016 Geometric Annual Returns
Global Govt Unhedged	2.3%	2.6%	7.3%	2.2%	2.0%	2.5%	2.9%
Global Govt Hedged	2.4%	2.6%	5.9%	2.3%	2.3%	2.5%	3.0%
Global Broad Unhedged	2.6%	2.9%	6.5%	2.5%	2.4%	2.9%	3.2%
Global Broad Hedged	2.7%	2.8%	5.5%	2.6%	2.6%	2.9%	3.3%
Global Inflation Indexed	2.5%	2.7%	6.2%	2.5%	2.5%	2.5%	2.6%
Global High Yield	4.8%	5.3%	10.5%	4.8%	5.5%	6.0%	6.3%
Miscellaneous							
Convertibles	4.6%	5.1%	9.5%	4.8%	5.4%	6.0%	6.7%
Stable Value/GICs	3.6%	3.6%	3.5%	3.2%	3.2%	3.3%	3.5%
Company Stock – Large Cap	4.4%	7.8%	27.4%	4.8%	5.0%	5.1%	5.4%
Company Stock – Small Cap	2.0%	8.6%	39.7%	2.6%	2.8%	2.9%	2.9%
Global Cash – Currencies	2.7%	2.8%	4.9%	2.5%	2.4%	2.4%	2.5%
Non-US Currency Exposure (UIRP)	0.8%	1.1%	8.0%	0.6%	0.7%	0.7%	0.7%
Alternative Assets¹							
US Real Estate – Unlevered	5.8%	6.5%	12.6%	5.7%	6.5%	6.5%	6.5%
US Real Estate – Core	6.8%	7.9%	15.7%	6.8%	6.6%	6.6%	6.6%
US Real Estate – Value-Added	7.6%	9.0%	17.4%	7.6%	7.0%	7.0%	7.0%
US Real Estate – Opportunistic	8.5%	10.2%	19.3%	8.6%	7.4%	7.4%	7.4%
US Real Estate – REITS	6.5%	8.5%	21.3%	6.3%	6.3%	6.5%	6.5%
Non-US Real Estate – Private	7.5%	9.0%	18.1%	7.6%	6.9%	6.9%	6.9%
Non-US Real Estate – REITS	6.7%	9.1%	23.1%	6.5%	6.5%	6.5%	6.5%
Global Real Estate – Private	7.9%	9.0%	15.9%	7.9%	7.2%	7.2%	7.2%
Global Real Estate – REITS	6.7%	8.7%	21.3%	6.4%	6.4%	6.5%	6.5%
Timberland	6.4%	7.4%	14.6%	7.4%	7.4%	7.4%	7.4%
Distressed Debt	7.9%	9.2%	16.9%	8.0%	8.8%	9.6%	9.8%
Private Equity – Total	9.9%	13.0%	26.9%	10.2%	10.2%	10.3%	10.3%
Private Equity – LBO	9.8%	13.4%	29.2%	10.1%	10.1%	10.2%	10.2%
Private Equity – Venture Cap	10.4%	14.2%	30.4%	10.8%	10.8%	10.9%	10.9%
Private Equity – Mezzanine	8.3%	9.9%	19.1%	8.3%	8.3%	9.2%	9.2%
Private Equity – Special Situations	10.3%	13.8%	28.9%	10.6%	10.7%	10.7%	10.7%
Infrastructure – Listed	6.5%	7.6%	15.2%	6.5%	6.5%	6.5%	6.5%
Infrastructure – Private	8.1%	9.3%	16.7%	7.9%	9.4%	9.4%	9.4%

CAPITAL MARKET OUTLOOK

Jan 2017 Capital Market Outlook: Expected Returns for the Next 20 Years

Asset Class	Nominal Annual Terms			Previous Nominal Expected Returns			
	Geometric Return Equivalent	Arithmetic Expected Return	Annual Standard Deviation	Oct 2016 Geometric Annual Returns	July 2016 Geometric Annual Returns	April 2016 Geometric Annual Returns	Jan 2016 Geometric Annual Returns
Hedge Funds – Zero Beta	4.4%	4.5%	3.6%	4.2%	4.1%	4.1%	4.3%
Hedge Funds – Conservative	6.0%	6.1%	6.0%	5.8%	5.7%	5.7%	5.9%
Hedge Funds – Moderate	6.7%	7.0%	8.2%	6.5%	6.5%	6.5%	6.6%
Hedge Funds – Mod/Aggressive	7.4%	7.9%	10.7%	7.3%	7.2%	7.3%	7.4%
Hedge Funds – Aggressive	8.0%	8.8%	13.0%	8.1%	8.0%	8.0%	8.1%
Hedge Funds – Macro	7.3%	8.0%	12.1%	7.5%	7.4%	7.4%	7.6%
Commodities – Long Only	3.2%	4.6%	17.2%	3.2%	3.2%	4.2%	4.2%
Natural Resources – Listed	6.6%	9.3%	24.7%	6.9%	7.0%	7.0%	7.0%
Natural Resources – Private	9.3%	12.1%	25.3%	9.6%	9.6%	9.6%	9.6%
Private Debt	6.4%	6.9%	10.5%	6.2%	6.6%		
Gold	3.2%	4.6%	17.1%	3.2%	3.9%	3.9%	3.9%
Inflation	2.2%	2.2%	1.7%	2.2%	2.2%	2.2%	2.2%

¹ Returns for alternative assets include a net of fee alpha assumption.

Current Conditions

All of our projections start with current conditions of interest rates, equity pricing, economic growth, and inflation. We then overlay our forward looking projections of normal inflation, growth, and interest rates to determine expected returns.

In this section, we review current conditions in the fixed income, equity, and derivatives markets to help establish our starting point for projections.

Economic Conditions

2016 was another disappointing year for growth with the global economy expanding by only 2.4%. Satisfactory growth in the developed world was offset by weak results in some emerging economies. Encouragingly, there are signs the global economy is improving. Growth and inflation should be slightly higher in 2017, and the risks of deflation are receding. Fiscal policy has turned more stimulatory, while a recovery in emerging economies seems to be taking hold.

While UK economic growth held up in 2016, it is likely to weaken in 2017 on weak investment related to Brexit uncertainty and a sharp rise in inflation caused by the drop in the pound. The Eurozone grew above trend in 2016, and it gained momentum in the second half of 2016, supported by stronger consumption and export growth. The main risks to the Eurozone economy in 2017 are political rather than economic. Growth forecasts for Japan have been creeping higher over the last few months, reflecting the combination of a weaker yen, a broader easing in financial conditions and expectations of further fiscal stimulus.

US economic growth strengthened in the second half of 2016, following a disappointing first half. Still, growth for the year was only around 1.6%, down from 2.5% in 2015. Fiscal stimulus could give the economy a short-term boost in late-2017 and 2018, although there is considerable uncertainty on the shape and magnitude of any program.

Emerging market economies generally stabilized in 2016 and should improve further in 2017. Following currency weakness over the past few years, emerging economies are more competitive with the developed world. Meanwhile, the recent uptick in commodity prices should support countries that are big commodity exporters.

Bond Market Pricing

	Dec 2016	Sep 2016	Jun 2016	Mar 2016	Jun 2015
Treasury Yields					
3-Month	0.51%	0.29%	0.26%	0.21%	0.16%
1-Year	0.85%	0.59%	0.45%	0.59%	0.65%
5-Year	1.93%	1.14%	1.01%	1.21%	1.76%
10-Year	2.45%	1.60%	1.49%	1.78%	2.27%
30-Year	3.06%	2.32%	2.30%	2.61%	3.01%
10-Year TIPS	0.50%	0.00%	0.09%	0.16%	0.73%
30-Year TIPS	0.99%	0.59%	0.70%	0.83%	1.28%
Barclays Long AA Corporate Bond Yields	4.44%	3.97%	4.12%	4.50%	4.85%
Federal Reserve Target Discount Rate	0.50%	0.25%	0.25%	0.25%	0.25%

Source: US Treasury, Bloomberg

Interest rates spiked during the fourth quarter. While rates began to move higher in October, the move accelerated following the election on expectations that fiscal stimulus could lead to a faster pace of Fed rate hikes. The 10-year Treasury yield increased by 85 bps to 2.45%, although this was only 18 bps above where it started the year.

Investment Grade credit spreads finished the year at 1.23%, which is close to the historical median

Breakeven Inflation Rates: Nominal Bond Yield minus Real Bond Yield

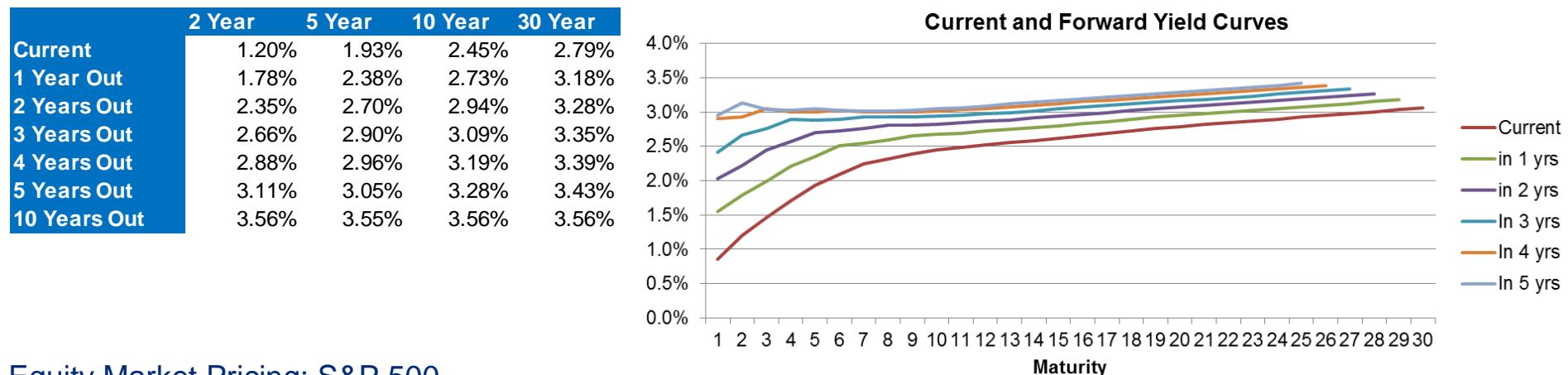
Maturity	Current		Previous		
	Dec-16	Sep-16	Jun-16	Mar-16	Dec-15
10-Year	1.95%	1.60%	1.40%	1.62%	1.54%
20-Year	1.97%	1.61%	1.33%	1.63%	1.73%

The election contributed to an increase in inflation expectations during the quarter. The inflation breakeven on 10-year TIPS rose by 35 bps to 1.95%. Expected inflation should be lower than break-even inflation due to inflation risk premiums in nominal bonds. If we set the inflation risk premium at 25 basis points for 10-year bonds and 30 basis points for 20-year bonds, then expected 10-year inflation would be approximately 1.70% based on current TIPS pricing. Core CPI increased by 2.2% in 2016 and seems likely to top the Fed's target again in 2017. As the economy nears full employment, wage increases could apply additional upward pressure on CPI. We expect inflation breakeven rates to rise further.

CAPITAL MARKET OUTLOOK

Implied Forward Rates

Since the financial crisis, the market has consistently (and correctly) priced in less tightening than the Fed itself has projected. However, the market is now assigning more credibility to the Fed's projections. The current pace of Fed rate hike expectations seems reasonable relative to the underlying economic conditions. However, risks seem tilted to a more hawkish Fed than a more dovish one.



Equity Market Pricing: S&P 500

While equity markets have posted modest gains YTD, the P/E ratio has increased due to a decline in earnings.

	Dec 31, 2016		Sep 30, 2016		Jun 30, 2016		Mar 31, 2016		Dec 31, 2016	
	P/E	Yield								
Trailing 4-Qtr Earnings	23.1	4.11%	24.3	4.11%	24.2	4.14%	23.8	4.20%	23.6	4.23%
Trailing 4-Qtr Operating Earnings	21.0	4.68%	21.4	4.68%	21.4	4.68%	20.9	4.79%	20.4	4.91%
Projected 1-Yr Earnings	17.1	5.71%	17.5	5.71%	18.4	5.43%	17.7	5.65%	17.0	5.88%
S&P 500® Dividend Yield	-	2.07%	-	2.09%	-	2.18%	-	2.16%	--	2.13%
VIX® Implied Volatility Index	14.04%		13.29%		15.63%		13.95%		18.21%	

Source: standardandpoors.com

3

Fixed Income Returns

Our process for determining fixed income returns is:

- Start with current conditions (as discussed in previous section).
- Establish a long run set of yield curves (real, nominal, and corporate) that current yields will converge to over a ten-year time horizon. (In our stochastic modeling, the convergence process may take longer.)
- Compute returns for fixed income sectors as yields move to the long run yield curves and assume they stay at equilibrium for the remaining portion of the time period.
 - Include adjustments for defaults and downgrades for corporate bonds and prepayment patterns for mortgage-backed and asset-backed securities.

The Equilibrium Yield Curve

Our assumption of 2.2% inflation and 2.1% real economic growth implies that the long-run nominal growth rate of the economy will be approximately 4.3%. This provides an important benchmark to guide the equilibrium level of bond yields. Financial theory suggests bond yields should approximate nominal economic growth over the long-term given the need to match demand for borrowing with lending. Of course, in the short run, yields deviate substantially from this equilibrium benchmark.

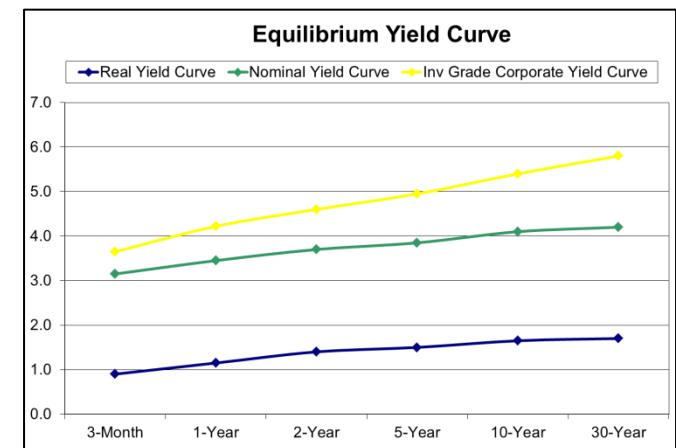
The 2.2% inflation assumption also helps set the boundary for short-term interest rates. Cash should be a store of value after taxes and inflation. We assume cash returns 3.05% at equilibrium.

Our corporate fixed income assumptions are represented by the full investment grade corporate universe, rather than having an AA-rated bias.

CAPITAL MARKET OUTLOOK

The following aggregates various economic components to identify real, nominal and corporate equilibrium yield curves and ranges of possible outcomes.

	3-Month	1-Year	2-Year	5-Year	10-Year	30-Year
Real Yield Curve	0.80	1.05	1.30	1.40	1.45	1.50
Expected Inflation	2.20	2.20	2.20	2.20	2.20	2.20
Inflation risk Premium	0.05	0.10	0.10	0.15	0.25	0.30
Nominal Yield Curve	3.05	3.35	3.60	3.75	3.90	4.00
Inv Grade Corp Default Spreads	0.50	0.75	0.90	1.10	1.30	1.60
Inv Grade Corporate Yield Curve	3.55	4.12	4.50	4.85	5.20	5.60
AA Corp Default Spreads	0.33	0.49	0.60	0.73	0.87	1.07
AA Corp Yield Curve	3.38	3.87	4.20	4.48	4.77	5.07
Current Real Yields	--	-	--	0.09	0.50	0.99
Current Treasury Yield Curve	0.51	0.85	1.20	1.93	2.45	3.06
Investment Grade Corporate Curve	--	1.55	2.02	3.20	3.97	4.65



Given a transition from current yields to the equilibrium yields above, the following table summarizes our expected returns over one, three, five, ten, and twenty years. Expected returns from this table are based on the yields as of December 31, 2016. We assume a 10 year period for reversion for current yields to return to equilibrium yields. Implied forward rates are being used for the initial 3 years of the ten year reversion period followed by straight line reversion over the next 7 years.

Expected Returns with Transition to Equilibrium Yield Curve

Domestic Fixed Income	1-Year Expected	2-Year Expected	3-Year Expected	5-Year Expected	10-Year Expected	20-Year Expected	Modified Adj Duration
Aggregate	1.2%	1.6%	1.9%	2.3%	2.8%	3.6%	5.9
Short G/C	1.0%	1.3%	1.6%	2.1%	2.8%	3.5%	0.5
Intermediate G/C	1.2%	1.5%	1.8%	2.3%	2.9%	3.6%	4.1
Long G/C	1.4%	1.7%	2.0%	2.2%	2.5%	3.5%	15.0
Very Long Government (20+ STRIPS)	0.0%	0.4%	0.8%	0.9%	1.2%	2.6%	25.0
Inflation Indexed	2.2%	2.2%	2.3%	2.5%	2.7%	3.2%	5.3
Cash	1.0%	1.4%	1.7%	2.1%	2.5%	3.8%	0.3

TIPS pricing is directly related to real interest rates. Thus, they have a “real duration” as opposed to the nominal duration reported above. The real duration of TIPS is higher than comparable nominal Treasuries due to the lower real coupon rate.

High Yield Bonds

Our assumptions for the return of high yield bonds are based on current yields, projected default and recovery rates, and a transition to normal spreads. The following table shows our specific assumptions and calculations.

	Initial Conditions Dec 2016	Year 1	Year 2	Year 3	10 Years ¹	20 Years ¹
Yield	6.1%	6.7%	7.1%	7.4%	7.8%	8.2%
Default Rate		4.0%	4.0%	4.0%	4.0%	4.0%
Cumulative Default		4.0%	7.8%	11.5%	33.5%	55.8%
Recovery Rate		40.0%	40.0%	40.0%	40.0%	40.0%
Total Return		0.7%	2.1%	3.0%	3.5%	4.7%

¹ Averages for yields, default rates, and recovery rates. Total return is cumulative annualized return.

Static Case

As a reference point, we often use a “Static Case” of fixed income returns in which interest rates are kept constant at current conditions. Using the actual weightings to the different sectors, our returns for the two major bond indices representing investment grade bonds are presented in the following table with data as of December 31, 2016. Expected returns in the following table for the Barclays Aggregate™ Bond Index and Barclays Gov/Credit™ Index assume a static yield curve.

	Aggregate Weight	Yield to Worst	Downgrades and Default losses	Expected Return	Modified Adjusted Duration
Treasury	36.2%	1.89%	0.00%	1.79%	6.1
Government Related	7.7%	2.58%	0.00%	2.58%	5.4
Credit	25.8%	3.37%	0.70%	2.67%	7.3
Securitized	30.3%	2.83%	0.00%	2.83%	4.6
Barclays Aggregate	100.0%	2.61%		2.42%	5.9

Other Observations

- Convertible bonds should be slightly more correlated with equities than high yield bonds, but typically both suffer from equity-like risk in down markets.
- Stable value funds are assumed to have market or intermediate bond market returns with money-market-type volatility. Recent market forces have resulted in most funds shortening the average maturity of underlying investments and shortening amortization periods which increases volatility. Mean-variance models fail to capture this investment's unique characteristics.

International Fixed Income Yields

Yields outside the US are generally lower, reflecting weaker economic growth, lower inflation, and the expected course of monetary policy:

- Nominal yields are lower outside the US. With inflation having risen in Japan and Germany, real yields in both countries are negative.

Government Index	10-Year Nominal Yield	Trailing 12-Month Inflation	Current Real Yield
Germany	0.1	0.8	-0.7
UK	1.2	1.2	0.0
Japan	0.1	0.5	-0.5
Canada	1.7	1.2	0.5
Australia	2.8	1.3	1.5
China	3.0	2.3	0.7
US	2.5	1.7	0.8
Emerging Markets ¹	6.8 ¹	N/A	N/A

¹ JPMorgan GBI-EM Global Diversified Index Yield to Maturity.

Outlook for Equity Returns

As with fixed income, our long run projection of equity returns are based on our long run assumptions for inflation, economic growth, and interest rates. We use a Growth DDM approach as our main estimate of equity returns. We also review the implied equity risk premium relative to Treasuries as a check on our DDM model. For US large-cap stocks, this breakdown is as follows:

<u>Growth Approach</u>		<u>Equity Risk Premium</u>	
Earnings Growth	4.4%	Broad Govt. Bond Exp. Return	3.2%
P/E Contraction	-0.7%	Implied Equity Risk Premium	<u>3.1%</u>
Shareholder Yield	<u>2.7%</u>		
Total Return	~6.3%		~6.3%

- We are assuming that the growth in earnings per share (EPS) for US equities is strongly related to GDP growth. Historically EPS growth has trailed GDP growth due to the dilutive effect of share issuance for corporate purposes, including options programs, executive compensation and M&A. However, in recent years stock buybacks have become an increasingly common means of paying out earnings to shareholders in a tax efficient manner, which has counteracted dilution associated with share issuance.
- We believe that the “equilibrium” P/E for US large-cap equities is approximately 17.0, based on trailing 10-year real earnings (adjusted Shiller’s P/E). We adjust the current Shiller P/E to reflect trend growth in real earnings. The current trend-adjusted Shiller P/E on large cap stocks is 22.7, which is above the upper end of the fair value range for normalized earnings, resulting in a -0.7% impact from P/E reversion in our large cap assumption. Small cap stock valuations are more elevated and we incorporate an approximately 0.9% annual return reduction over 20 years.
- We assume an average total earnings payout ratio of 45% of earnings, which equates to 2.65% dividend yield for US large-cap equities.
- The current implied equity risk premium of 3.1% is below the realized historical equity risk premium of ~4.3% over past decades because of elevated equity valuations.

CAPITAL MARKET OUTLOOK

US Large Cap Equity Return Estimates

The table presents how to combine components of US large-cap equity returns in order to arrive at the equilibrium and market aware return expectations

	Equilibrium	Market Aware
a Shiller's P/E at Equilibrium	17.0	17.0
b Upper Shiller P/E Band		20.0
c Lower Shiller P/E Band		14.0
d Earnings Yield at Equilibrium (1/a)	5.9%	5.9%
e Payout Ratio	45.0%	45.0%
f Dividend Yield (d*e)	2.6%	2.6%
g Real Economic Growth	2.1%	2.1%
h Allowance for 'Dilution'	(0.1%)	(0.1%)
i Real Earnings Growth (g-h)	2.0%	2.0%
j Current Shiller's P/E	24.7	
k Adjusted Shiller's P/E	22.8	
l P/E Reversion $((b/k)^{(1/20)} - 1)$		(0.7%)
m Expected Real Return $(1+f) * (1+i) * (1+l) - 1$	4.7%	4.0%
n Inflation	2.2%	2.2%
o Expected Nominal Local Return $(1+m) * (1+n) - 1$	7.0%	6.3%

Equity Volatility

Asset Class	% of Publicly Traded Market	Equity Beta	Expected Equilibrium Geometric Return	Standard Deviation
All Cap	100%	1.00	7.0%	18.4%
Large Cap	75%	0.98	7.0%	18.1%
Mid Cap	14%	1.05	7.2%	19.6%
Small Cap	9%	1.13	7.4%	22.1%
Micro Cap	2%	1.37	7.8%	23.4%

- Compared to other analysts, we typically have higher equity volatility – some have set it as low as 15%. However, we have calibrated our volatility to produce a probability of extreme losses that is consistent with historical results. Our equity volatility expectation is higher than the historical volatility of approximately 16% in order to capture those “black swan” events.
- The distribution of equities between large, mid, small, and micro cap is our estimate of reasonable static allocations. They are not based on any particular index. Definitions and weights of Russell, S&P, Wilshire, and MSCI® will differ from our static definition.

International Returns

We show returns from a US dollar investor's perspective. We assume that multi-country regions, such as EAFE, provide diversification, but have slightly higher volatility than the US due to the safe haven status of the US dollar. Total \$US return is the local return plus the currency impact. Total volatility is the local currency volatility plus currency volatility with the correlation between the two assumed to be zero.

The impact of currency is assumed to follow purchasing power parity for developed markets and purchasing power parity adjusted for productivity differentials for emerging markets. We use separate approaches because of the lower stability of interest rates in emerging countries, higher inflation and higher productivity growth. Under purchasing power parity, the impact of currency is the difference between assumed inflation rates, with a higher inflation rate in a foreign country leading to a decline in that currency's value. For the purchasing power parity currency impact in emerging markets, the currency return is assumed to be comprised of two parts. The difference between the assumed inflation rates is the first part, which is standard purchasing power. We add to this 1/3 of the productivity differential between the emerging and home country (this is the Balasa-Samuelson effect). Productivity differentials capture the appreciation of an emerging currency.

International hedged returns are assumed to follow uncovered interest rate parity (UIRP). Under UIRP, the impact of currency is the difference between interest rates in the home versus the foreign country. A higher home rate equates to an expected depreciation in the home currency. Meanwhile, a lower foreign currency rate corresponds to an expected increase in those foreign currencies relative to dollar. This would create a positive return for holding foreign currency. Investors typically hedge foreign currency exposure through currency futures. Futures typically trade at a forward premium or discount to the spot currency exchange rate, which is tied to interest differentials and UIRP. Finally, hedged returns for developed markets reflect a 0.2% cost of hedging.

Based on historical analysis, we estimate the volatility of a major currency index against the Dollar to be around 8.0%. Emerging markets currency as a whole should have volatility of around 10.0% to 12.0%.

CAPITAL MARKET OUTLOOK

Currency hedging reduces our estimates of volatility. We estimate that hedging of international developed equity portfolios reduces the risk for equity portfolios by ~2.0%. The effect for fixed income is larger. This is because equities already have high volatility to begin with, while fixed income has a low volatility and so currency exposure substantially increases volatility. We expect hedging to reduce volatility of international developed fixed income portfolios by nearly 4.0%.

Our assumption for Global Equity are based on MSCI All Country World® Index weights. As of December 31, 2016 the MSCI All Country World® Index had a float-adjusted weight of 53.8% to the United States, 35.7% to international developed markets and 10.5% to emerging markets. We expect the weight of US stocks to decline gradually over time as the emerging markets mature into developed markets and the “frontier” emerging markets evolve into conventional emerging markets.

Defensive (Low Volatility) Equity

We have reviewed the history and case for low volatility equity as an equity investment approach that achieves returns consistent with broad market returns but with lower absolute volatility. We have included defensive equity assumptions that assume an equity market beta of 0.75 plus an added non-systematic return component that increases the long term expected return back to the level of the broad market. This results in an asset with correlations and returns that are similar to traditional equity but with volatility reduced by approximately 25%.

Alternative Asset Classes and Other Observations

Typically, in setting expected returns for asset classes, we assume passive index funds or extremely low cost vehicles that allow diversified exposure to the asset classes. For most publicly traded asset classes, this is certainly true, as dozens, if not hundreds of index funds, enhanced index funds, and ETFs exist. The hallmarks of these funds are very low tracking error risk and high liquidity. However, for a few categories, most notably the alternative investments—hedge funds, private equity, and private real estate—this is untrue. There is no way of gaining passive exposure. Instead, investors planning a strategic asset allocation must utilize active management and pay active management fees.

Hedge Fund Returns

We now provide five sets of general hedge fund strategy returns—ranging from zero beta to aggressive. The strategy returns vary by beta exposure, expected return and volatility.

We use a multi-factor beta plus alpha approach to developing our hedge fund risk and return assumption. The assumptions begin with the assumed return on Treasury Bills (T-bills) and then beta exposure to market factors such as equities, credit and duration as well as assuming an illiquidity premium. When looking at beta exposure we use a mix of historical analysis as well as forward looking assumptions. The illiquidity premium is based on the assumption that hedge funds can access opportunities not available to strategies offering daily or monthly liquidity, thus boosting returns.

The net alpha assumptions for hedge funds are based on what we think Mercer A-rated manager can earn. For most hedge fund strategies, we think managers can generate 200 bps in net alpha, which represents the wide range of strategies available to them as well as ability to generate alpha on both the long and short side. The fees for hedge funds are based on the standard management fee of 1.5% to 2% plus incentive fees.

In analyzing historical hedge fund returns, there are several factors of which to be aware. Several studies show that survivorship bias in hedge fund indices increases reported returns¹. Survivorship bias can range from 100 basis points to 400 basis points at the extreme. Instant history can also be an issue, boosting hedge fund index returns. However, the Hedge Fund Research (HFRI) indices report returns on a going forward basis only, so some of that effect is minimized in the data used. Negating some of the effects of survivorship and instant reporting biases is the fact that many successful hedge funds do not report to index providers because they do not need to and do not want the public exposure. Very little research exists to support the aforementioned impact, but we believe it is meaningful. One additional consideration is that poorly performing hedge funds tend to stop reporting to the database providers. This tends to dampen the volatility of reported index data.

¹ Hedge Funds: Risk and Return, Burton G. Malkiel, Princeton University and Atanu Saha, Analysis Group, CEPS Working Paper 104, October 2004; Do Hedge Funds Hedge?, Clifford Asness, Robert Kral and John Liew, The Journal of Portfolio Management, Fall 2001; The Life Cycle of Hedge Funds: Fund Flows, Size and Performance, Mila Getmansky Sherman, September 2004.

Private Equity

We use a multi-factor beta plus alpha methodology for developing our private equity assumptions. We begin with cash rates and then add high equity beta exposure. We also add in beta to other equity factors such as value and size. Additionally, for mezzanine funds we also add in beta exposure to credit. We also assume an illiquidity premium given the long life of the typical fund and the benefits associated with being a long-term holder of capital. The net alpha assumptions for private equity are based on what we think Mercer A-rated manager can earn. We think private equity managers can generate 100 bps in net alpha. The fees for private equity are based on the standard management fee of 1.5% to 2% plus incentive fees.

Estimating the volatility of private equity funds can be difficult given that most underlying net asset values are updated only quarterly. As such, there can be difference between underlying economic volatility and visible realized pricing volatility. The visible realized private equity returns are very smoothed and do not have much mark to market pricing. On a fundamental basis we do believe that if a private equity portfolio were marked to market, at a market price for the underlying holdings, it would have higher levels of volatility. We realize that this is not how private equity funds are operated and private equity investors do not think in these terms, however this type of analysis does capture the appropriate long term risks, translated to mean variance statistics. Because one-period annual volatility is needed, the volatility number used for private equity may seem to be higher than the numbers investors are used to seeing. However, if you apply our ~30% volatility assumption over a 10 year horizon, the standard deviation of 10 year returns is ~10%, which is consistent with the range of realized returns for 10 year old private equity funds over rolling 10 year periods. For comparison, public equity is assumed to have an 18% annual volatility which equates to 6% volatility over a 10 year horizon.

For Total Private Equity, we assume a weighting of 55% LBO funds, 25% venture capital funds, 10% mezzanine funds, and 10% special situations and other private equity.

Real Estate

We use a multi-factor beta plus alpha for developing our real estate returns. The returns for real estate are driven by economic growth given the significant impact that GDP growth has on underlying rental and property price growth. We also assume that real estate is impacted by the overall level of interest rates and credit conditions given their use of the debt. Real estate is also assumed to have some underlying equity beta.

Alpha assumptions reflect what we think Mercer A-rated managers can return. Similar to hedge funds and private equity, we assume standard management and incentive fees, where applicable.

We differentiate between REITs and private forms of real estate for two key reasons. First, REITs are able to employ leverage without incurring UBTI for tax-exempt accounts. Additionally, REITs have the ability to grow by using additional public offerings of stock or debt. Global real estate is assumed to be very similar to domestic real estate—it has a low beta relative to the equity markets. Currency volatility increases the volatility of this asset class slightly.

Infrastructure Investing

We view infrastructure investing as investment in projects that are normally operated or undertaken by governments, but are outsourced to private firms. We categorize them as an asset class similar to private equity and private real estate.

The typical government project in question is a large, capital intensive project (road, airport, sewage system) financed by the issuance of debt. In this financial structure, the government is taking all the equity risk and it is highly unlikely that such a debt/equity ratio is an optimal solution for all situations. (Also, given the governance structure of government organizations and as sole equity-holders, they cannot rely on other equity participants to share risks and reduce the agency costs of managing projects and running enterprises.) Clearly, there is an economic incentive for governments to lay off at least some, and in a few cases all, of the equity risk. In this sense, infrastructure investing can be thought of as a transfer of risks involved in the financing and operation of public projects; governments decrease their equity risks in return for a more certain stream of cash flows.

From an investor's perspective, this is a type of private investing. An investor dedicates specific cash flows into a partnership in return for a stream of variable payments that is anticipated to end at a certain time. We view infrastructure as far less uncertain than either venture capital or LBO funds, and maybe not even as risky as mezzanine financing. Some of the uncertainties of venture capital are reduced or not even present in infrastructure. In particular, a clear demand exists for the product and the risks are more those of management and implementation (not product design, development, and marketing). Also, private firms sometimes capture the gains of implementing pricing structures that, because of political constraints, governments are unable to exploit. Infrastructure is similar to real estate in that cash flows are normally quite stable and are expected to have a long life. In a sense, infrastructure could be considered a low beta, private equity investment. Our infrastructure investments are assumed to be more value-added" like.

Like other private investments, liquidity is very limited and shareholder rights may be obscured through the partnership format.

We assume a fee structure for infrastructure similar to that of private equities.

Timberland

We have set an assumption for timberland investing based on a core timberland play with only small amounts of leverage. We view this asset class not as a leveraged play on a type of real estate, but a pure resource-based asset class.

CAPITAL MARKET OUTLOOK

Expected Return and Risk for Alternative Asset Classes

Asset Class	Cash	Multi-Factor Beta Exposures										Expected Returns				
		Equity Beta	Small Beta	Credit Beta	Illiquidity Beta	Term Beta	Mom. Beta	Carry Beta	Unexpected Inflation Beta	Non-Corp. GDP Beta	Beta Returns	Net Alpha	Geo Return	Arith Return	Std Dev	
Hedge Funds																
Zero Beta	2.8%	0.0	-	-	0.20	-	0.10	-	-	-	0.7%	1.00%	4.4%	4.5%	3.6%	
Conservative	2.8%	0.1	-	0.10	0.20	-	0.10	-	-	-	1.3%	2.00%	6.0%	6.1%	6.0%	
Moderate	2.8%	0.2	-	0.10	0.50	-	0.10	-	-	-	2.2%	2.00%	6.7%	7.0%	8.2%	
Mod/Aggressive	2.8%	0.4	-	0.10	0.50	-	0.10	-	-	-	3.1%	2.00%	7.4%	7.9%	10.7%	
Aggressive	2.8%	0.5	-	0.10	0.50	-	0.10	-	-	-	4.0%	2.00%	8.0%	8.8%	13.0%	
Global Macro / Alpha	2.8%	0.1	0.20	-	-	1.00	0.30	0.10	-	-	3.2%	2.00%	7.3%	8.0%	12.1%	
Asset Class																
Private Equity	Cash	Multi-Factor Beta Exposures										Expected Returns				
		Equity Beta	Small Beta	Credit Beta	Illiquidity Beta	Term Beta	Mom. Beta	Value Beta	Unexpected Inflation	Non-Corp. GDP Beta	Beta Returns	Net Alpha	Geo Return	Arith Return	Std Dev	
Total PE		2.8%	1.3	1.30	0.0	1.00	-	-	-	-	9.1%	1.00%	9.9%	13.0%	26.9%	
LBO		2.8%	1.3	1.00	-	1.00	-	-	0.10	-	9.6%	1.00%	9.8%	13.4%	29.2%	
Venture Cap		2.8%	1.5	1.50	-	1.00	-	-	-	-	10.4%	1.00%	10.4%	14.2%	30.4%	
Mezzanine		2.8%	0.6	-	4.00	0.80	-	-	-	-	6.1%	1.00%	8.2%	9.9%	19.1%	
Special Situations		2.8%	1.4	0.50	0.60	1.00	-	-	0.10	-	10.0%	1.00%	10.3%	13.8%	28.9%	
Multi-Factor Beta Exposures										Expected Returns						
Equity Beta		Small Beta	Credit Beta	Illiquidity Beta	Term Beta	Mom. Beta	Value Beta	Unexpected Inflation	Non-Corp. GDP Beta	Beta Returns	Net Alpha	Geo Return	Arith Return	Std Dev		
Real Estate																
Unlevered Property		2.8%	0.2	-	-	1.00	-	-	-	1.00	1.00	3.7%	0.00%	5.8%	6.5%	12.6%
Core		2.8%	0.2	-	0.50	1.00	0.50	-	-	1.00	1.10	4.4%	0.67%	6.8%	7.9%	15.7%
Value-Added		2.8%	0.3	-	0.50	1.00	0.10	-	-	1.00	1.10	5.2%	1.00%	7.6%	9.0%	17.4%
Opportunistic		2.8%	0.5	-	0.50	1.00	0.10	-	-	1.00	1.10	6.4%	1.00%	8.5%	10.2%	19.3%
Private Natural Resources		2.8%	1.0	0.50	-	1.00	-	-	-	5.00	0.80	8.3%	1.00%	9.3%	12.1%	25.3%
Private Infrastructure		2.8%	0.3	-	0.50	1.00	0.40	-	-	1.00	1.20	5.5%	1.00%	8.1%	9.3%	16.7%

6

Factor Scores

Mercer provides some additional risk measures in our Capital Market Outlook in the form of risk factor scores. Risk is multi-dimensional and we believe that the mean-variance characteristics do not properly reflect the many dimensions of risk. By defining and measuring some of these factors, we hope to improve an investor's ability to properly judge the risk and potential return of different portfolios.

Equity Beta

The *Equity Beta* measure is relative to the All Cap US Equity asset class. We include this because a few asset classes may be very attractive in mean-variance terms, but this exposes the investor to high sensitivity to the equity markets. For example, small cap and private equity when unconstrained will take up large portions of a portfolio at high risk levels. A portfolio might have 70% equity, but the equity beta might be closer to 0.90. Another example is high yield bonds, which are typically very attractive on a mean-variance basis, but are highly correlated with US equities in times of booms and busts. High yield bonds are by definition fixed income, but in effect, they provide exposure to equity markets.

Current Duration

This is the standard measure of interest rate sensitivity for fixed income portfolios: modified effective duration. We set the duration of equities to zero although we acknowledge that on average there is some duration to equities. The idea here is to show the amount of protection when Treasury yields decline.

By and large, asset-oriented investors are not rewarded for taking on much duration risk (though in times of steep yield curves, we have seen long bonds on the asset-only efficient frontiers).

Current Liquidity

We define *Current Liquidity* as the ability to liquidate and replace a security within a week's time including transaction costs. We chose a week as it is a reasonable time period to execute a complete sell of securities within an asset class and a purchase of replacements in either that asset class or in another one. The idea is to provide a measure of expected costs of rebalancing, funding normal distributions, and illiquidity costs of private assets. The score also reflects the percentage of a portfolio that could be transacted with a short notice. We have found that in many liquidations, a security or two fail to transact. For example, in times of stress, we would expect it to be very difficult (and/or costly) to transact a high yield bond portfolio.

We measure Current Liquidity on a 0 (least liquid and no ability to assist in rebalancing or paying projected fund distributions in a short time period) to 100 (complete liquidity with virtually no transaction costs) scale. Cash has the highest liquidity at 100 and private equity would have a 0 liquidity score.

Along with cash, US Treasury bonds are probably the next most liquid asset class. Large cap equities may be the next most liquid, but beyond that some subjective elements come into play. Are high yield bonds less liquid than international small cap stocks? A few hedge funds have near daily liquidity. Other hedge funds have lock-up periods that can last for years.

Current Income

Current Income is simply the expected cash income over the next year from the portfolio from coupon payments or dividends. It may not be equal to our long run income estimate.

Transaction Costs

We present representative costs for total one-way transaction costs for asset classes. (One-way means a buy only or a sell only, not the round-trip costs of turning a portfolio over and replacing securities within the same asset classes.) These are representative costs that include any commissions, dealer costs, and market impact costs. These numbers are to be used to help determine trigger points for rebalancing and the overall liquidity of a portfolio. These costs are not reflective of the costs of any individual transactions or particular portfolio transition or restructuring. The actual costs of specific transactions cannot be known with certainty before the transaction, but can only be estimated afterwards and depends on a multitude of factors.

Inflation Hedge

We have developed an inflation hedge score based on historic correlations and future expectations. Overall, inflation is very difficult to hedge precisely—even inflation-indexed bonds can fail at times because the bonds are also subject to changes in valuations because of changes in real yields.

Our inflation score is based on a 0 to 100 scale, with 100 being the highest score (perfect inflation hedging) and 0, the lowest (no ability to hedge against inflation). A neutral score is 50.

In theory, equities ought to be neutral to inflation. If we look at the basic dividend discount model, inflation expectations will show up in both the cost-of-capital and in the expected growth rate of dividends; thus, any change in inflation expectation should cancel out and leave valuation unchanged. More sophisticated models might have cost-of-capital rising faster than the growth rate of dividends, causing a negative correlation between inflation and equity valuation. Also, it is thought that higher inflation should produce slightly lower economic growth rates because both consumers and producers have trouble reading price signals (i.e. were recent changes in prices due to inflation or true shifts in supply and demand?)

The historical correlation of equities with inflation is close to zero. Given the large standard deviation of equity returns, we view it quite possible to have large positive or negative returns as inflation increases.

Fixed income is very sensitive to inflation. Cash and very short-term fixed income have slightly positive correlation, but as duration increases, fixed income becomes more negatively correlated. We put long term government bonds as the asset class with the least amount of inflation protection.

Inflation indexed bonds (IIB or TIPS) and commodities offer the best protection against inflation, but even these are not perfect hedges. TIPS have the additional real interest rate risk, which can be quite large in the short run. Commodities cover only a portion and thus have correlations more in the 0.7 range.

At least historically, we see that real estate—whether through private investing or REITS—offers slightly better inflation protection than traditional equities. We have set the inflation hedging capabilities of this asset class to be between equities and commodities.

Other Factors

One factor that we have found useful in looking at the difficulty of implementation and clearly relates to the ultimate level of returns is management fees. Since the fees are affected by the size of the allocation and the vehicle used, we do not set a factor score and leave it up to consultants to set the expected fees for asset classes. (We recommend using the Mercer Global Fee survey to help set them.) We have looked at fees as both a minimum expected fee (using index funds as much as possible or using the lowest cost active management fees) and at average fees. We find that there is a relationship between the size of the management fees and the resources needed to devote to due diligence and monitoring to perform proper oversight of the allocation.

Consultants and clients should feel free to adjust these factor scores as appropriate.

Asset Class Standard Deviations and Correlations

Standard deviation and correlation assumptions are based on historical data adjusted at Mercer's discretion and in its professional judgment. For example, Mercer's large cap equity standard deviation is 18.1%, lower than the S&P 500 standard deviation of 20.5% since 1929. We believe that along with the lowering of the equity risk premium, there is a slight lowering of volatility as well.

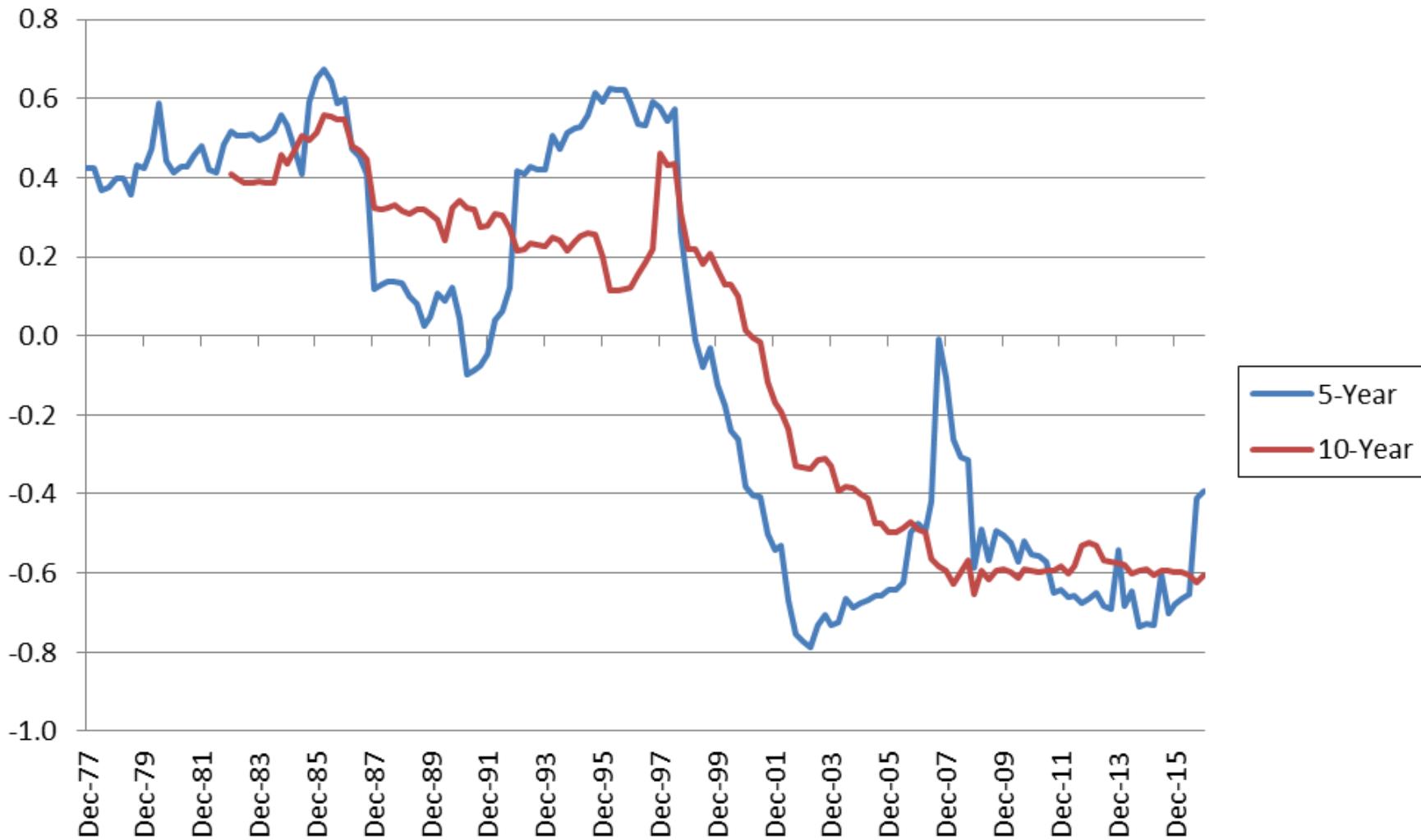
For fixed income, we primarily concentrate on the period from 1970 onward. Interest rates were completely deregulated in the mid-1970s through early 1980s (for example, Regulation Q, which set a maximum for interest offered by banks and savings and loans, was repealed in the 1970s). Additionally, flexible exchange rates, the elimination of the gold standard, and the advent of financial futures also occurred during that period.

Historically, we have seen a wide discrepancy between actual and expected inflation. For instance, during the period from the late 1970s through the mid-1990s, as inflation rose in the early part of this period, the market factored in high inflation expectations. Even when inflation came in lower than expected in the late 1980s and early 1990s, the market was cautious and kept nominal interest rates quite high relative to actual inflation. (Some analysts cite the 1980s as a period of high real returns, but that does not necessarily mean that real yields were high.) Consequently, we have seen a much weaker relationship between inflation and many asset classes than commonly assumed. Another problem is in adjusting for the difference between actual inflation, which is a backward measure, and yield, which is forward looking. Finally, the market is pricing in expected inflation and reacts to unexpected changes in inflation only when they are deemed permanent.

Correlation of Stocks and Bonds

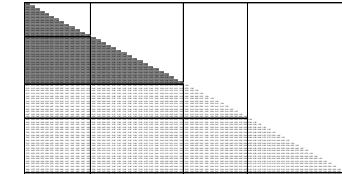
Rolling 5-yr and 10-yr averages of quarterly returns for the S&P 500 Index and the Bloomberg Barclays US Government Index.

Correlation between stocks and bonds has been highly unstable. From the early 1970s through 1997, correlation was moderately positive. However, correlation shifted to decidedly negative with the drop in the equity markets in 2000. In the short run, we expect a zero to slightly negative correlation of stocks and bonds and a very low positive rate in the longer run.



CAPITAL MARKET OUTLOOK

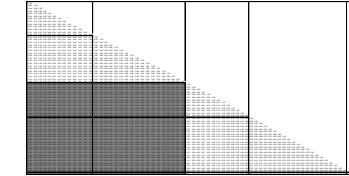
Nominal Return Correlations



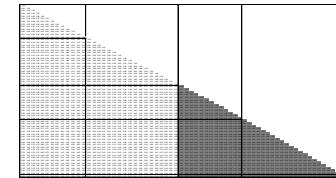
	US All Cap Equity	US Large Cap Equity	US Mid Cap Equity	US Small Cap Equity	US Micro Cap Equity	US Small/Mid Cap Equity (Smd)	US Defensive Equity	Non-US Developed All Cap Equity Unhedged	Non-US Developed All Cap Equity Hedged	Non-US Developed Large Cap Equity Unhedged	Non-US Developed Large Cap Equity Hedged	Non-US Developed Small Cap Equity Unhedged	Non-US Developed Small Cap Equity Hedged	Emerging Markets Equity Unhedged	AC World ex-US All Cap Equity Unhedged	AC World ex-US All Cap Equity Hedged	Global AC All Cap Equity Hedged	Global AC Large Cap Equity Unhedged	Global AC Large Cap Equity Hedged	Global AC Small Cap Equity Unhedged	Global AC Small Cap Equity Hedged	Global Developed Large Cap Unhedged	Global Developed Large Cap Hedged	Global Developed Small Cap Unhedged	Global Developed Small Cap Hedged	Global Defensive Equity Unhedged	US Govt/Credit FI	US Govt/Credit FI (Downgrade Tolerant)	US Aggregate FI	US Short G/C FI	US Intermediate G/C FI	US Long G/C FI	US Long G/C FI (Downgrade Tolerant)	US Intermediate Government FI	US Long Government FI	US Intermediate Credit FI	US Long Credit FI	US Long Credit FI (Downgrade Tolerant)	US Municipal FI	US Inflation Indexed FI	US Long Inflation Indexed FI	US Senior/Leveraged Loans	US Cash
1 US All Cap Equity	1.00																																										
2 US Large Cap Equity	1.00	1.00																																									
3 US Mid Cap Equity	0.98	0.97	1.00																																								
4 US Small Cap Equity	0.94	0.91	0.98	1.00																																							
5 US Micro Cap Equity	0.92	0.90	0.96	0.97	1.00																																						
6 US Small/Mid Cap Equity (Smd)	0.97	0.95	1.00	0.99	0.97	1.00																																					
7 US Defensive Equity	1.00	1.00	0.97	0.91	0.90	0.95	1.00																																				
8 Non-US Developed All Cap Equity Unhedged	0.77	0.77	0.76	0.72	0.71	0.74	0.77	1.00																																			
9 Non-US Developed All Cap Equity Hedged	0.85	0.84	0.83	0.79	0.78	0.82	0.84	0.82	1.00																																		
10 Non-US Developed Large Cap Equity Unhedged	0.76	0.77	0.75	0.70	0.69	0.73	0.77	1.00	0.91	1.00																																	
11 Non-US Developed Large Cap Equity Hedged	0.84	0.84	0.82	0.77	0.76	0.80	0.85	0.91	0.91	0.91	1.00																																
12 Non-US Developed Small Cap Equity Unhedged	0.76	0.73	0.79	0.80	0.78	0.80	0.73	0.96	0.89	0.94	0.88	1.00																															
13 Non-US Developed Small Cap Equity Hedged	0.81	0.85	0.86	0.84	0.86	0.79	0.88	0.96	0.86	0.94	0.93	1.00																															
14 Emerging Markets Equity Unhedged	0.73	0.71	0.67	0.68	0.76	0.73	0.76	0.74	0.72	0.69	1.00																																
15 AC World ex-US All Cap Equity Unhedged	0.77	0.77	0.76	0.72	0.71	0.74	0.77	0.96	0.88	0.98	0.88	0.92	0.83	0.90	1.00																												
16 AC World ex-US All Cap Equity Hedged	0.86	0.86	0.85	0.80	0.79	0.83	0.86	0.92	0.97	0.92	0.89	0.89	0.93	0.87	0.94	1.00																											
17 AC World ex-US Large Cap Equity Unhedged	0.77	0.75	0.70	0.68	0.73	0.77	0.96	0.87	0.91	0.82	0.90	0.90	0.94	1.00																													
18 AC World ex-US Large Cap Equity Hedged	0.86	0.85	0.84	0.77	0.82	0.86	0.98	0.97	0.88	0.91	0.88	0.94	1.00	0.94	1.00																												
19 Global AC All Cap Equity Unhedged	0.94	0.94	0.93	0.88	0.87	0.91	0.94	0.98	0.98	0.92	0.90	0.88	0.86	0.94	0.95	1.00																											
20 Global AC All Cap Equity Hedged	0.97	0.97	0.95	0.91	0.88	0.91	0.97	0.87	0.98	0.87	0.94	0.85	0.90	0.88	0.96	0.98	1.00																										
21 Global AC Large Cap Equity Unhedged	0.94	0.94	0.89	0.85	0.84	0.89	0.94	0.92	0.92	0.92	0.88	0.86	0.84	0.96	0.94	0.96	1.00	0.98	1.00																								
22 Global AC Large Cap Equity Hedged	0.97	0.97	0.94	0.88	0.87	0.92	0.97	0.84	0.93	0.88	0.82	0.88	0.86	0.96	0.98	1.00	0.98	1.00																									
23 Global AC Small Cap Equity Unhedged	0.91	0.88	0.94	0.93	0.95	0.98	0.88	0.86	0.86	0.93	0.80	0.89	0.91	0.88	0.90	0.94	0.94	0.92	1.00																								
24 Global AC Small Cap Equity Hedged	0.93	0.90	0.96	0.97	0.95	0.97	0.83	0.90	0.88	0.95	0.76	0.83	0.91	0.82	0.89	0.93	0.95	0.91	0.99	1.00																							
25 Global Developed Large Cap Unhedged	0.95	0.96	0.93	0.87	0.86	0.91	0.95	0.92	0.93	0.93	0.88	0.87	0.79	0.91	0.94	0.99	0.99	0.97	0.92	0.91	0.99	0.97	0.91	0.90	0.99	0.99	1.00																
26 Global Developed Large Cap Hedged	0.97	0.97	0.95	0.89	0.88	0.93	0.97	0.86	0.94	0.82	0.88	0.76	0.84	0.94	0.94	0.97	0.99	0.97	1.00	0.91	0.93	0.98	1.00																				
27 Global Developed Small Cap Unhedged	0.91	0.88	0.95	0.97	0.94	0.96	0.88	0.86	0.84	0.83	0.73	0.84	0.88	0.83	0.86	0.93	0.91	0.91	0.92	0.91	0.99	1.00																					
28 Global Developed Small Cap Hedged	0.92	0.89	0.96	0.98	0.96	0.97	0.89	0.81	0.88	0.78	0.86	0.85	0.70	0.79	0.88	0.77	0.86	0.91	0.97	0.90	0.92	0.99	0.99	1.00																			
29 Global Defensive Equity Unhedged	0.94	0.94	0.92	0.86	0.85	0.94	0.92	0.92	0.92	0.92	0.88	0.85	0.79	0.97	0.97	0.97	0.91	0.99	0.97	0.91	0.99	0.89	1.00																				
30 US Govt/Credit FI	0.12	0.12	0.12	0.11	0.11	0.12	0.13	0.04	0.09	0.04	0.10	0.06	0.08	-0.01	0.02	0.06	0.02	0.07	0.08	0.10	0.08	0.10	0.07	0.09	0.10	0.12	0.09	0.11	0.15	1.00													
31 US Govt/Credit FI (Downgrade Tolerant)	0.12	0.12	0.11	0.11	0.10	0.11	0.13	0.04	0.09	0.04	0.08	0.05	0.01	0.06	0.01	0.06	0.07	0.09	0.07	0.09	0.09	0.11	0.09	0.10	0.11	0.15	1.00																
32 US Aggregate FI	0.11	0.11	0.10	0.10	0.09	0.10	0.11	0.03	0.08	0.04	0.08	0.04	0.07	-0.03	0.06	0.05	0.06	0.08	0.06	0.08	0.10	0.08	0.09	0.14	0.98	0.98	1.00																
33 US Short G/C FI	0.04	0.04	0.04	0.03	0.04	0.04	0.05	-0.04	-0.01	-0.03	0.01	-0.02	-0.06	-0.02	-0.06	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	1.00												
34 US Intermediate G/C FI	0.10	0.10	0.09	0.09	0.09	0.09	0.11	0.06	0.07	0.06	0.06	0.05	0.05	0.06	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.13	1.00	1.00	0.98	0.99	1.00															
35 US Long G/C FI	0.26	0.26	0.25	0.23	0.23	0.24	0.23	0.17	0.21	0.12	0.15	0.12	0.21	0.17	0.16	0.19	0.20	0.22	0.20	0.23	0.24	0.20	0.22	0.27	0.93	0.93	0.91	0.81	0.89	1.00													
36 US Long G/C FI (Downgrade Tolerant)	0.24	0.24	0.23	0.22	0.22	0.23	0.25	0.15	0.21	0.16	0.21	0.16	0.19	0.13	0.19	0.20	0.22	0.20	0.23	0.24	0.20	0.22	0.28	0.92	0.92	0.90	0.80	0.89	1.00														
37 US Very Long Govt FI (20+ STRIPS)	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13	-0.13	-0.18	-0.16	-0.18	-0.16	-0.15	-0.23	-0.22	-0.19	-0.18	-0.19	-0.18	-0.18	-0.16	-0.15	-0.15	-0.12	-0.12	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	1.00												
38 US Government FI	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.07	-0.03	-0.09	-0.11	-0.07	-0.15	-0.12	-0.15	-0.12	-0.11	-0.09	-0.11	-0.09	-0.10	-0.09	-0.08	-0.08	-0.07	-0.07	-0.03	-0.03	-0.03	-0.03	-0.03	1.00											
39 US Credit FI	0.32	0.32	0.31	0.29	0.29	0.32	0.23	0.23	0.27	0.27	0.21	0.27	0.21	0.27	0.28	0.31	0.28	0.31	0.26	0.29	0.32	0.30	0.28	0.33	0.33	0.32	0.32	0.31	0.31	0.31	0.31	1.00											
40 US Credit FI (Downgrade Tolerant)	0.30	0.30	0.30	0.28	0.28	0.27	0.31	0.21	0.28	0.21	0.25	0.21	0.25	0.26	0.26	0.28	0.26	0.28	0.26	0.28	0.30	0.28	0.32	0.33	0.33	0.32	0.32	0.32	0.32	0.32	0.32	1.00											
41 US Intermediate Government FI	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-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	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	1.00											
42 US Long Government FI	-0.06	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.02	-0.08	-0.08	-0.16	-0.14	-0.12	-0.12	-0.14	-0.12	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	1.00											
43 US Intermediate Credit FI	0.22	0.22	0.22	0.20	0.20	0.21	0.23	0.13	0.19	0.13	0.19	0.14	0.18	0.08	0.11	0.17	0.11	0.17	0.16	0.20	0.18	0.21	0.22	0.25	0.94	0.93	0.91	0.90	0.89	0.89	0.89</												

CAPITAL MARKET OUTLOOK

Nominal Return Correlations – Continued



Nominal Return Correlations – Continued



CAPITAL MARKET OUTLOOK

Mean-Variance Assumptions (Real Terms)

Real Terms (Annual)											
Asset Class	GRR	ARR	STD	Asset Class	GRR	ARR	STD	Asset Class	GRR	ARR	STD
Domestic Equity				US Short G/C FI	1.3%	1.4%	4.5%	Miscellaneous			
US All Cap Equity	4.1%	5.6%	18.4%	US Intermediate G/C FI	1.4%	1.5%	5.0%	Convertibles	2.4%	2.9%	9.5%
US Large Cap Equity	4.0%	5.6%	18.1%	US Long G/C FI	1.3%	1.7%	9.6%	Stable Value/GICs	1.4%	1.4%	3.5%
US Mid Cap Equity	4.2%	6.0%	19.6%	US Govt/Credit FI (Dow ngrade Tolerant)	1.5%	2.0%	9.7%	Company Stock - Large Cap	2.2%	5.6%	27.4%
US Small Cap Equity	4.2%	6.4%	22.1%	US Very Long Govt FI (20+ STRIPS)	0.4%	2.0%	18.1%	Company Stock - Small Cap	-0.3%	6.4%	39.7%
US Micro Cap Equity	4.3%	6.8%	23.4%	US Government FI	1.0%	1.2%	5.2%	Global Cash - Currencies	0.5%	0.6%	4.9%
US Small/Mid Cap Equity (Smid)	4.2%	6.2%	20.5%	US Credit FI	1.8%	2.0%	6.9%	Non-US Currency Exposure (UIRP)	-1.4%	-1.1%	8.0%
US Defensive Equity	4.1%	5.0%	13.7%	US Credit FI (Dow ngrade Tolerant)	2.0%	2.2%	6.8%	Alternative Assets1			
International Equity				US Intermediate Government FI	1.1%	1.2%	4.5%	US Real Estate - Unlevered	3.6%	4.3%	12.6%
Non-US Developed All Cap Equity Unhedged	5.5%	7.4%	20.5%	US Long Government FI	0.8%	1.6%	12.9%	US Real Estate - Core	4.6%	5.7%	15.7%
Non-US Developed All Cap Equity Hedged	5.1%	6.7%	18.4%	US Intermediate Credit FI	1.8%	2.0%	6.0%	US Real Estate - Value-Added	5.4%	6.8%	17.4%
Non-US Developed Large Cap Equity Unhedged	5.4%	7.2%	20.3%	US Long Credit FI	1.6%	2.1%	10.1%	US Real Estate - Opportunistic	6.3%	8.0%	19.3%
Non-US Developed Large Cap Equity Hedged	5.1%	6.6%	18.2%	US Long Credit FI (Dow ngrade Tolerant)	1.9%	2.4%	9.9%	US Real Estate - REITS	4.2%	6.3%	21.3%
Non-US Developed Small Cap Equity Unhedged	5.8%	8.0%	22.4%	US Mortgage-Backed FI	1.4%	1.5%	5.6%	Non-US Real Estate - Private	5.3%	6.8%	18.1%
Non-US Developed Small Cap Equity Hedged	5.5%	7.4%	20.7%	US High Yield FI	2.5%	3.0%	10.0%	Non-US Real Estate - REITS	4.5%	6.9%	23.1%
Emerging Markets Equity Unhedged	6.8%	9.9%	26.4%	US Municipal FI	1.1%	1.5%	8.7%	Global Real Estate - Private	5.6%	6.8%	15.9%
AC World ex-US All Cap Equity Unhedged	5.7%	7.9%	22.2%	US Inflation Indexed FI	1.0%	1.2%	5.6%	Global Real Estate - REITS	4.5%	6.5%	21.3%
AC World ex-US All Cap Equity Hedged	5.4%	7.1%	19.2%	US Intermediate Inflation Indexed FI	1.1%	1.2%	3.3%	Timberland	4.2%	5.2%	14.6%
AC World ex-US Large Cap Equity Unhedged	5.6%	7.8%	22.1%	US Long Inflation Indexed FI	0.7%	1.0%	6.9%	Distressed Debt	5.7%	7.0%	16.9%
AC World ex-US Large Cap Equity Hedged	5.4%	7.0%	19.1%	US Senior/Leveraged Loans	2.5%	2.7%	6.5%	Private Equity - Total	7.6%	10.8%	26.9%
Global AC All Cap Equity Unhedged	5.1%	6.7%	18.9%	US Cash	0.6%	0.6%	2.0%	Private Equity - LBO	7.5%	11.2%	29.2%
Global AC All Cap Equity Hedged	4.8%	6.3%	18.1%	International Fixed Income				Private Equity - Venture Cap	8.1%	12.0%	30.4%
Global AC Large Cap Equity Unhedged	5.0%	6.6%	18.6%	Non-US Govt FI Unhedged	-0.2%	0.3%	10.3%	Private Equity - Mezzanine	6.0%	7.7%	19.1%
Global AC Large Cap Equity Hedged	4.8%	6.3%	17.8%	Non-US Govt FI Hedged	-0.1%	0.1%	6.9%	Private Equity - Special Situations	8.0%	11.6%	28.9%
Global AC Small Cap Equity Unhedged	5.2%	7.3%	21.4%	Non-US Broad FI Unhedged	0.0%	0.5%	9.9%	Infrastructure - Listed	4.3%	5.4%	15.2%
Global AC Small Cap Equity Hedged	5.1%	7.0%	20.7%	Non-US Broad FI Hedged	0.1%	0.3%	6.1%	Infrastructure - Private	5.8%	7.1%	16.7%
Global Developed Large Cap Unhedged	4.8%	6.2%	17.8%	Emerging Markets FI - Hard Currency	3.1%	3.7%	11.6%	Hedge Funds - Zero Beta	2.2%	2.3%	3.6%
Global Developed Large Cap Hedged	4.7%	6.1%	17.4%	Emerging Markets FI - Local Currency	4.2%	4.8%	11.2%	Hedge Funds - Conservative	3.8%	3.9%	6.0%
Global Developed Small Cap Unhedged	5.0%	7.0%	21.2%	Global Govt FI Unhedged	0.1%	0.4%	7.3%	Hedge Funds - Moderate	4.5%	4.8%	8.2%
Global Developed Small Cap Hedged	4.8%	6.8%	20.9%	Global Govt FI Hedged	0.2%	0.4%	5.9%	Hedge Funds - Mod/Aggressive	5.2%	5.7%	10.7%
Global Defensive Equity Unhedged	4.9%	5.8%	13.7%	Global Broad FI Unhedged	0.4%	0.7%	6.5%	Hedge Funds - Aggressive	5.8%	6.6%	13.0%
Domestic Fixed Income				Global Broad FI Hedged	0.5%	0.6%	5.5%	Hedge Funds - Macro	5.1%	5.8%	12.1%
US Govt/Credit FI	1.4%	1.5%	5.4%	Global Inflation Indexed FI	0.3%	0.5%	6.2%	Commodities - Long Only	1.0%	2.4%	17.2%
US Govt/Credit FI (Dow ngrade Tolerant)	1.5%	1.6%	5.4%	Global High Yield	2.6%	3.1%	10.5%	Natural Resources - Listed	4.4%	7.1%	24.7%
US Aggregate FI	1.4%	1.6%	5.3%					Natural Resources - Private	7.0%	9.9%	25.3%

Nominal and Real Volatility

We have used historic volatilities of asset classes to help develop our forward looking volatilities. Generally, equities have maintained volatility in the 15% to 25% range (with small cap stocks having the higher volatility), while bonds are in the 3% to 7% range.

For equities, we note that the VIX index—which is based on the implied volatility of S&P 500 options—has averaged around 20% since its inception in 1990 and as of June 30, 2016 was in the 15% range. This index is more a sentiment index and its construction methodology is biased upward by up to 30%. However, it also only looks at short-term options, so longer dated options could have higher volatility.

Generally, we have found that for equities, nominal volatility is very similar to volatility measured in inflation-adjusted terms (real volatility). Thus, we do not change the volatility of equities when we convert to real returns.

Across the board, however, bonds show an increase in volatility in real terms (except for inflation-indexed bonds). Thus, real volatility of fixed income and cash is set 1% higher than nominal volatility.

For several of our tools, we need to model interest rate volatility. Specifically, we look at relative volatility—the percentage change of yields based on the level of yields (as opposed to absolute volatility). Thus, when 10-year Treasuries are at 5% and have a 15% volatility, we would project that interest rates would have a standard deviation of 75 basis points ($5\% \times 0.15 = 0.75\%$). When 10-year Treasuries are at 10%, we would project the standard deviation to move to 150 basis points.

Historical Yield Volatility Analysis

As of December 31, 2016

Specific Bond	Period			Projected Volatility of Yields			Mercer Long Run Value	
	Jan-63 Current	Jan-83 Current	Jan-03 Current	Current Yield	Assumed Volatility	Current Absolute Std Dev		
10-Year US Treasury	Relative Volatility	17.9%	19.6%	23.6%	2.45%	20.0%	0.50%	3.90%
	Serial Correlation	-0.16	-0.30	-0.24				
3-Month US T-Bill ¹	Relative Volatility		43.6%	69.9%	0.51%	45.0%	n/m	3.05%
	Serial Correlation		0.30	0.19				
BarCap Corp.	Relative Volatility		15.6%	18.5%	3.37%	15.0%	0.51% ²	5.20% ²
	Serial Correlation		-0.22	-0.18				
BarCap Corp. Spread (OAS)	Relative Volatility			59.1%	123 bps	40.0%	49 bps	130 ²
	Serial Correlation			0.08				

¹ Due to Fed policy since 2007, the 3 month T-Bill yield has been close to zero and therefore the percentage change calculation is not meaningful. Therefore the statistics shown are for periods through 2007.

² Corporate bonds are shown on a 10 year maturity basis.

CAPITAL MARKET OUTLOOK

Based on the historical record, we observe:

- Shorter maturities have a lower absolute and relative volatility than longer maturities.
- Real yields are more volatile on a relative basis than nominal yields.
- Corporate bonds have relatively stable yields, but the spreads are far more volatile.

Appendix

Mean-Variance Assumptions, Short Term Reversion and Equilibrium Returns and Factor Scores as of January 2017

Asset Class	Mean-Variance Assumptions							Factor Scores					
	20-Yr Assumptions			Shorter Geometric Returns			Equil Return	Equity		T-		Infl	
	GRR	ARR	STD	3-Yr	5-Yr	10Yr		Beta	Dur	Liq	Inc	Costs	Hedg
Domestic Equity													
US All Cap Equity	6.3%	7.8%	18.4%	5.6%	5.6%	5.6%	7.0%	1.00	0.0	93	2.0	30	50
US Large Cap Equity	6.3%	7.8%	18.1%	5.6%	5.6%	5.6%	7.0%	0.98	0.0	95	2.1	25	50
US Mid Cap Equity	6.5%	8.2%	19.6%	5.8%	5.8%	5.8%	7.2%	1.05	0.0	92	1.9	30	50
US Small Cap Equity	6.5%	8.6%	22.1%	5.5%	5.5%	5.5%	7.4%	1.13	0.0	90	1.5	40	50
US Micro Cap Equity	6.6%	9.0%	23.4%	5.4%	5.4%	5.4%	7.8%	1.17	0.0	85	1.2	55	50
US Small/Mid Cap Equity (Smid)	6.5%	8.4%	20.5%	5.7%	5.7%	5.7%	7.3%	1.08	0.0	91	1.3	35	50
US Defensive Equity	6.3%	7.2%	13.7%	5.7%	5.7%	5.7%	7.0%	0.74	0.0	92	2.5	30	50
International Equity													
Non-US Developed All Cap Equity Unhedged	7.7%	9.6%	20.5%	8.1%	8.1%	8.1%	7.3%	0.85	0.0	89	3.1	45	50
Non-US Developed All Cap Equity Hedged	7.4%	8.9%	18.4%	7.3%	7.3%	7.3%	7.4%	0.85	0.0	89	3.1	55	50
Non-US Developed Large Cap Equity Unhedged	7.6%	9.4%	20.3%	8.1%	8.1%	8.1%	7.1%	0.84	0.0	90	3.0	36	50
Non-US Developed Large Cap Equity Hedged	7.3%	8.8%	18.2%	7.3%	7.3%	7.3%	7.3%	0.83	0.0	90	3.0	46	50
Non-US Developed Small Cap Equity Unhedged	8.0%	10.2%	22.4%	8.5%	8.5%	8.5%	7.6%	0.92	0.0	87	2.4	55	50
Non-US Developed Small Cap Equity Hedged	7.7%	9.6%	20.7%	7.8%	7.8%	7.8%	7.7%	0.92	0.0	87	2.4	65	50
Emerging Markets Equity Unhedged	9.1%	12.1%	26.4%	9.1%	9.1%	9.1%	8.3%	1.05	0.0	83	2.6	75	50
AC World ex-US All Cap Equity Unhedged	8.0%	10.1%	22.2%	8.5%	8.5%	8.5%	7.4%	0.93	0.0	88	3.0	85	50
AC World ex-US All Cap Equity Hedged	7.7%	9.3%	19.2%	7.8%	7.8%	7.8%	7.6%	0.90	0.0	88	3.0	95	50
AC World ex-US Large Cap Equity Unhedged	7.9%	10.0%	22.1%	8.5%	8.5%	8.5%	7.3%	0.92	0.0	88	3.1	55	50
AC World ex-US Large Cap Equity Hedged	7.6%	9.2%	19.1%	7.8%	7.8%	7.8%	7.4%	0.89	0.0	88	3.1	65	50
Global AC All Cap Equity Unhedged	7.3%	8.9%	18.9%	7.4%	7.4%	7.4%	7.3%	0.96	0.0	91	2.5	62	50
Global AC All Cap Equity Hedged	7.1%	8.5%	18.1%	6.8%	6.8%	6.8%	7.4%	0.95	0.0	91	2.5	72	50
Global AC Large Cap Equity Unhedged	7.3%	8.8%	18.6%	7.3%	7.3%	7.3%	7.2%	0.95	0.0	92	2.6	55	50
Global AC Large Cap Equity Hedged	7.0%	8.5%	17.8%	6.8%	6.8%	6.8%	7.3%	0.93	0.0	92	2.6	65	50
Global AC Small Cap Equity Unhedged	7.5%	9.5%	21.4%	7.3%	7.3%	7.3%	7.6%	1.06	0.0	88	2.0	75	50
Global AC Small Cap Equity Hedged	7.3%	9.2%	20.7%	6.9%	6.9%	6.9%	7.7%	1.04	0.0	88	2.0	85	50
Global Developed Large Cap Unhedged	7.0%	8.4%	17.8%	6.9%	6.9%	6.9%	7.1%	0.92	0.0	93	2.6	37.5	50
Global Developed Large Cap Hedged	6.9%	8.3%	17.4%	6.7%	6.7%	6.7%	7.1%	0.92	0.0	93	2.6	47.5	50
Global Developed Small Cap Unhedged	7.2%	9.2%	21.2%	6.9%	6.9%	6.9%	7.5%	1.04	0.0	88	1.9	55	50
Global Developed Small Cap Hedged	7.0%	9.0%	20.9%	6.5%	6.5%	6.5%	7.5%	1.04	0.0	88	1.9	65	50
Global Defensive Equity Unhedged	7.1%	8.0%	13.7%	7.2%	7.2%	7.2%	7.1%	0.70	0.0	93	3.1	37.5	50

CAPITAL MARKET OUTLOOK

Mean-Variance Assumptions, Short Term Reversion and Equilibrium Returns and Factor Scores as of January 2017

Asset Class	Mean-Variance Assumptions						Factor Scores						
	20-Yr Assumptions			Shorter Geometric Returns			Equil Return	Equity		T-		Infl Hedg	
	GRR	ARR	STD	3-Yr	5-Yr	10Yr		Beta	Dur	Liq	Inc	Costs	
Domestic Fixed Income													
US Govt/Credit FI	3.6%	3.7%	5.4%	1.9%	2.3%	2.8%	4.3%	0.04	6.5	94	2.5	30	20
US Govt/Credit FI (Dow ngrade Tolerant)	3.7%	3.8%	5.4%	2.0%	2.4%	2.9%	4.4%	0.03	6.5	94	2.5	30	20
US Aggregate FI	3.6%	3.8%	5.3%	1.9%	2.3%	2.8%	4.4%	0.03	5.9	93	2.6	35	20
US Short G/C FI	3.5%	3.6%	4.5%	1.6%	2.1%	2.8%	4.1%	0.01	0.5	95	1.0	20	55
US Intermediate G/C FI	3.6%	3.7%	5.0%	1.8%	2.3%	2.9%	4.3%	0.03	4.1	94	2.1	30	40
US Long G/C FI	3.5%	3.9%	9.6%	2.0%	2.2%	2.5%	4.5%	0.13	15.0	95	4.0	25	20
US Long G/C FI (Dow ngrade Tolerant)	3.7%	4.2%	9.7%	2.2%	2.4%	2.8%	4.7%	0.13	15.0	95	4.0	25	20
US Very Long Govt FI (20+ STRIPS)	2.6%	4.2%	18.1%	0.8%	0.9%	1.2%	4.1%	-0.13	25.0	96	0.0	20	10
US Government FI	3.2%	3.4%	5.2%	1.5%	1.9%	2.5%	4.0%	-0.02	5.9	99	1.9	10	20
US Credit FI	4.0%	4.2%	6.9%	2.4%	2.7%	3.2%	4.7%	0.12	7.1	90	3.3	50	30
US Credit FI (Dow ngrade Tolerant)	4.2%	4.4%	6.8%	2.6%	3.0%	3.5%	4.9%	0.11	7.1	90	3.3	50	30
US Intermediate Government FI	3.3%	3.4%	4.5%	1.5%	2.0%	2.6%	4.0%	-0.02	3.9	99	1.7	10	40
US Long Government FI	3.0%	3.8%	12.9%	1.5%	1.7%	2.0%	4.1%	-0.04	17.2	99	3.0	10	10
US Intermediate Credit FI	4.0%	4.2%	6.0%	2.4%	2.8%	3.4%	4.7%	0.07	4.4	89	2.9	50	40
US Long Credit FI	3.8%	4.3%	10.1%	2.4%	2.6%	2.9%	4.7%	0.23	13.6	89	4.6	50	30
US Long Credit FI (Dow ngrade Tolerant)	4.2%	4.6%	9.9%	2.7%	2.9%	3.3%	5.1%	0.22	13.6	89	4.6	50	30
US Mortgage-Backed FI	3.6%	3.7%	5.6%	1.7%	2.1%	2.7%	4.4%	0.02	4.6	88	2.9	60	30
US High Yield FI	4.7%	5.2%	10.0%	1.9%	2.6%	3.5%	5.9%	0.35	4.1	70	6.1	120	60
US Municipal FI	3.3%	3.7%	8.7%	1.8%	2.2%	2.8%	4.3%	0.02	6.2	70	2.7	120	30
US Inflation Indexed FI	3.2%	3.4%	5.6%	2.3%	2.5%	2.7%	3.8%	0.03	5.3	96	2.2	20	85
US Intermediate Inflation Indexed FI	3.3%	3.4%	3.3%	2.0%	2.4%	2.8%	3.8%	0.02	7.1	95	1.7	25	85
US Long Inflation Indexed FI	2.9%	3.2%	6.9%	2.4%	2.5%	2.5%	3.8%	0.04	11.6	95	2.3	25	85
US Senior/Leveraged Loans	4.7%	4.9%	6.5%	3.7%	4.1%	4.5%	5.0%	0.16	0.0	30	4.8	200	80
US Private Debt	6.4%	6.9%	10.5%	5.4%	5.8%	6.2%	6.6%	0.39	0.0	15	0.0	300	60
US Cash	2.8%	2.8%	2.0%	1.7%	2.1%	2.5%	3.1%	0.00	0.3	100	0.5	4	65
International Fixed Income													
Non-US Govt FI Unhedged	2.0%	2.5%	10.3%	0.7%	0.4%	0.7%	3.4%	-0.02	8.1	90	0.4	50	40
Non-US Govt FI Hedged	2.1%	2.3%	6.9%	0.5%	0.2%	0.5%	3.4%	-0.03	8.1	90	0.4	50	35
Non-US Broad FI Unhedged	2.2%	2.7%	9.9%	0.8%	0.6%	0.9%	3.6%	0.02	8.0	85	0.7	70	40
Non-US Broad FI Hedged	2.3%	2.5%	6.1%	0.6%	0.3%	0.7%	3.6%	0.01	8.0	85	0.7	70	35
Emerging Markets FI - Hard Currency	5.3%	5.9%	11.6%	4.1%	4.5%	4.8%	5.8%	0.34	7.9	75	6.0	100	30
Emerging Markets FI - Local Currency	6.4%	7.0%	11.2%	6.4%	6.4%	6.4%	5.0%	0.32	5.0	75	6.3	125	30
Global Govt FI Unhedged	2.3%	2.6%	7.3%	0.8%	0.6%	1.0%	3.7%	-0.02	7.9	85	1.0	70	30
Global Govt FI Hedged	2.4%	2.6%	5.9%	0.7%	0.5%	0.9%	3.7%	-0.02	7.9	85	1.0	70	30
Global Broad FI Unhedged	2.6%	2.9%	6.5%	1.2%	1.0%	1.3%	4.0%	0.02	6.9	89	1.6	50	30
Global Broad FI Hedged	2.7%	2.8%	5.5%	1.0%	0.8%	1.2%	4.0%	0.02	6.9	89	1.6	50	30
Global Inflation Indexed FI	2.5%	2.7%	6.2%	0.8%	0.5%	0.9%	4.1%	0.03	5.3	88	2.1	60	78
Global High Yield	4.8%	5.3%	10.5%	2.4%	3.3%	4.2%	5.8%	0.36	4.3	70	5.9	125	50
Miscellaneous													
Convertibles	4.6%	5.1%	9.5%	1.9%	2.6%	3.5%	6.0%	0.41	3.4	70	4.0	120	45
Stable Value/GICs	3.6%	3.6%	3.5%	1.7%	2.2%	2.9%	4.2%	-0.01	2.3	95	1.2	25	50
Company Stock - Large Cap	4.4%	7.8%	27.4%	3.9%	3.9%	3.9%	5.0%	1.24	0.0	90	2.1	40	50
Company Stock - Small Cap	2.0%	8.6%	39.7%	0.8%	0.8%	0.8%	3.3%	1.80	0.0	80	1.5	85	50
Global Cash - Currencies	2.7%	2.8%	4.9%	1.7%	2.1%	2.6%	3.1%	0.01	0.1	99	0.7	10	60
Non-US Currency Exposure (UIRP)	0.8%	1.1%	8.0%	0.5%	0.5%	0.5%	1.0%	0.00	0.0	100	0.0	2	50

CAPITAL MARKET OUTLOOK

Mean-Variance Assumptions, Short Term Reversion and Equilibrium Returns and Factor Scores as of January 2017

Asset Class	Mean-Variance Assumptions						Equil Return	Factor Scores ³						
	20-Yr Assumptions			Shorter Geometric Returns				Beta	Equity		T-		Infl	
	GRR	ARR	STD	3-Yr	5-Yr	10-Yr			Dur	Liq	Inc	Costs	Hedg	
Alternative Assets¹														
US Real Estate - Unlevered	5.8%	6.5%	12.6%	5.8%	5.8%	5.8%	6.0%	0.28	0.0	0	3.5	500	60	
US Real Estate - Core	6.8%	7.9%	15.7%	6.8%	6.8%	6.8%	7.0%	0.35	0.0	0	4.0	500	60	
US Real Estate - Value-Added	7.6%	9.0%	17.4%	7.6%	7.6%	7.6%	7.8%	0.42	0.0	0	3.0	500	60	
US Real Estate - Opportunistic	8.5%	10.2%	19.3%	8.5%	8.5%	8.5%	8.7%	0.48	0.0	0	3.0	500	60	
US Real Estate - REITS	6.5%	8.5%	21.3%	6.5%	6.5%	6.5%	6.5%	0.81	0.0	90	4.4	50	60	
Non-US Real Estate - Private	7.5%	9.0%	18.1%	7.5%	7.5%	7.5%	7.8%	0.36	0.0	0	3.5	500	60	
Non-US Real Estate - REITS	6.7%	9.1%	23.1%	6.7%	6.7%	6.7%	6.7%	0.72	0.0	85	3.7	70	60	
Global Real Estate - Private	7.9%	9.0%	15.9%	7.9%	7.9%	7.9%	7.8%	0.36	0.0	0	3.5	500	60	
Global Real Estate - REITS	6.7%	8.7%	21.3%	6.7%	6.7%	6.7%	6.7%	0.76	0.0	88	4.1	60	60	
Timberland	6.4%	7.4%	14.6%	6.4%	6.4%	6.4%	7.4%	0.49	0.0	0	4.5	500	60	
Distressed Debt	7.9%	9.2%	16.9%	7.9%	7.9%	7.9%	8.0%	0.65	3.2	30	6.1	350	50	
Private Equity - Total	9.9%	13.0%	26.9%	9.9%	9.9%	9.9%	9.8%	1.40	0.0	0	0.0	500	50	
Private Equity - LBO	9.8%	13.4%	29.2%	9.8%	9.8%	9.8%	9.7%	1.44	0.0	0	0.0	500	50	
Private Equity - Venture Cap	10.4%	14.2%	30.4%	10.4%	10.4%	10.4%	10.2%	1.49	0.0	0	0.0	500	50	
Private Equity - Mezzanine	8.3%	9.9%	19.1%	7.1%	7.5%	8.0%	8.7%	0.94	0.0	0	4.8	500	50	
Private Equity - Special Situations	10.3%	13.8%	28.9%	10.3%	10.3%	10.3%	10.2%	1.39	0.0	0	0.0	500	50	
Infrastructure - Listed	6.5%	7.6%	15.2%	6.5%	6.5%	6.5%	6.5%	0.67	0.0	0	2.6	500	50	
Infrastructure - Private	8.1%	9.3%	16.7%	8.1%	8.1%	8.1%	8.2%	0.74	0.0	90	1.9	50	50	
Hedge Funds - Zero Beta	4.4%	4.5%	3.6%	4.4%	4.4%	4.4%	4.7%	0.00	0.0	50	0.0	300	50	
Hedge Funds - Conservative	6.0%	6.1%	6.0%	6.0%	6.0%	6.0%	6.2%	0.19	0.0	40	0.0	400	50	
Hedge Funds - Moderate	6.7%	7.0%	8.2%	6.7%	6.7%	6.7%	6.9%	0.31	0.0	40	0.0	400	50	
Hedge Funds - Mod/Aggressive	7.4%	7.9%	10.7%	7.4%	7.4%	7.4%	7.5%	0.43	0.0	40	0.0	400	50	
Hedge Funds - Aggressive	8.0%	8.8%	13.0%	8.0%	8.0%	8.0%	8.2%	0.61	0.0	40	0.0	400	50	
Hedge Funds - Macro	7.3%	8.0%	12.1%	7.3%	7.3%	7.3%	7.5%	0.00	0.0	50	0.0	100	50	
Commodities - Long Only	3.2%	4.6%	17.2%	2.4%	2.8%	3.2%	3.9%	0.29	0.0	90	0.5	50	80	
Natural Resources - Listed	6.6%	9.3%	24.7%	6.6%	6.6%	6.6%	7.1%	0.93	0.0	90	2.0	25	65	
Natural Resources - Private	9.3%	12.1%	25.3%	9.3%	9.3%	9.3%	9.3%	0.97	0.0	90	0.0	25	65	
Gold	3.2%	4.6%	17.1%	2.4%	2.8%	3.2%	3.2%	0.17	0.0	92	2.0	50	80	
Economic Variables														
Inflation	2.2%	2.2%	1.7%	2.0%	2.1%	2.2%	2.2%							
Real GDP Growth	2.1%	2.1%	1.9%	2.1%	2.3%	2.4%	2.4%							
Nominal GDP	4.3%	4.3%	2.3%	4.1%	4.4%	4.6%	4.6%							
Total Comp-PC ²	5.1%	5.1%	1.6%	4.5%	4.7%	4.8%	4.6%							
Wage/Salary-PC ²	3.8%	3.8%	1.9%	3.8%	3.9%	4.0%	4.1%							
Medical Costs-PC ²	5.5%	5.5%	1.7%	6.8%	6.5%	6.3%	4.6%							
Housing Appreciation	3.5%	3.8%	8.5%	3.7%	3.7%	3.7%	3.7%							
Corporate Profits/Earnings	4.5%	5.0%	10.5%	4.5%	4.5%	4.5%	4.5%							

Market Sizes

Standard/Public Capital Markets				
Broad Asset Class	Sectors	Representative Index/Source	Size as of 12/31/2016 (\$MM)	Attribution
Domestic Equity	Large Cap	S&P 500 ¹	20,026,066	19.59%
	Mid Cap	Russell Midcap ¹	6,739,647	6.59%
	Small Cap	Russell 2000 ¹	2,214,479	2.17%
	Micro Cap	Russell Microcap ¹	458,728	0.45%
	Total Market	Dow Jones US Total Stock Market Index ¹	25,079,426	24.53%
International Equity	Large Cap	MSCI World ex-US ¹	17,118,988	16.75%
	Small Cap	MSCI EAFE Small Cap ¹	2,923,435	2.86%
	Emerging Markets	MSCI EM ¹	7,666,314	7.50%
Real Estate	REITS	FTSE NAREIT ²	959,818	0.94%
Domestic Fixed Income	Investment Grade	Barclays US Aggregate ³	19,059,684	18.64%
	High Yield	Barclays US High Yield ³	1,333,832	1.30%
	Floating Rate	Barclays FRN ³	317,387	0.31%
	Municipal	Barclays Municipal ³	1,383,519	1.35%
	Inflation Indexed	Barclays US TIPS ³	1,087,288	1.06%
International Fixed Income	Non-US Broad	Barclays Global ex-US ³	24,399,472	23.87%
	Emerging Market Debt	Barclays EMD Hard Currency Agg. ³	1,649,416	1.61%
Convertibles	US Convertibles	Barclays Convertibles ³	206,991	0.20%
			Total	102,225,752
				100.00%
Alternative/Private Capital Markets				
Fixed Income	Private Placements	N/A		N/A
	Distressed Debt	Burgis Private IQ ⁴	545,428	
Private Equity	LBO	Burgis Private IQ ⁴	1,735,530	
	Venture Cap	Burgis Private IQ ⁴	471,026	
Real Estate	Private Real Estate	Burgis Private IQ ⁴	606,900	
	Private Natural Resources	Burgis Private IQ ⁴	397,169	
Hedge Funds	N/A	HFR ⁵	3,020,000	

* As of 12/31/2016

¹Bloomberg

²National Association of Real Estate Investment Trusts

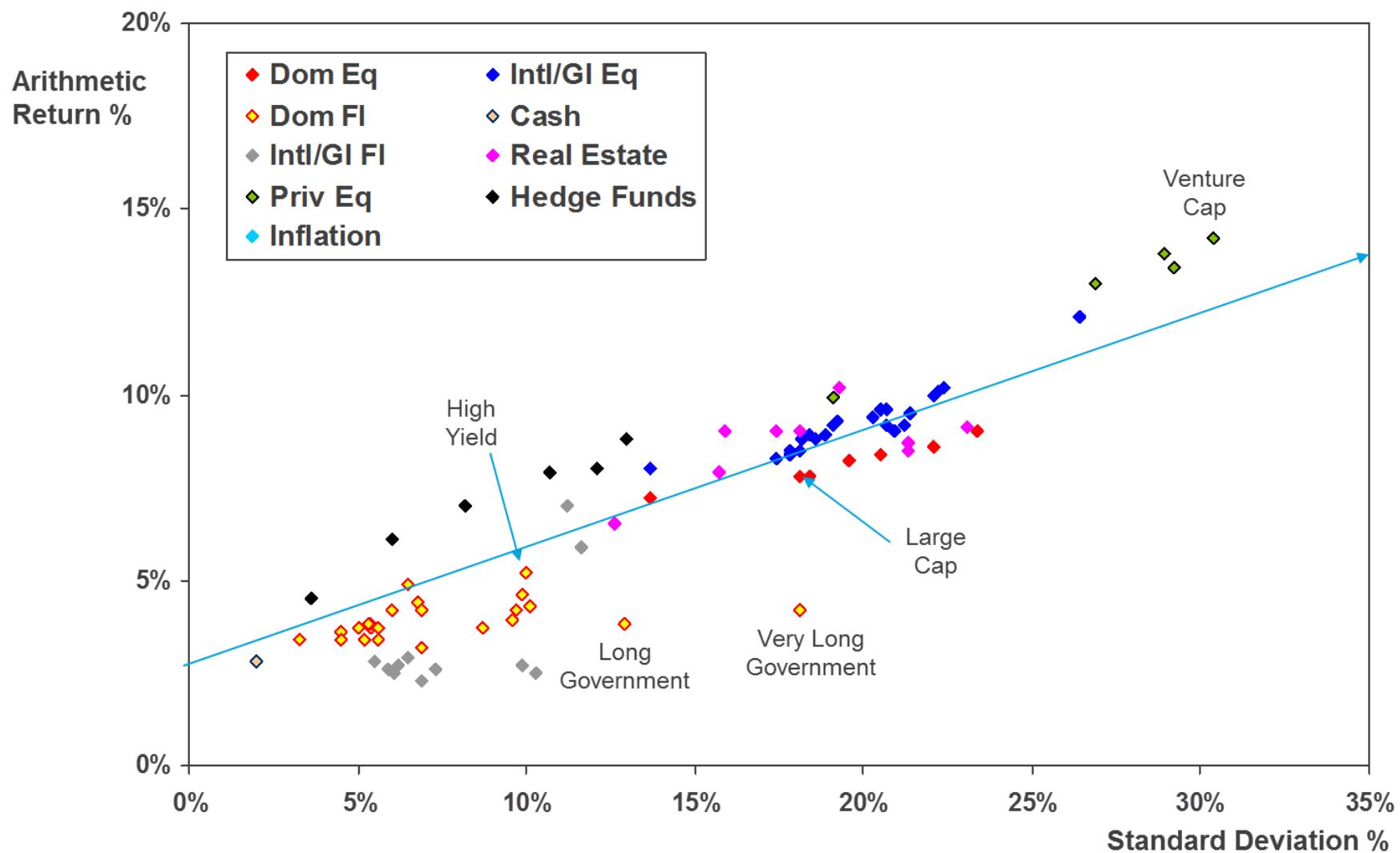
³Barclays Capital

⁴Burgis Private IQ (Cumulative value of funds raised over last 10 years as of December 2016)

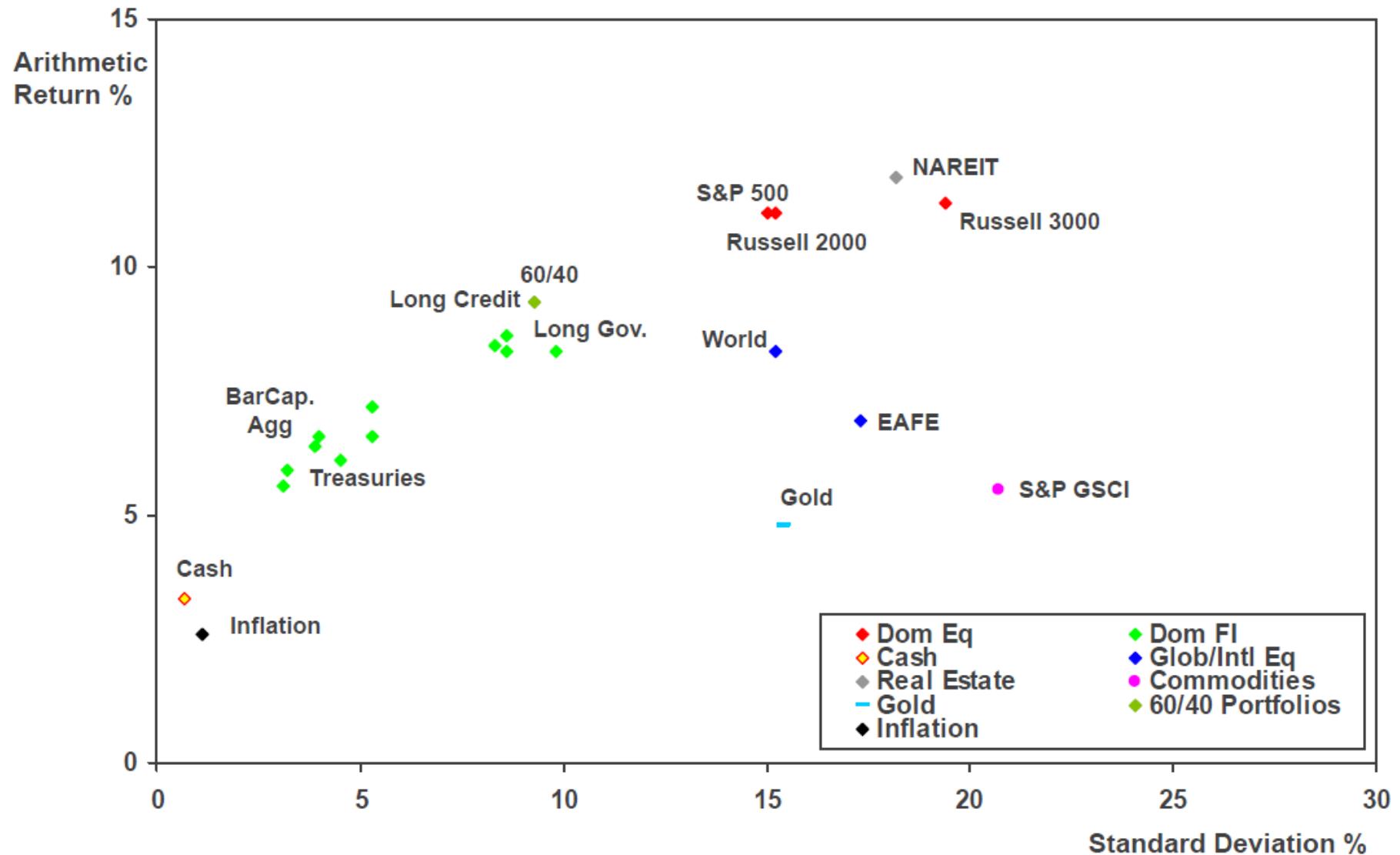
⁵Hedge Fund Research

Mean Variance Assumptions – January 2017

Our mean-variance assumptions follow a roughly linear return-risk relationship, but not a perfect one. Several factors—liquidity, duration, exchange rate risk, inflation risk, and market technical factors can push asset classes off the straight linear relationship.



Historical Risk and Reward – 30 Years Ending January 2017



Historical Growth Rates of Economic Factors

US Economic Performance: 1989 through 2016¹

	Geometric Average	Standard Deviation
Economic Growth		
Real GDP Growth	2.4%	1.2%
Nominal GDP Growth	4.9%	2.7%
Inflation		
GDP Deflator	2.6%	0.5%
Profits		
US Corporate Profits	6.7%	12.7%

¹ Data from Bureau of Economic Analysis, Bureau of Labor Statistics, and Standard & Poor's. Estimates by Mercer.

GDP Growth and Corporate profits are expected to have an approximate 1:1 relationship. This has held true over the long term. However, in recent years higher growth of corporate profits relative to GDP reflects primarily an increase in corporate profit margins.

Long Run Economic Assumptions – January 2017

Our long run economic assumptions can be used to set wage growth and health care cost parameters.

Real Economic Growth (US GDP) can be considered to consist of two components:

$$\begin{aligned} & 1.6\% \text{ Total Factor Productivity Growth} \\ + & 0.5\% \text{ Population Growth} \\ = & 2.1\% \text{ Real Economic Growth} \end{aligned}$$

We set inflation at 2.2% over the next 20 years. This is roughly consistent with consensus forward-looking economic forecasts and market implied indicators of inflation.

To derive our wage growth factors, we first note that Total Compensation Growth (per Capita) should match per capita GDP growth:

$$\begin{aligned} & 1.6\% \text{ Productivity Growth} \\ + & 2.2\% \text{ Inflation} \\ = & 3.8\% \text{ Total Compensation} \end{aligned}$$

Actual wage growth is lower than total compensation in the last couple of decades due to the higher growth rate of benefits over compensation. (In particular, health care costs have exceeded wage growth.) To adjust for this, we get:

$$\begin{aligned} & 1.5\% \text{ General productivity growth applied to wages} \\ + & 2.2\% \text{ Inflation} \\ = & 3.7\% \text{ Wage growth} \end{aligned}$$

Long run per capita health care cost assumption: 5.7%

- Short run trend rate: 7.0%

Asset Class Benchmarks

These are the commonly-used indices for our assumptions. We do not set our assumptions around any specific set of indices.

Asset Class	Index	Asset Class	Index
Domestic Equity		Global Government	Barclays Global Aggregate Bond
US All Cap	Russell 3000, DJ Wilshire 5000	Global Broad	JPMorgan Global Bond Index Broad
US Large Cap	Russell 1000, S&P 500	Global Inflation Indexed	Barclays Global Inflation-Linked
US Mid Cap	Russell Midcap	Miscellaneous	
US Small Cap	Russell 2000	Convertibles	Barclays US Convertibles
US Micro Cap	DJ Wilshire Micro Cap	Stable Value/GICs	Merrill Lynch Treasury (1-3 Year)
US Small/Mid Cap (Smid)	Russell 2500, DJ Wilshire 4500	Company Stock	N/A
US Defensive Equity	N/A	Global Cash - Currencies	N/A
International Equity		Non-US Currency Exposure (UIRP)	N/A
Non-US Developed Markets	MSCI EAFE	Alternative Assets	
Non-US Developed Small Cap	MSCI EAFE Small Cap	US Real Estate - Core	N/A
Emerging Markets	MSCI EM	US Real Estate - Private	N/A
All-Country World ex-US	MSCI ACWI ex-US	US Real Estate - REITS	FTSE NAREIT Real Estate, DJ US Real Estate
Global All-Country	MSCI ACWI	Non-US Real Estate - Private	N/A
Global All-Country Small Cap	MSCI ACWI Small Cap	Non-US Real Estate - REITS	FTSE EPRA/NAREIT Global Real Estate ex-US
Global Developed Markets	MSCI World	Global Real Estate - Private	N/A
Global Defensive Equity	N/A	Global Real Estate - REITS	FTSE EPRA/NAREIT Global Real Estate
Domestic Fixed Income		Timberland	N/A
US Govt/Credit	Barclays US Government/Credit	Distressed Debt	Barclays Distressed Securities
US Aggregate	Barclays US Aggregate Bond	Private Equity	N/A
US Short G/C	Barclays US Government/Credit (1-3 Year)	Infrastructure - Private	N/A
US Intermediate G/C	Barclays US Government/Credit (Intermediate)	Hedge Funds - Zero Beta	HFRI EH: Equity Market Neutral
US Long G/C	Barclays US Government/Credit (Long)	Hedge Funds - Conservative	HFRI FOF Conservative
US Very Long Govt (20 years)	Custom	Hedge Funds - Moderate	HFRI FOF Defensive
US Government	Barclays US Government	Hedge Funds - Mod/Aggressive	HFRI FOF Diversified
US Credit	Barclays US Credit	Hedge Funds - Aggressive	HFRI FOF Strategic
US Mortgage-Backed	Barclays US Mortgage	Hedge Funds - Macro	HFRI Macro
US High Yield	Barclays US Corp HY, Merrill Lynch US Corp HY	Commodities - Long Only	Bloomberg Commodity, S&P GSCI Commodity
US Municipal	Barclays US Municipal	US Natural Resources Stocks	S&P 500 Energy
US Inflation Indexed	Barclays US TIPS	Gold	N/A
US Senior/Leveraged Loans	S&P/LSTA Leveraged Loans Index		
US Cash	3-Month T-Bills		
International Fixed Income			
Non-US Government	Barclays Global Treasury ex-US		
Non-US Broad	Barclays Global Aggregate Bond ex-US		
Emerging Markets	Barclays Emerging Markets		

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However, we want to be cautious about making changes. We have designed our assumptions to be strategic in nature, and will typically not be adjusted to short-term market spikes. We use our judgment to determine whether interest rate moves are sustainable. In practice, we continuously review our assumptions and work to refine our methodology as we gain additional information relating to the capital markets, but do not anticipate changes every time interest rates rise in 25 or 50 basis point increments.

Capital market assumptions provided by Mercer Investments.

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Mercer Investment Consulting, Inc.
3560 Lenox Road, Suite 2400
Atlanta, GA 30326
+1 404 442 3100

Services provided by Mercer Investment Consulting, Inc.



APPENDIX P

Additional Analysis for Portfolio Construction

Chart I: Historical performance of emerging markets equity strategies in the past 20 years with comparison to MSCI Emerging Markets (Net) Index (“MSEMFN”)

Return in \$US (before fees) over 1 yr, 3 yrs, 5 yrs, 7 yrs, 10 yrs, 15 yrs, 20 yrs ending December-16

Comparison with the Emerging Markets Equity universe (Percentile Ranking)



The Mercer Emerging Markets Equity Universe is limited to emerging markets equity composites. It consists of equity strategies invested in stocks of emerging market countries. Additionally, the returns are most highly correlated to an emerging markets equity index such as the Morgan Stanley Capital International (MSCI) Emerging Markets Index. The returns in this universe are all gross of fees.

Table I: Information Ratio for trailing periods ending December 31, 2016

Information Ratio (against MSCI EM Net Index)	1 yr (%)	3 yrs (%pa)	5 yrs (%pa)	7 yrs (%pa)	10 yrs (%pa)	15 yrs (%pa)
Emerging Markets Equity Median Manager	-0.14	0.29	0.43	0.39	0.31	0.40

Table II: Active vs passive management for trailing periods ending December 31, 2016 based on representative fee of 0.78%⁴⁴

Periods ending 12/31/2016	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	15 yrs	20 yrs
MSCI EM Index	11.19%	-2.55%	1.28%	0.47%	1.84%	9.50%	n/a
Median Manager	10.60%	-1.43%	3.14%	2.05%	3.09%	11.09%	n/a
Median Manager(Net)	9.82%	-2.21%	2.36%	1.27%	2.31%	10.31%	n/a
'Winner'	Index	Manager	Manager	Manager	Manager	Manager	n/a
Magnitude	1.36%	0.35%	1.08%	0.80%	0.47%	0.81%	n/a

Table III and IV: Active vs passive management for calendar year periods based on representative fee of 0.78%

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
MSCI EM Index	n/a	n/a	n/a	n/a	-2.6%	-6.2%	55.8%	25.6%	34.0%	32.1%
Median Manager	n/a	n/a	n/a	n/a	-0.5%	-3.7%	59.6%	26.5%	36.7%	34.0%
Median Manager (Net)	n/a	n/a	n/a	n/a	-1.2%	-4.4%	58.8%	25.7%	35.9%	33.2%
'Winner'	n/a	n/a	n/a	n/a	Manager	Manager	Manager	Manager	Manager	Manager
Magnitude	n/a	n/a	n/a	n/a	1.4%	1.7%	3.0%	0.1%	1.9%	1.1%

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
MSCI EM Index	39.4%	-53.3%	78.5%	18.9%	-18.4%	18.2%	-2.6%	-2.2%	-14.9%	11.2%
Median Manager	40.3%	-53.6%	79.5%	20.8%	-18.3%	20.4%	0.0%	-0.8%	-13.6%	10.6%
Median Manager (Net)	39.5%	-54.4%	78.8%	20.0%	-19.0%	19.6%	-0.8%	-1.6%	-14.4%	9.8%
'Winner'	Manager	Index	Manager	Manager	Index	Manager	Manager	Manager	Manager	Index
Magnitude	0.1%	1.0%	0.3%	1.2%	0.6%	1.4%	1.8%	0.6%	0.5%	1.4%

⁴⁴ Based on Mercer's Global Asset Management Fee Survey for \$US segregated mandates \$500 million and over. Fee kept constant for all time periods.

APPENDIX Q

An Investment Framework for Sustainable Growth

HEALTH WEALTH CAREER

AN INVESTMENT FRAMEWORK FOR SUSTAINABLE GROWTH

CAPTURING A BROADER SET OF RISKS
AND OPPORTUNITIES: INTEGRATING ESG
AND SUSTAINABILITY THEMES

MAKE TOMORROW, TODAY

 MERCER



An Investment Framework for Sustainable Growth

Capturing a Broader Set of Risks and Opportunities: Integrating ESG and Sustainability Themes

CONTENTS

Introduction	1
Constructing and Implementing the Framework	2
Step 1: Beliefs	3
Step 2: Policy and Process	4
Step 3: Portfolio	5
ESG Ratings	6
Sustainability Themes	7
What's Next?	8

Investment that considers sustainability isn't about **changing the world** – it's about understanding how **the world is changing**.

INTRODUCTION

Increasing awareness of the growing and aging population; natural resource constraints; and a shifting public sentiment and regulatory landscape on many environmental and social issues, presents risks and opportunities to investors.^{1,2}

Mercer's investment framework for sustainable growth distinguishes between the financial implications (e.g. risks) associated with environmental, social, and corporate governance (ESG) factors, and the growth opportunities in industries most directly affected by sustainability issues. Mitigating emerging risks requires flexibility, foresight, and fresh thinking about risk management. At the same time, investors should adapt their strategies to capitalise on the new opportunities being created.

Including this additional perspective is a gradual evolution, not revolution, of an existing investment process, within your existing governance budget. The framework follows a "beliefs, policy and process, portfolio" approach that can help to:

- **Mitigate portfolio risk**, by ensuring ESG factors are captured throughout investment processes.
- **Demonstrate active ownership**, to improve the governance of underlying investments and markets, directly or via manager monitoring, through voting practices and engagement.
- **Construct portfolios that target long-term returns**, with alpha or beta allocations to sectors and markets expected to perform well, given sustainability considerations.

"If the rate of change on the outside of an organisation exceeds the rate of change on the inside, the end is near."

— Jack Welch, Former Chairman and CEO, General Electric



ENVIRONMENTAL

- Climate change and GhG emissions.
- Energy efficiency.
- Resource scarcity.
- Pollution.
- Water availability.

SOCIAL

- Health and safety.
- Population/consumption.
- Stakeholder relations/reputation.
- Supply chains.
- Working conditions.

GOVERNANCE

- Accounting and audit quality.
- Board structure.
- Remuneration.
- Shareowner rights.
- Transparency.

1 Word Economic Forum. *Global Risks 2015*, available at <http://reports.weforum.org/global-risks-2015>.

2 Mercer. *Investing in a Time of Climate Change*, 2015, available at <http://www.mercer.com/climate-change>.

Each investor's approach will be unique, reflecting priorities based on the requirements of stakeholders (including regulators), investment structure and approach, available resources, and governance budget.

CONSTRUCTING AND IMPLEMENTING THE FRAMEWORK

Applying sustainable growth principles is most effective when it is integrated into standard investment processes, providing an additional layer of insight and oversight. The framework below identifies where ESG and sustainability considerations sit within the typical 'Beliefs, Policy and Processes, Portfolio' investment approach.

We recommend a three-step process:

1. Review your beliefs.
2. Update your policy and embed it within your processes.
3. Create a workplan that incorporates ESG factors and sustainability-themed strategies.

ESG POLICY			INTEGRATED MODEL
BELIEFS	PROCESSES	PORTFOLIO	
RESEARCH INTO ESG	<ul style="list-style-type: none">- Experience in the PAST.- Stakeholder's needs TODAY.- Expectations of the FUTURE.	<ul style="list-style-type: none">- Regulation.- Industry practice.- Governance.	<ul style="list-style-type: none">- ESG ratings.- Themed strategies.
DEVELOP WORKPLAN	<ul style="list-style-type: none">- Beliefs workshop.- Ongoing trustee education.- Member engagement.	<ul style="list-style-type: none">- Embed ESG into existing processes.- Active ownership.	<ul style="list-style-type: none">- Portfolio reviews.- Allocations.

STEP 1: BELIEFS

An investment strategy is underpinned by the investment beliefs of the stakeholders who design it. These beliefs reflect long-term views of how investment markets work and therefore how value is created. Clearly articulating your beliefs regarding ESG and sustainability gives you a broader perspective on long-term risks and opportunities and means you are less reactive when market conditions change, which represents a strengthening of the investment governance process.

When reviewing ESG and sustainability beliefs, trustees and investment staff should consider the following:

ESG investment case: the growing body of literature demonstrating ESG factors can improve risk-adjusted returns.^{3, 4, 5, 6, 7, 8}

Regulation: changing regulatory requirements.⁹

Stakeholders: changing stakeholder expectations on particular environmental, social, and governance topics.¹⁰

Peers: increased peer activity, e.g. signatories to the UN Principles for Responsible Investment and clients using Mercer's ESG ratings in selecting and monitoring managers, together with trends in data availability and index development.¹¹

Future possibilities: research anticipating developing themes, e.g. climate change, resource scarcity, and human rights, which investors can elect to prioritise based on perceived materiality, stakeholder connection, investment exposure and opportunity for impact.

At Mercer, we believe investing should consider a wide range of risks and opportunities, including sustainability factors such as good governance, and environmental, and social impacts on assets, as well as the associated policy and regulatory implications. We believe this approach is more likely to create and preserve long-term investment capital.

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- 3 Mercer and the United Nations Asset Management Working Group. *Demystifying Responsible Investment Performance*, 2007.
 - 4 Mercer. *Shedding Light on Responsible Investment Approaches, Returns and Impacts*, 2009.
 - 5 Deutsche Bank. *Sustainable Investing: Establishing Long-Term Value and Performance*, 2012.
 - 6 Deloitte. *Finding the Value in Environmental, Social and Governance Performance*, 2013.
 - 7 Ambachtsheer J, Fuller R, Hindocha D. "Behaving Like an Owner: Plugging Investment Chain Leaks," *Rotman International Journal of Pension Management*, Volume 6:2 (2013), pp. 18-27.
 - 8 Dimson E, Karakas O, Li X. *Active Ownership Social Science Research Network Working Paper Series*, 2013.
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 - 11 The Financial Services Council. "UK Stewardship Code," 2014, available at <https://www.frc.org.uk/Our-Work/Codes-Standards/Corporate-governance/UK-Stewardship-Code.aspx>, accessed 7 September 2015.
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STEP 2: POLICY AND PROCESS

Once beliefs regarding ESG integration and sustainability are established, policy documents should be updated as appropriate and consideration given to implementation within each stage of the investment process.

Further detail is provided on the following pages on portfolio implementation by integrating ESG and sustainability themes. If you would also like to review your approach to active ownership, particularly share voting and engagement, please advise your consultant or local contact and we can discuss this in more detail with you.

STEP 1

Develop Beliefs in Context

- Fiduciary role
- Regulation, stakeholder, and peer context
- ESG beliefs

STEP 2

Policy and Process Development

- ESG policy
- Risk/return impacts
- Stakeholder preferences

STEP 3

Research the Portfolio Opportunities

- Risks/opportunities from structural trends e.g. climate change
- ESG ratings, sustainability-themed strategies

STEP 4

Develop Asset Allocation Strategy

- ESG related assumptions
- Targeted themed allocations and alpha opportunities

STEP 5

Implement Portfolio

- ESG ratings in manager selection
- New investments/weights
- Valuations

STEP 6

Manage and Monitor Portfolio

- Active ownership
- Improve ESG credentials
- Review and reporting

STEP 3: PORTFOLIO

Incorporating ESG factors and sustainability themes across asset classes can be considered in the context of risk mitigation and proactive allocations.

Sustainability overlay: This may include reweighting passive index constituents or engaging with companies based on sustainability issues. This is most applicable for listed equity.

High ESG ratings: We assign ESG ratings at the investment strategy level, enabling clients to identify managers that actively integrate ESG into investment decision-making and those that do not.

Pure-play allocations: This focuses primarily on one particular sustainability theme, such as water, clean energy, timber, or agriculture.

Broad sustainability: This focuses on strategies that target a range of environmental and social trends as a key investment driver. In addition to the pure-play themes, they often include social opportunities in health, education, and other sustainable goods and services.



**Approximately
12% of the 5,000+
rated strategies
receive the highest
ESG ratings (ESG1 or 2).¹²**

ESG RATINGS

Incorporating ESG factors within portfolio decisions typically leverages Mercer's ESG ratings for managers. These are standard within Mercer's manager research process across most asset classes. There are now more than 5,000 strategies with a Mercer ESG rating that captures to what extent a manager includes ESG factors and active ownership principles throughout its investment process.

This research is increasingly being utilised by clients as an additional tool for differentiation in the manager selection and review process. Different approaches exist for incorporating ESG factors – it could mean simply applying a minimum standard for ESG ratings (e.g. ESG3, applied either at the individual strategy level or the average across a whole portfolio), or could include more structured due diligence and engagement.

For example, a growing number of clients are reviewing the average ESG rating for their managers and setting targets to improve this score. Your consultant will be able to discuss the ESG ratings in your reports and manager research notes, or you can search for these directly if you have access to Mercer's Global Investment Manager Database (GIMD™).

1. APPLY MERCER ESG RATINGS

- Screen for highly rated strategies from both a research and ESG perspective, e.g. select only strategies that are A-rated and ESG2 or ESG3 and above, where possible.
- Review the average rating for your portfolio as a whole, compared to the ratings universe.

2. UNDERTAKE ADDITIONAL DUE DILIGENCE

- Select potential strategies based on ESG ratings and then ask additional ESG questions during the final due diligence stage.
- Identify managers with the capacity to improve on ESG, and drive this change during your monitoring process.

12 Mercer, as of 12 November 2015.

SUSTAINABILITY THEMES

We have seen a growth in client interest and in managers identifying opportunities in sustainability as a theme. These strategies isolate one or more environmental and social demand or risk drivers and identify investments that are best positioned to benefit from these.

Risk and return expectations for each asset class are typically the same as a “mainstream” equivalent, given that the fundamental asset class drivers are the same. However, policy and regulatory developments, market inefficiencies, and associated environmental and social benefits are all additional considerations. Access via listed or unlisted options will depend on the usual client considerations such as time frames, liquidity, fee budgets, current portfolio diversification, and so on.

In the listed markets, the opportunity set typically includes equities, with only a limited number of fixed income “green bond” strategies currently available:

EQUITIES

- **Pure play:** water (including water infrastructure, technologies, and utilities); renewable energy and energy efficiency; food and agriculture.
- **Broad sustainability:** a broad market approach, with focus on the range of pure-play themes as well as social demographic opportunities in health, education, and other sustainable goods and services.

In the unlisted markets, the opportunity set includes:

- **Private equity, private debt:** businesses in environmental sectors such as energy, waste, water, materials and systems, at both the technology development stage (e.g. “cleantech”) and growth stage businesses looking to expand.
- **Infrastructure:** most likely to include clean energy infrastructure, e.g. renewables, but can also include waste recycling and energy efficiency centres.
- **Agriculture:** commodities, including grains, fruits, nuts, and livestock, that tap into food- and energy-related trends.
- **Timber:** for its renewable and low-carbon credentials.

Although the property asset class does not tend to explicitly access new sustainability themes, ESG factors are now captured within best-practices property portfolio decisions, e.g. water and energy usage.

There are more than 200 investment strategies with sustainable opportunities now available in GIMD.

WHAT'S NEXT?

This paper outlines a framework for applying sustainable growth principles. We can help you review your beliefs, policies, and processes to capture this additional perspective, accompanied by a portfolio implementation approach that suits your requirements.

A more detailed reference guide on integrating ESG and sustainability-themed investment drivers and opportunities by asset class is also available. Please contact your consultant or local contact to receive a copy and to discuss how you could implement these approaches within your portfolio.

Contact information: www.mercer.com/ri

Find out more about Mercer's services in the area of responsible investments, and speak to your consultant or one of our ESG specialists to access our full report on the pursuit of sustainable returns by integrating ESG factors and sustainability by asset class.

GLOBAL

Jane Ambachtsheer | Paris

jane.ambachtsheer@mercer.com
+33 603 10 21 62

EUROPE

Aled Jones | London

aled.jones@mercer.com
+44 20 7178 3594

ASIA PACIFIC

Helga Birgden | Melbourne

helga.birgden@mercer.com
+61 3 9623 5524

NORTH AMERICA

Alex Bernhardt | Seattle

alex.bernhardt@mercer.com
+1 206 214 3728

Ryan Pollice | Toronto

ryan.pollice@mercer.com
+1 416 868 8857

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APPENDIX R

Mercer Investments Beliefs



TALENT • HEALTH • RETIREMENT • INVESTMENTS

MERCER INVESTMENTS BELIEFS





Every investor has unique objectives. Our proprietary tools, breadth of expertise, global scale, and decades of experience will help you toward yours.

After over 40 years in the business, Mercer now advises clients who collectively have over \$7 trillion in assets worldwide.* That makes us one of the largest investment advisors in the world. It also allows us to offer a comprehensive menu of investment tools, advice, and solutions to help you navigate complex capital markets.

But like anything, effective investment strategy comes down to smart thinking. Here are our beliefs that underpin our approach and drive investment success.

* As of December 31, 2013

CLIENT OBJECTIVES



1. **The client comes first**, and we will work in partnership to deliver tailored solutions.
2. **All clients are different, and their investment objectives vary.** Client beliefs, time horizon, liability structure, and broader stakeholder objectives are all important factors in defining investment objectives and, hence, the risk relevant to particular circumstances.
3. **A fund exists to meet its obligations**, so obligations should be forefront in the development of any strategy. An investor's true risk is not being able to meet his/her objectives.
4. **The robustness and quality of the governance process are critical to success**, particularly in times of crisis.
5. **We believe that a strong flow of intellectual capital can help address our clients' objectives.** Continual intellectual capital generation seeks to develop innovative approaches and ways to address the constantly changing nature of markets and the different issues faced by our clients.
6. **It is important to clearly identify environmental, social, and governance (ESG) motivations.** Whether an investor is addressing ESG factors for financial reasons, or because they seek to achieve consistency with an organization's values or beliefs, will influence the appropriate approach.

RISK MANAGEMENT



1. Asset allocation is the most important decision an investor can make.

This is the primary driver of investment risk and return.

2. Risk and return are related.

To obtain higher returns, some amount of risk must be taken. However, higher risk does not always lead to higher returns. In other words, risk taking does not guarantee that an additional return will be achieved, even over long periods. We believe that clients will be successful if they seek to minimize their exposure to risk that is less well-rewarded and focus on risks where the expected return is commensurate with the risk taken.

3. We believe in the merits of genuine diversification

(at the asset allocation, “factor exposures,” and underlying investment manager levels). Clients can benefit from building efficiently diversified portfolios. Diversification across different sources of risk and return improves investment efficiency and may help achieve the same level of expected return with a lower level of risk. It should also limit adverse investment outcomes stemming from tail risk events. Diversification is more than a mathematical exercise, and history demonstrates that correlations vary over time and in response to differing market conditions.

4. Risk is a multi-dimensional concept.

Thoroughly understanding all of the risks attached to an asset will frequently be difficult (but necessary). Standard deviation is important to some investors as a measure of risk, but it is not a total measure of risk. Not all risks apply evenly to all investors. For example, liquidity risk is less of a risk to the investor who does not need access to his/her capital for many years than to one who needs access in the near term. Investment success can come from understanding and exploiting an investor’s risk tolerances.

ACTIVE MANAGEMENT



1. We believe that active management is a skill and, as evidenced by our value-add analysis, our manager research process can improve the likelihood of identifying skillful managers. There is no single right way to manage money successfully. Skilled managers demonstrate observable characteristics and follow approaches that set them apart from the average. These attributes may include: a better understanding of behavioral factors than a typical market participant, a willingness and ability to take a longer-term view (where relevant), superior insight, or an ability to “join the dots.” Different markets exhibit varying degrees of efficiency, and it is important to recognize which markets offer sufficient potential for alpha generation. Skilled managers are more likely to add value in less efficient markets.
2. High conviction managers have a better likelihood of delivering meaningful alpha after fees. A willingness to be “different” is a prerequisite for successful active management. The structuring of a portfolio comprising a number of high conviction managers is one route to achieving superior risk-adjusted returns.
3. Even the most skillful of managers will experience periods of underperformance. This can be amplified with high conviction managers. It follows that past performance is frequently a poor guide to future performance. Care should be taken in appointing or retaining managers following a strong period of performance.
4. Tailoring of mandates too far away from a manager’s standard approach is undesirable, as it creates the risk of diluting or curtailing his or her ability to exercise skill. Excessive customization may also increase implementation and operational risks.
5. An appropriate benchmark or measure should be agreed upon and used to assess the performance of the manager, with an appropriate timeframe commensurate with the nature of the strategy.
6. There are many different types of asset management organizations, but those most likely to be successful will have portfolio managers whose rewards are aligned with those of their clients and where the culture is investment-led and demonstrates a high degree of integrity. Investment management organizations frequently develop, change, and mature over time, in the manner of a lifecycle. Large organizations benefit from deeper and broader research, but they may also face the headwinds of not being able to implement investment views in a timely manner.

DYNAMIC ASSET ALLOCATION (DAA)



1. **We believe that DAA can add value.** While strategic asset allocation is key to clients achieving their long-term objectives, a static strategy is unlikely to be sufficiently robust or able to capture all the available return-seeking/risk-mitigation opportunities.
2. **Markets are behavioral in nature**, and “animal spirits” can move asset prices away from “fair value” for significant periods of time. Inefficiencies between markets are frequently larger than inefficiencies within markets, so dynamic asset allocation is a valuable resource for improving risk/return outcomes. Irrationality of markets creates opportunities for the long-term and/or contrarian investors.
3. **Many valuation variables in investment markets are mean-reverting in the very long run.** This allows long-term investors to obtain better risk/reward outcomes than those with shorter-time horizons. The length of time over which some investment views play out means that good investment decisions are rarely comfortable and comfortable investment decisions are rarely good.
4. **Implementing medium-term asset allocation views can add value, but it can also mitigate downside risk in a portfolio.** Success in dynamic asset allocation is more likely within a structured framework. Strong investment governance should improve investment decision making, particularly in times of crisis.

OPERATIONAL EFFICIENCY



1. All investors should assess the quality of their investment operations and investment implementation, regardless of their size or complexity. Operational inefficiencies, poor implementation, and lapses of internal controls within any of the participants in the process could erode returns and expose investors to unwanted risks and potential losses.
2. We believe that clients should look to achieve the highest value for money spent. Investors should consider both financial costs and non-financial elements (such as regulation, governance, reputation, etc.) As to financial costs, the effect of less obvious factors implicit in transacting business (such as spreads and market impact) should be considered alongside those that are directly observable and explicitly agreed (such as management charges).
3. The overall investment returns can be enhanced by having a monitoring and governance framework that focuses on evaluating and quantifying investment efficiency.

SUSTAINABILITY



1. **ESG risks and opportunities**, along with the exercise of active ownership (voting and engagement), can have a material impact on long-term risk and return outcomes. Consequently, a sustainable investment approach, which considers such risks and opportunities, is preferred.
2. **Taking a sustainable investment view is more likely to create and preserve long-term investment capital.**

We distinguish between:

- Financial implications (such as risks and costs) associated with ESG factors, where there is often shifting public sentiment and regulation.
 - Growth opportunities in industries most directly affected by sustainability challenges (such as the growing population and natural resource constraints).
3. **Active ownership helps the realization of long-term shareholder value.**
In companies with inactive/disengaged shareholders, the chances are greater that company management will act in ways detrimental to shareholders' interests. Active ownership — exercised through voting and engagement — provides diversified investors with an opportunity to enhance the value of companies and markets.
 4. **Accessing long-term streams of returns and long-term themes, rather than focusing on short-term price movements, can add value.** We seek to identify managers and strategies that are structured this way.

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Germany	Philippines	United Kingdom
Hong Kong	Poland	United States
India	Portugal	Venezuela

APPENDIX S

Ignorance isn't bliss...the risks your portfolio may be ignoring

IGNORANCE ISN'T BLISS ... THE RISKS YOUR PORTFOLIO MAY BE IGNORING

Today's highly quantitative risk management industry is the product of the simultaneous advances in computing power and finance theory we have seen since the 1960s. Exponential increases in computation speeds have allowed academics and practitioners to create a wide range of mathematical models able to process vast amounts of historical data and develop numerous projections of the future. Although they are undoubtedly helpful when used appropriately,¹ the resulting tools (now ubiquitous across the industry) have led to an over-reliance on numerical estimates of risk. The language of risk is dominated by the terms "volatility" and "value at risk," creating an unintended blind spot in relation to risks or trends that are inherently difficult to measure or quantify.

The following quote from Lord Kelvin² (inscribed on the wall of the social sciences building at the University of Chicago) could quite easily be the slogan of today's risk management industry:

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind."

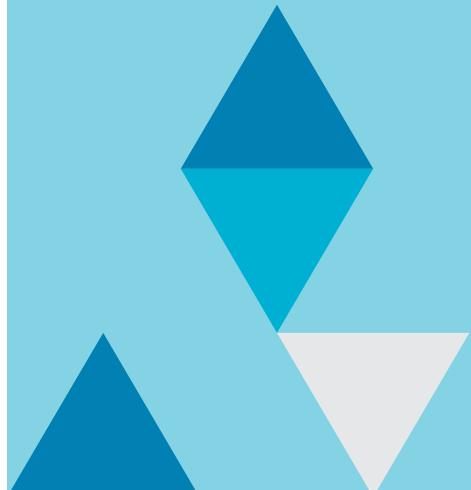
Risk is dominated by the terms "volatility" and "value at risk," creating an unintended blind spot.

as Andrew Lo and Mark Mueller pointed out in their paper, "Warning: Physics Envy May Be Hazardous to Your Wealth!"³ some aspects of the world around us involve a great degree of uncertainty and cannot be quantified or captured in mathematical models. As author and philosopher G. K. Chesterton wrote⁴:

"Life ... looks just a little more mathematical and regular than it is; its exactitude is obvious, but its inexactitude is hidden; its wildness lies in wait."

We believe that an appreciation of the inherent "wildness" of economies and markets, and an acceptance that this complexity cannot be easily measured or captured in mathematical models, is an important first step toward arriving at a more robust outlook on risk. This is not to suggest that quantitative tools should be abandoned altogether – rather that we should elevate a more qualitative perspective on risk to sit alongside the quantitative perspective that often dominates risk management discussions today.

It is important to acknowledge that we and many participants in the investment industry already place significant weight on qualitative views in many aspects of the investment decision-making process. For example, stress tests and scenario analyses, manager research ratings, dynamic asset allocation views, operational due diligence assessments, ESG⁵ views and ratings, and many other important investment activities are partially or largely qualitative in nature. However, at a strategic (total portfolio)



level, many investors and financial institutions rely heavily on the numerical outputs of stochastic models, while qualitative considerations are treated as supplementary or of secondary importance. We believe that a more robust approach to risk management should do two things to address this short-coming: First, it should raise the importance assigned to a qualitative perspective within the decision-making process while correspondingly reducing our faith in the output from quantitative models; second, it should provide a broader perspective by expanding the types of risk considered as part of the strategy-setting process.

ADOPTING A BROADER PERSPECTIVE ON RISK

The language of risk matters. As the Nobel prize-winning psychologist Daniel Kahneman pointed out in *Thinking, Fast and Slow*,⁶ humans have a tendency to jump to conclusions based on the available information — a bias he labeled “what you see is all there is” (or WYSIATI). The fact that volatility and value at risk (or VAR) have become the default measures of investment risk may therefore have had the effect of narrowing the focus of our attention to these measures alone. Instead of obsessing about one characteristic of asset prices (that is, volatility), we believe that investors should consider a broader range of risks that could materially affect their long-term financial position.

Adopting this broader perspective on risk is consistent with the direction of travel in the wider economic community since the financial crisis. In recognition of the failures of modern economic thinking in predicting the financial crisis, complexity economics (a branch of economics that had until recently been largely ignored by mainstream economists) has been increasingly receiving attention from both practitioners and policymakers. In short, complexity economics⁷ suggests a view of the global economy as an interdependent complex system that will experience periods of stability and (possibly extreme) instability. Needless to say, complexity economics views the economic world as inherently difficult to model or forecast.

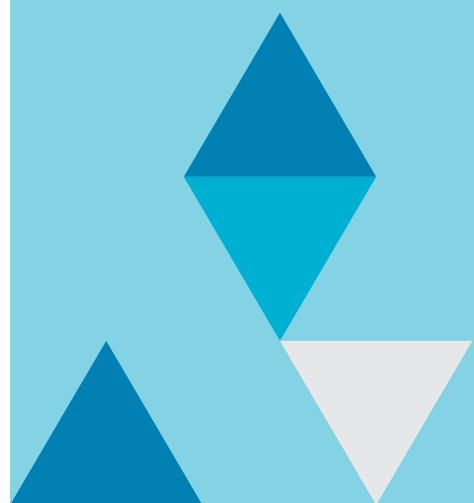
The drivers of instability in economies and markets could include anything from environmental threats to geopolitics or cyberterrorism. We therefore need a framework in order to simplify the task of identifying and understanding the multitude of risks that might ultimately cause financial pain. This framework should be open to risks that have a long history (such as asset-price bubbles) as well as risks deriving from major structural trends in the world economy, about which history can teach us relatively little (for example, the global demographic trends and resource challenges we are likely to experience over the coming decades have no precedent in history).

DEVELOPING A FORWARD-LOOKING RISK MANAGEMENT FRAMEWORK

The World Economic Forum (in partnership with Marsh & McLennan Companies⁸ and Zurich Insurance Group) produces an annual *Global Risks Report*⁹ that puts forward a survey-based, qualitative perspective on the major risks facing the world over the coming decade. The report acknowledges the challenges of making such wide-ranging long-term forecasts and uses a simple framework with five broad categories of risk:

- Economic
- Environmental
- Technological
- Societal
- Geopolitical

Within each category, a number of important “global risks”¹⁰ are identified and their relative likelihood and impact are assessed. We have adopted this framework as the starting point for creating a qualitative risk dashboard. This dashboard identifies a handful of potentially significant risks under each of the five categories. Against each risk, we propose a number of possible mitigation actions as well as approaches that might capture the upside opportunity arising from the market’s underappreciation of a given risk or trend.



THINKING LIKE RUMSFELD

The range of actions that could follow from consideration of the major secular trends taking place in the world around us is potentially huge.

Taking a lead from Donald Rumsfeld and his famous quote about the “known unknowns and unknown unknowns,” we believe that it is possible to identify a manageable number of important trends (the known unknowns) that we should seek to better understand while retaining a healthy degree of humility in recognition of the fact that we will inevitably fail to foresee some other important developments.¹¹

The appropriate actions will vary by investor, depending on time horizon, risk appetite, and governance budget. However, in broad terms, we believe that three categories of action warrant discussion:

At the board level, investors should be clear on the time horizon and categories of risk that matter most to them. A clear set of beliefs is a prerequisite for effective decision-making.

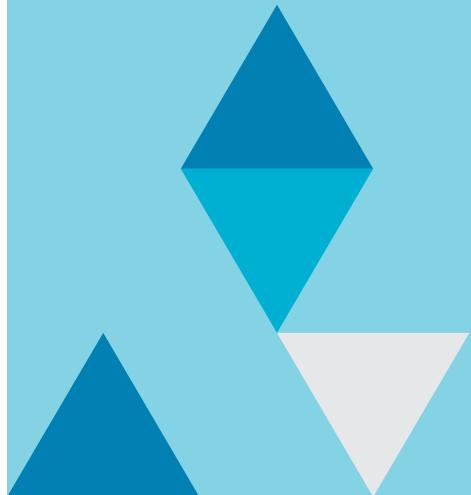
- Does your board have a view on extra-financial risks and their role in addressing them?

At the strategy level, investors might identify specific areas of risk that could present a material threat to their objectives and consider actions to mitigate or manage those risk exposures.

- What priority risks has your organisation identified and how are they being managed?

At the portfolio level, investors should seek to ensure that the time horizon of their underlying managers is consistent with their own time horizon (recognizing that many investors will care about outcomes at multiple time horizons). In addition, strategies with a focus on delivering sustainable long-term returns are likely to adopt a broader perspective on risk (by considering factors such as ESG and other risks) as an integral part of their portfolio construction process.

- Do you regularly monitor ESG criteria at the portfolio level?



In an increasingly complex and interconnected world, we believe that a broader perspective on risk is necessary to help investors navigate an uncertain future. In this vein, we have developed a qualitative forward-looking framework designed to complement the quantitative tools already at our disposal. This framework is intended to enhance our understanding of some of the major risks and trends facing us, as well as providing tangible suggestions around risk mitigation and opportunity capture.

We look forward to much debate and discussion on this topic with asset owners and asset managers as our thinking on this important subject evolves over time.

For more information, please contact your Mercer consultant or visit www.mercer.com.

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- 1 The reader might ask: So what does "used appropriately" mean? The short answer is that any output from mathematical models should be treated with a healthy dose of skepticism, reflecting model risk (the fact that no model will ever be a true reflection of the world).
 - 2 Lord Kelvin was a British mathematical physicist and engineer born in 1824. He helped develop the first and second laws of thermodynamics (among much else), and absolute temperatures are stated in units of "kelvin" in his honor.
 - 3 Lo AW, Mueller MT. "Warning: Physics Envy May Be Hazardous to Your Wealth!" *Journal of Investment Management*, Volume 8 (2010).
 - 4 Chesterton GK. *Orthodoxy*, United Kingdom, 1908.
 - 5 ESG refers to environmental, social, and corporate governance risks.
 - 6 Kahneman D. *Thinking, Fast and Slow*, Farrar, Straus and Giroux, 2011.
 - 7 Wikipedia: Complexity economics is the application of complexity science to the problems of economics. It studies computer simulations to gain insight into economic dynamics, and avoids the assumption that the economy is a system in equilibrium.
 - 8 Mercer is a wholly owned subsidiary of Marsh & McLennan Companies, a global team of professional services companies offering clients advice and solutions in the areas of risk, strategy, and human capital.
 - 9 World Economic Forum in partnership with Marsh & McLennan Companies and Zurich Insurance Group. *Global Risks 2015*, available at <http://www.weforum.org/reports/global-risks-report-2015>.
 - 10 The terms "global risk" and "emerging risk" are broadly synonymous and refer to potentially disruptive events or long-term trends. We use the term "global risk" to avoid any possible confusion arising from use of the term "emerging" (which is often used to refer to developing economies).
 - 11 "From an 'Unknown' to a 'Known': Managing Climate Change Risk," *The Ambachtsheet Letter*, July 2015, available at http://www.kpa-advisory.com/pdf_documents/Ambachtsheer_Letter_July%202015.pdf.

IMPORTANT NOTICES

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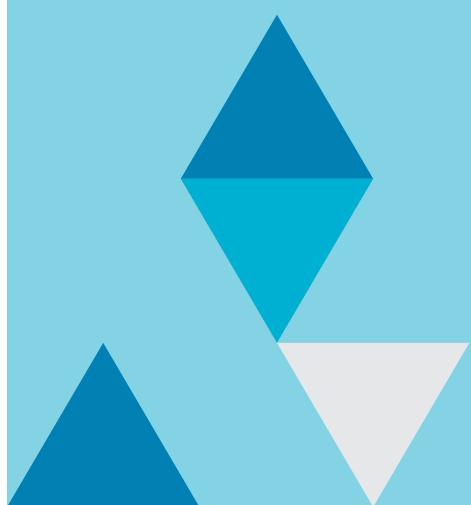
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APPENDIX T

Investing in a Time of Climate Change

INVESTING IN A TIME OF CLIMATE CHANGE

EXECUTIVE SUMMARY

SUPPORTED BY:



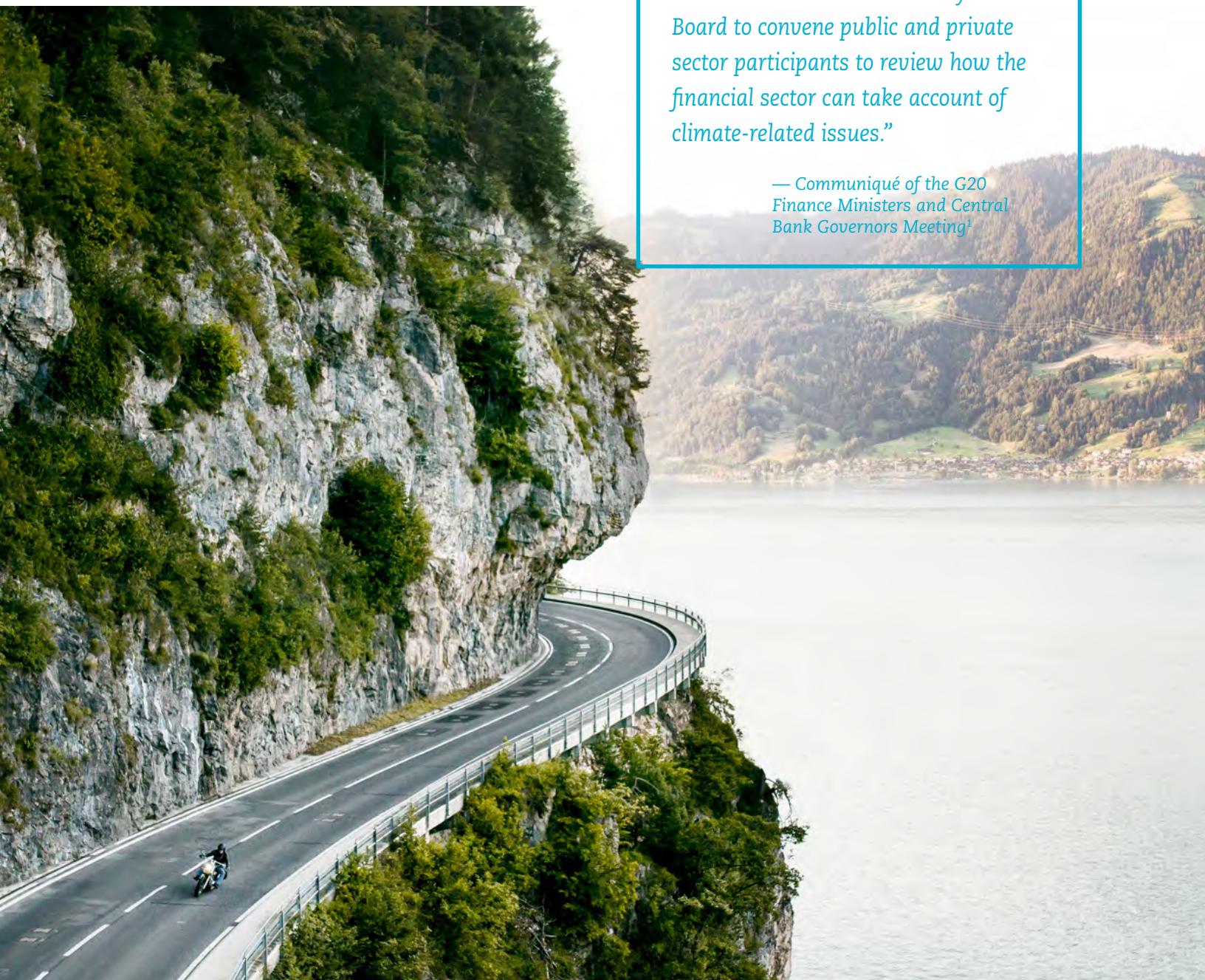
In partnership with:



MAKE TOMORROW, TODAY

 MERCER

EXECUTIVE SUMMARY



“We ask the Financial Stability Board to convene public and private sector participants to review how the financial sector can take account of climate-related issues.”

— Communiqué of the G20 Finance Ministers and Central Bank Governors Meeting¹

¹ Communiqué: G20 Finance Ministers and Central Bank Governors Meeting, available at April 2015, <https://g20.org/wp-content/uploads/2015/04/April-G20-FMCG-B-Communiqué-Final.pdf>, accessed 20 May 2015.



Climate change is an environmental, social, and economic risk, expected to have its greatest impact in the long term. But to address it, and avoid dangerous temperature increases, change is needed now. Investors cannot therefore assume that economic growth will continue to be heavily reliant on an energy sector powered predominantly by fossil fuels. This presents asset owners and investment managers with both risks and opportunities.

Mercer's 2011 study on this topic established important foundations for investors, and its key findings still hold true. The study highlighted the importance of climate policies as a risk factor for investors, given their ability to incentivize meaningful changes in the energy sector. This policy risk was not found to be more important than equity or credit risk premiums, but was considered potentially more important than factors such as the illiquidity premium. This study estimates the impact of climate change on returns to demonstrate why climate-related risk factors should be standard considerations for investors.

This study helps address the following investor questions:

- How big a risk/return impact could climate change have on a portfolio, and when might that happen?
- What are the key downside risks and upside opportunities, and how do we manage these considerations to fit within the current investment process?
- What plan of action can ensure an investor is best positioned for resilience to climate change?

How big a risk/return impact could climate change have on a portfolio, and when might that happen?

Our investment modeling has demonstrated the following:

1. Climate change, under the scenarios modeled, will inevitably have an impact on investment returns, so investors need to view it as a new return variable.
2. Industry sector impacts will be the most meaningful. For example, depending on the climate scenario that plays out, the average annual returns from the coal sub-sector could fall by anywhere between 18% and 74% over the next 35 years, with effects more pronounced over the coming decade (eroding between 26% and 138% of average annual returns). Conversely, the renewables sub-sector could see average annual returns increase by between 6% and 54% over a 35-year time horizon (or between 4% and 97% over a 10-year period).
3. Asset class return impacts could also be material – varying widely by climate change scenario. For example, a 2°C scenario could see return benefits for emerging market equities, infrastructure, real estate, timber, and agriculture. A 4°C scenario could negatively impact emerging market equities, real estate, timber, and agriculture. Growth assets are more sensitive to climate risks than defensive assets.²
4. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level over the period modeled (to 2050), and is expected to better protect long-term returns beyond this time frame.

What are the key downside risks and upside opportunities, and how do we manage these considerations within the current investment process?

Key downside risks come either from structural change during the transition to a low-carbon economy, when investors are unprepared for change, or from higher physical damages.

In the first instance, under a 2°C or Transformation scenario, investors could see a negative impact on returns from developed market equity and private equity, especially in the most affected sectors. On the flip side, this scenario would be likely to lead to gains in infrastructure, emerging market equity, and low-carbon industry sectors.

Under a 4°C or Fragmentation (Higher Damages) scenario, chronic weather patterns (long-term changes in temperature and precipitation) pose risks to the performance of asset classes such as agriculture, timberland, real estate, and emerging market equities. In the case of real asset investments, these risks can be mitigated through geographic risk assessments undertaken at the portfolio level.

To embed these considerations in the investment process, the first step is to develop climate-related investment beliefs alongside other investment beliefs. These can then be reflected in a policy statement, with related investment processes evolved accordingly. The next step is portfolio-oriented activity, including risk assessments, new investment selection/weights and, finally, enhanced investment management and monitoring.

What plan of action can ensure an investor is best positioned for resilience to climate change?

Investors have two key levers in their portfolio decisions – investment and engagement. From an investment perspective, resilience begins with an understanding that climate change risk can have an impact at the level of asset classes, of industry sectors and of sub-sectors. Climate-sensitive industry sectors should be the primary focus, as they will be significantly affected in certain scenarios.

Investors also have numerous engagement options. They can engage with investment managers and the companies in their portfolio to ensure appropriate climate risk management and associated reporting. They can also engage with policymakers to help shape regulations.

²Growth assets include listed equity, private equity, real assets (such as real estate, infrastructure, timber, and agriculture), growth fixed income, hedge funds, and multi-asset funds. Defensive assets include cash, sovereign bonds, and index-linked bonds (long dated); absolute return bonds; and Investment-grade credit.



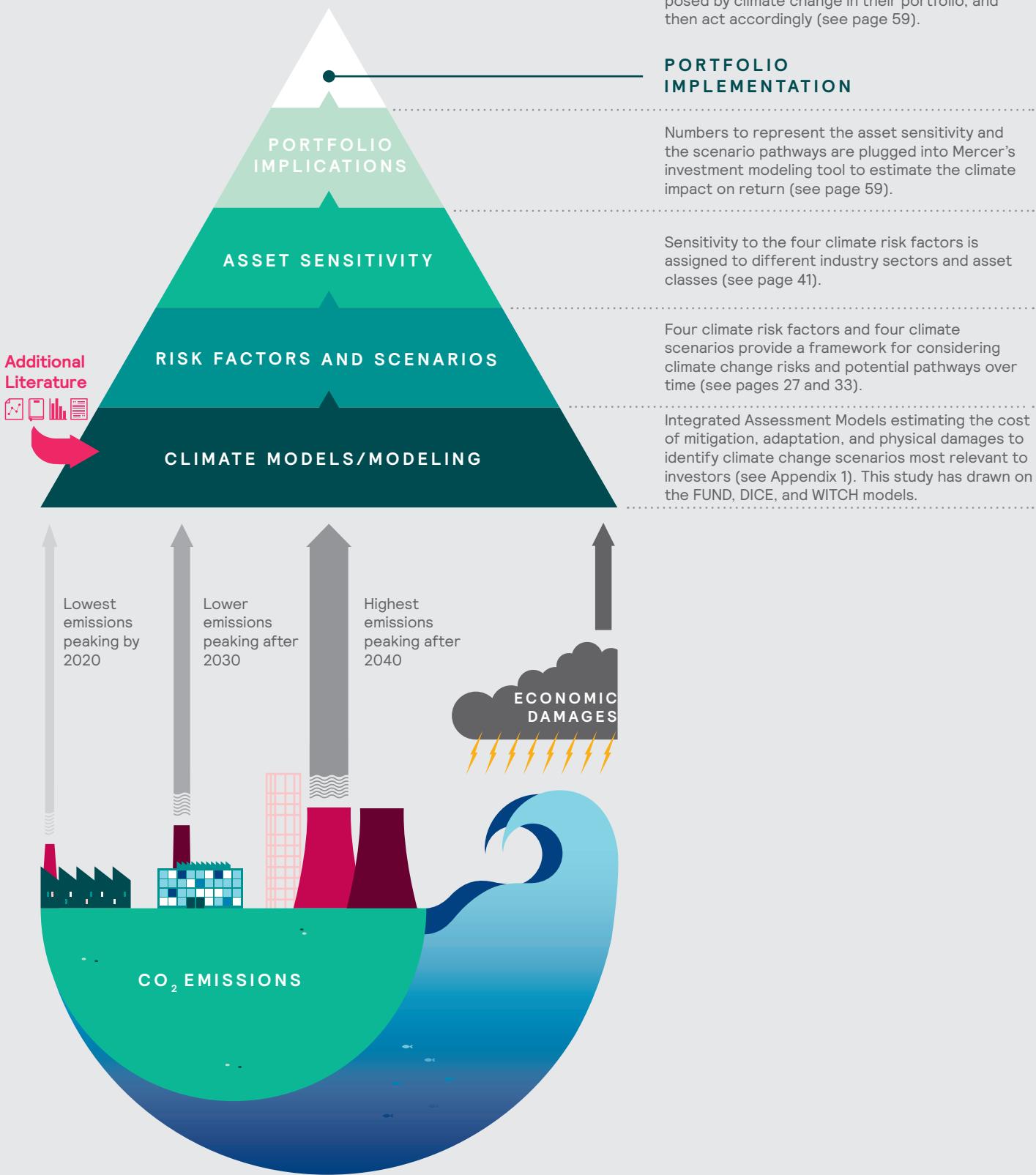
STUDY BACKGROUND

Scenarios provide helpful guides for prioritizing actions when faced with uncertainty. Therefore, our study uses a scenario-based approach to inform investment strategy; this builds on our groundbreaking work in 2011. In the 2015 study, an extensive process has identified four climate risk factors and four climate scenarios most relevant to investors. To estimate the impact of climate change on expected returns, we have incorporated these into our investment model for setting asset allocation.

Our analysis estimates the potential impact of climate change on industry sectors, asset classes, and total portfolio returns, between 2015 and 2050.

Figure 1: Getting to the Point: From Climate Modeling to Portfolio Implementation

Modeling the investment implications helps investors identify the risks and opportunities posed by climate change in their portfolio, and then act accordingly (see page 59).



Source: Mercer

CLIMATE MODELS

Climate models are technically referred to as integrated assessment models (IAMs). These provide quantitative projections, integrating both climate science and economic data, which represent the interactions of natural and human systems.

These are the best tools available to estimate a quantitative impact of climate change over the long term (many decades or centuries). There are, however, significant limitations in quantifying the linkages and feedbacks within and between these highly complex systems. There are also challenges in representing these in a simple numeric way. Typically, IAMs focus more on mitigation (measures to reduce net carbon emissions) and less on adaptation (actions that aid a response to new climate conditions). They have often been accused of underestimating physical damages.

This study began with a review by NERA Economic Consulting (NERA) of the climate models used to estimate mitigation costs and economic damages associated with physical impacts. NERA's scenario analysis combined two major models — one for mitigation, one for damages — with additional literature reviews. This provided global and regional results for the energy sector and the total economy.

To address gaps in physical-impact estimates, Guy Carpenter drew on its direct experience with catastrophe-risk modeling, as well as its analysis of climate change and its knowledge of current climate change research.³ Analysis of additional perils, not quantified by the climate models used, was also included for perils believed to have the largest potential impact on the economy over the next 35 years — namely “Coastal Flood as influenced by Sea Level Rise” (Coastal Flood/ coastal flooding), and Wildfire.

Further detail on the climate models can be found in Appendix 1.

RISK FACTORS – TRIP

Climate change has many dimensions. We have isolated four risk factors that indicate the future implications of climate change for investors.

The first is **Technology (T)**, broadly defined as the rate of progress and investment in the development of technology to support the low-carbon economy. Next is **Resource Availability (R)**, defined as the impact on investments of chronic weather patterns (for example, long-term changes in temperature or precipitation) and related physical changes. Thirdly, there is **Impact (I)**, defined as the physical impact on investments of acute weather incidence/severity (that is, extreme or catastrophic events). Finally, there's **Policy (P)**, broadly defined as all international, national, and sub-national targets; mandates; legislation; and regulations meant to reduce the risk of further man-made or “anthropogenic” climate change.

³ Guy Carpenter. *Global Warming: The Evolving Risk Landscape*, 2013.

SCENARIOS

Based on our research, we developed four relevant scenarios for investors, collaboratively with input from all 18 project partners and the study advisory group. Our scenarios are based on some of the most advanced climate modeling and scientific literature available.⁴ They offer investors a range of what's possible, providing several views of the way the next 35 years might play out.

We have labeled these scenarios:

1. Transformation.
2. Coordination.
3. Fragmentation (Lower Damages).
4. Fragmentation (Higher Damages).

Transformation is characterized by strong climate change mitigation that puts us on a path to limiting global warming to 2°C above pre-Industrial-era temperatures this century. This scenario has:

- Strong climate-mitigation action: emissions peak by 2020, then fall by 56%, relative to 2010 levels, by 2050.
- Fossil fuels representing less than half of the energy mix by 2050.
- Estimated annual emissions of 22 gigatons of equivalent carbon dioxide (GtCO₂e) by 2050.

Coordination is a scenario in which policies and actions are aligned and cohesive, limiting global warming to 3°C above pre-Industrial-era temperatures this century.

The Coordination scenario has:

- Substantial climate-mitigation action: emissions peak after 2030, then fall by 27%, relative to 2010 levels, by 2050.

- Fossil fuels representing around 75% of the energy mix by 2050.
- Estimated annual emissions of 37 GtCO₂e by 2050.

Fragmentation (Lower Damages) sees limited climate-mitigation action and lack of coordination, resulting in a 4°C or more rise above pre-Industrial-era temperatures this century. This sees:

- Limited climate action: emissions grow another 33% over 2010 levels, peaking after 2040.
- Fossil fuels representing 85% of the energy mix by 2050.
- Estimated annual emissions of 67 GtCO₂e by 2050.

Fragmentation (Higher Damages) sees the same limited climate-mitigation action as the previous scenario, but assumes that relatively higher economic damages result.

Of these four scenarios, Transformation is the best and Fragmentation (Higher Damages) the worst for limiting the environmental and social implications of climate change.

For a long-term investor, Fragmentation (Higher Damages) is also the worst climate scenario over the very long term, with the greatest expected economic damages and uncertainty (albeit with substantially lower mitigation costs). During different time periods between now and 2050, however, different scenarios will be “best” or “worst,” depending on whether investors have anticipated the changes that occur, and whether portfolio holdings are positioned accordingly.

⁴ NERA developed detailed modeling information for three of the scenarios, with Guy Carpenter modifying and supplementing the climate-damage results. Mercer developed information for the Transformation scenario.

For context:

- The 2012 fossil fuel share of global primary energy demand was 82% (IEA WEO 2014).
- A recent report from the World Bank (Nov 2014), found that, globally, warming of close to 1.5°C above pre-Industrial times is already locked into Earth’s atmospheric system by past and predicted greenhouse gas emissions.

SCENARIO PATHWAYS AND ASSET SENSITIVITY

To model the climate impact on returns, we adapted our investment model by adding two inputs. The first was a quantified representation of the future pathways for each TRIP factor under each of the four scenarios, and their relative impacts over time. The second was the sensitivity to the TRIP factor for different asset classes and industry sectors. We assigned sensitivities according to evidence that suggested the relative magnitude and whether the impact was positive or negative. This enabled us to consider the differing scale and direction of climate impacts on different asset class and industry sectors over time.

The range of climate impact on returns by asset class and industry sector are presented below, with further detail in the "Portfolio Implications and Investor Actions" section.

ASSET CLASS SENSITIVITY AND RETURN IMPACTS

There are material impacts at the asset-class level, with the outcome dependent on the eventuating scenario in many cases. Only developed market global equity has a minimum negative impact, regardless of the scenario, given its negative sensitivity to the Policy factor.

Infrastructure, emerging market equity, and real estate are expected to benefit from climate policy and technology. Agriculture and timber have the widest-ranging impacts, dependent on the scenario, as they have negative sensitivity to Resource and Impact factors and positive Policy sensitivity. Agriculture also has positive sensitivity to the Technology factor.

Developed market sovereign bonds are not viewed as sensitive to climate risk at an aggregate level where they are driven by other macro-economic factors, although there are some exceptions.

Figure 2 on the following page shows the climate impact on returns by asset class over 35 years to 2050.

INDUSTRY SENSITIVITY AND RETURN IMPACTS

There are meaningful impacts on return at the industry-sector level. This is particularly evident for those industry sectors expected to be most sensitive to the Policy factor: energy and utilities. The sub-sectors with the highest negative sensitivity are coal and electric utilities. Renewables have the highest positive sensitivity, followed by nuclear.

Industry sectors and sub-sectors with the greatest positive sensitivity to the Technology factor include renewables, nuclear, materials, and industrials.

Energy and utilities have the greatest negative sensitivity to the Resource Availability and Impact factors, with industrials also sensitive to physical impacts.

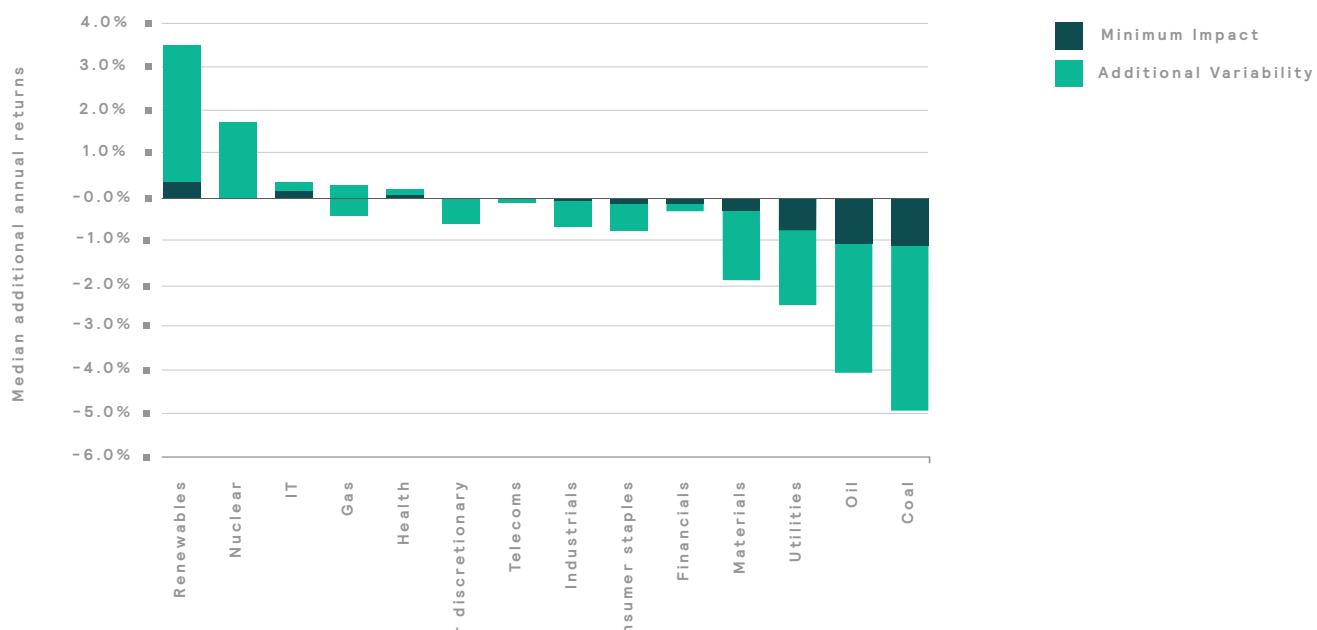
Figure 3 on the following page shows the climate impact on returns by industry sector over 35 years to 2050.

Figure 2: Climate Impact on Returns by Asset Class (35 Years)



Source: Mercer

Figure 3: Climate Impact on Returns by Industry Sector (35 Years)



Source: Mercer



PORTRFOIO IMPLICATIONS AND INVESTOR ACTIONS

Our approach to investment modeling analyzes changes in return expectations in the 35 years between 2015 and 2050, driven by the four climate change scenarios reviewed. The results allow us to identify the potential climate impact on returns, including the minimum and maximum impact investors can expect when climate considerations are included (that is, the TRIP factors and four climate scenarios).

In the “Portfolio Implications and Investor Actions” section, we give further detail on the findings from our investment modeling. These are also captured below as the “**what?**”, alongside why they matter to investors (“**so what?**”), and what can be done in response (“**now what?**”).

Following the process indicated by these findings will lead to an evolution of the portfolio over time, from the asset allocation of the overall portfolio to exposures within asset classes. The process will also lead to an enhanced focus on monitoring and engaging with managers on sector exposures and company positions. The focus for investors will be on portfolio exposures to the asset classes and industry sectors most sensitive to the TRIP factors and those with the greatest potential for climate impact on returns. Investors should also consider the use of engagement as a tool for risk management, both with companies and from a market-wide perspective.

Asset owners will require a governance approach that enables them to build capacity to monitor and act on shorter-term (1–3 years) climate risk indicators, as well as longer-term (10-year plus) considerations. This will include engaging with investment managers whose focus will be on building capacity to address shorter-term climate considerations.

Consistent with our thinking on the best way to incorporate environmental, social, and governance (ESG) considerations into the investment process, we recommend an integrated approach that establishes investment beliefs and policy, enhances processes and then reviews the portfolio.⁵

⁵ Mercer. *An Investment Framework for Sustainable Growth*, 2014, available at <http://www.mercer.com/services/investments/investment-opportunities/responsible-investment.html>, accessed 11 May 2015

PUTTING THE FINDINGS IN CONTEXT: SO WHAT?

Tables 1(a) to (e) below outline how our key findings (“**what?**”) matter most to investors (“**so what?**”), and show what can be done in response (“**now what?**”). In summary, we find that all investors have action to take in response to climate change.

The Actions tables (Tables 4 and 5) referenced in the following pages can be found in the full report online, on pages 73–75.

Table 1(a): Climate Risk Is Inevitable — Investors Can Improve Outcomes by Being Prepared

WHAT?

Some impacts on investment returns are inevitable.

- Findings suggest that climate change risks will impact investment returns — regardless of which scenario unfolds. In a low-return environment, these numbers are particularly meaningful.

SO WHAT?

Some action will lead to better investment outcomes than no action.

- To optimize investment outcomes, investors should consider climate risks at the asset class, industry-sector, and industry sub-sector level. This will require changes in how they work with service providers.
- Uncertainty about the future should not be a barrier to action.

NOW WHAT?

Improve investor governance of climate risk.

- Attention to long-term issues often requires new or revised governance arrangements — in particular, to ensure that due attention is given to them even if the “so what” isn’t next quarter.
- Developing related investment beliefs and policies is an important step.
- Investors should also revisit and review climate impacts and sensitivities as part of their regular monitoring processes.

See the “Beliefs, Policy, and Process” sections of the Actions tables (Tables 4 and 5) in the full report online.

Table 1(b): Sensitive Industry Sectors Deserve Focus That May Be Outside the Typical Remit of Investment Committees

WHAT?

The impact on different sectors varies widely but can be significant.

- Energy sub-sectors, utilities, and materials will have the most meaningful impacts.
- The minimum impact for the coal sub-sector is likely to be a reduction in expected returns from 6.6% p.a. to 5.4% p.a. averaged over the next 35 years, and with additional variability average returns may fall as low as 1.7% p.a. Renewables have the greatest potential for additional returns: depending on the scenario, average expected returns may increase from 6.6% p.a. to as high as 10.1% p.a. Oil and utilities could also be significantly negatively impacted over the next 35 years, with expected average returns potentially falling from 6.6% p.a. to 2.5% p.a. and 6.2% p.a. to 3.7% p.a., respectively.
- The impacts are particularly apparent in annual returns, which are more significant in the shorter term (i.e. that is, over the coming 10 years).

SO WHAT?

Investment committees will be stretched to address this.

- Considering company winners and losers within industry sectors stretches the typical remit of investment committees and will require direct engagement with investment managers (be they internal or external), potentially requiring mandated guidance and longer-term incentives.
- This may require investors to invest in different vehicles or with different managers or to develop alternative benchmarks.

NOW WHAT?

Consider hedging and weighting changes.

- Policy-related risks are most significant in the near term and can be mitigated.
- For passive mandates, investors can consider low-carbon and more sustainable versions of broad market indices, which are evolving rapidly to provide investors with the means to hedge climate exposure.
- Within active mandates, managers have opportunities to manage portfolio exposure to climate change risks. Asset owners can track industry-sector exposure, and discuss approaches to climate risk assessment as part of the manager search and monitoring process. Numerous thematic strategies are also available, which can complement a core equity allocation. For investors with a strong long-term economic outlook, a change in benchmark may be warranted.
- Beyond equities, investors should consider industry sector exposure in private market and corporate bond investments.

See the “Portfolio” sections of the Actions tables, particularly the equities section (Tables 4 and 5) in the full report online.

Table 1(c): Certain Asset Classes Deserve Particular Attention

WHAT?

Emerging markets, infrastructure, and real estate are positively aligned with a low-carbon scenario.

- There are also material impacts at the asset-class level, with the outcome dependent on the particular scenario in many cases. Only developed market global equity equity is expected to experience a reduction in returns across all scenarios.
- Infrastructure and emerging market equities show positive additional returns under the Transformation and Coordination scenarios over 35 years, with further gains expected in real estate (due to its positive sensitivity to the Technology factor).
- Agriculture and timber are the asset classes with the widest-ranging potential impacts (positive or negative, depending on the scenario), given their negative sensitivity to Resource and Impact factors and positive Policy sensitivity (with agriculture also positive to the Technology factor).
- Developed market sovereign bonds are not viewed as sensitive to climate risk at an aggregate level (they are driven by other macro-economic factors), with exceptions, such as Japan and New Zealand.

SO WHAT?

Medium-term allocations should consider climate-oriented opportunities.

- Investors should consider increasing exposure to emerging market equities and sustainable real assets if they envision strong or very strong action on climate change.
- Physical risks must be managed in property, infrastructure, and natural resources, particularly if we see little action taken to reduce emissions.

NOW WHAT?

Focus on risks and opportunities across and within asset classes.

- Investors should consider climate risk — including a discussion of which scenario(s) they believe is most probable — when undertaking strategic asset-allocation exercises to prioritize key actions.
- Having clear investment beliefs about climate change will support this process.

See the “Portfolio” sections of the Actions tables (Tables 4 and 5) in the full report online.

Table 1(d): For a Total Portfolio, Medium-term (Multi-year) and 50+ Year Economic Motivations Are Aligned Toward a Lowest-emissions Scenario

WHAT?

Investment impacts of different scenarios are not significantly different at the total portfolio level.

- Across a total portfolio, results are less significant because of the combination of positive and negative effects over the next 35 years.
- Comparing the Transformation scenario with the other three scenarios suggests that the economic transition implied by Transformation is not punitive from an investment perspective. A 2°C scenario does not have negative return implications for long-term diversified investors at a total portfolio level over the period modeled (to 2050).
- Extending modeled trends beyond 2050 – the end point for this analysis – we would expect the Fragmentation scenarios to have increasingly large negative impacts on returns at the total portfolio level. A Transformation scenario is expected to better protect long-term returns beyond this time frame.

SO WHAT?

A “2°C” scenario (i.e. Transformation) doesn’t jeopardize financial returns.

- This finding is counter to a relatively common view that a rapid transition toward a low-carbon economy would come at a significant financial cost to investors.
- This outcome could remove a barrier to more investors taking action to help achieve a 2°C outcome.

NOW WHAT?

Potential motivation for heightened investor focus on a 2°C outcome.

- The fact that the lowest emissions do not result in a drag on investment returns compared with the other scenarios means that fiduciaries can align short and long-term behavior around investing and engaging for this outcome.
- Asset owners should discuss and determine their position.

See the argument in support of investors adopting “future maker” behavior, as outlined in the Closing Reflections section “Investors as ‘Future Makers’ or ‘Future Takers’”.

Table 1(e): Climate Risk Is More Complex and Longer-term Than Most Investment Risks

WHAT?

Climate risk is complex and has multiple dimensions.

- This is made clear through the TRIP (Technology, Resource Availability, Impact, and Policy) climate risk factors modeled in this study.

SO WHAT?

Managing climate risk is outside the average investor focus area.

- Traditional risks (such as market, inflation, or interest rate) are typically measured on an annual-plus (1 to 3 year) basis using familiar measures such as volatility or value at risk. Climate risks generally demand longer-term (>3 years) measurement, with risk metrics such as sea-level rise, carbon-price developments, and low-carbon investment flows outside the average investor's range of knowledge or experience.

NOW WHAT?

Climate risk deserves more attention on the long-term investment agenda.

- Long-term investors are rethinking the way they set priorities and define and measure risk. Climate change fits naturally into the "long-term investors' agenda," yet more must be done to bridge these time frames.

See the Actions tables (Tables 4 and 5) to establish a short-term action plan to ensure immediate steps are taken in the full report online.

CLOSING REFLECTIONS

All investors will be influenced by whichever global political and physical climate scenario emerges over the coming decades. In this sense, they are all "future takers" in the context of climate change, although investors will face this issue with different levels of resilience – with those investors that are unprepared for the minimum return impact expected to accompany any of the future scenarios effectively negating their best possible outcome.

On the other end of the spectrum is the emergence of a group of investors that we could term "future makers." These investors feel compelled by the magnitude of the longer-term risk of climate change to seek to influence which scenario comes to pass.

A key question for fiduciaries is, "**Which category best describes your approach?**"

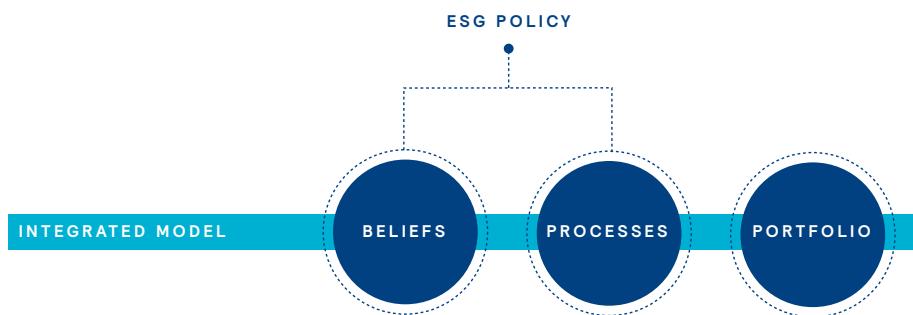
FROM THINKING TO DOING: NOW WHAT?

This section provides investors with further guidance on the “now what,” in considering how to establish an appropriate governance and implementation framework for monitoring and managing climate risk.

The key objective for investors is to first understand their portfolio exposures to the asset classes and industry sectors most sensitive to the TRIP factors and those with the greatest potential climate impact on returns and, second, position their portfolios accordingly.

Consistent with our thinking on the best way to incorporate ESG considerations into the investment process, we recommend an integrated approach within setting beliefs, policy, process, and portfolios. As set out in Figure 4, this enables investors to integrate climate risk management within a broader risk management function during the investment process.

Figure 4: Integrated Model for Addressing ESG Considerations



Source: Mercer, *An Investment Framework for Sustainable Growth*⁶

PORTFOLIO DECARBONIZATION

The concept of “portfolio decarbonization”⁷ has been developed, reflecting action taken by investors to reduce the carbon-intensity of their portfolios over time. This generally begins with equities and can advance to cover other asset classes. The advantages of this approach from the perspective of the TRIP risk factors are as follows:

- It reduces the Policy risk (P) of the portfolio, and, more broadly, helps to address market mispricing of carbon. The lower the carbon-intensity of the holdings, the less susceptible they should be to increasing carbon pricing and/or related regulation.
- This, in turn, supports the flow of capital to a resilient low-carbon economy, which should help to reduce the long-term physical Impact risks (R and I).
- It can also result in increased investment exposure to companies or assets benefiting from climate action strategies, which are more likely to be supported by new Technology solutions (T).

⁶ Mercer, *An Investment Framework for Sustainable Growth*, 2014, available at <http://www.mercer.com/services/investments/investment-opportunities/responsible-investment.html>, accessed 11 May 2015

⁷ See the Portfolio Decarbonisation Coalition (<http://unepfi.org/pdc>), which follows the September 2014 Montreal Pledge supporting portfolio decarbonisation at the PRI meeting, at <http://montrealpledge.org/>

Embarking on this process will lead to an evolution of portfolios over time, from the total portfolio asset allocation through exposures within asset classes, and an enhanced focus on monitoring and engaging with managers on sector exposures and company positions. Climate risks may be addressed alongside and as a part of other ESG considerations.

Investors will require a governance approach that enables them to build capacity to monitor and act on shorter-term climate risk indicators (1–3 years), as well as longer-term (10-year plus) considerations. Initially, investors may take a safeguarding position. This may develop into a more proactive approach in time.

Safeguarding

Investors believe particular industry sectors or asset classes are likely to be “at risk.” In equity portfolios, they can proactively seek to manage or change sector weights. At the company level, this may include tilting toward less carbon-intense companies within industry sectors.⁸

Proactive

Investors believe that low-carbon industry sector or assets are relatively more attractive over the long-term. They may choose to structure deliberate biases in portfolios over the coming decades. This could involve a change of outlook on appropriate sector classifications and market benchmarks.

ACTIONS FOR POLICYMAKERS

The key action for policymakers is to put policies in place that serve to reduce the scenario-uncertainty risk currently facing investors, which serves as a barrier to enacting the low-carbon transition that avoids the worst long-term impacts of climate risk. The Global Investor Coalition Statement on Climate Change (2014)⁹ summarized this as follows, calling on governments to:

- Provide stable, reliable, and economically meaningful carbon pricing that helps redirect investment commensurate with the scale of the climate change challenge.
- Strengthen regulatory support for energy efficiency and renewable energy, where this is needed to facilitate deployment.

- Support innovation in and deployment of low-carbon technologies, including financing clean energy research and development.
- Develop plans to phase out subsidies for fossil fuels.
- Ensure that national adaptation strategies are structured to deliver investment.
- Consider the effect of unintended constraints from financial regulations on investments in low-carbon technologies and in climate resilience.

These policy changes will ultimately protect investors from the negative sensitivities their assets have to the Resource Availability and Impact (physical damages) risk factors.

⁸ A number of low-carbon indices are now available that closely track the performance of key broad-based indices while significantly reducing the carbon footprint of the overall portfolio.

⁹ United Nations. 2014 Global Investor Statement on Climate Change, available at <http://www.un.org/climatechange/summit>, accessed 28 September 2015.

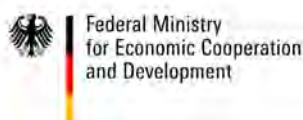
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Core Team

Jane Ambachtsheer

Alex Bernhardt

Helga Birgden

Kate Brett

Vanessa Hodge

Aled Jones

Karen Lockridge

Rodney Marmilic

Jillian Reid

Tom Snape

Christina Teague

Leadership Sponsors

Deb Clarke

Global Head of Investment Research, Mercer

Simon O'Regan

President, EuroPac Region, Mercer

Additional Contributors

Brian Birnbaum

David Coleman

Michael Cross

Sarika Goel

Hendrie Koster

Harry Liem

Steven Sowden

Nick Sykes

Thien Tran

Lucy Tusa

Nick White

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¹¹ Alex joined Mercer as the US Head of Responsible Investment in March 2015.

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Paul Dickinson

Carbon Disclosure Project, UK

Nathan Fabian

Investor Group on Climate Change,
Australia/Global

Mark Fulton

Carbon Tracker Initiative, CERES,
Energy Transition Advisors,
US/Australia

Sean Kidney

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UK/Global

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RMS, UK

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Alternatively, you can connect directly with your region's Mercer RI expert:

GLOBAL

Jane Ambachtsheer
Paris
jane.ambachtsheer@mercer.com
+33 603 10 21 62

USA

Alex Bernhardt
Seattle
alex.bernhardt@mercer.com
+1 206 214 3728

ASIA PACIFIC

Helga Birgden
Melbourne
helga.birgden@mercer.com
+61 3 9623 5524

CANADA

Ryan Pollice
Toronto
ryan.pollice@mercer.com
+1 416 868 8857

EUROPE

Aled Jones
London
aled.jones@mercer.com
+44 20 7178 3594

APPENDIX U

Building a Bridge to Sustainable Infrastructure

BUILDING A BRIDGE TO SUSTAINABLE INFRASTRUCTURE

MAPPING THE GLOBAL INITIATIVES
THAT ARE PAVING THE WAY



WHAT IS ‘SUSTAINABLE INFRASTRUCTURE’?

SUSTAINABLE INFRASTRUCTURE IS INFRASTRUCTURE THAT IS PLANNED, BUILT, AND MAINTAINED TO PROVIDE SERVICES OF ADEQUATE QUALITY THAT PROMOTE SUSTAINABLE AND INCLUSIVE GROWTH.

INTER-AMERICAN DEVELOPMENT BANK¹

SUSTAINABLE INFRASTRUCTURE IS INFRASTRUCTURE THAT IS SOCIALLY, ECONOMICALLY AND ENVIRONMENTALLY SUSTAINABLE.

BROOKINGS INSTITUTION²

INTEGRATING ENVIRONMENTAL, SOCIAL AND GOVERNANCE CONSIDERATIONS INTO PROJECT PLANNING AND DEVELOPMENT

GLOBAL INFRASTRUCTURE BASEL FOUNDATION³

Investment in infrastructure is widely recognized as crucial to promoting economic and social growth through the development of essential services and assets. As the global population grows and urbanizes, the demand for infrastructure grows with it. The New Climate Economy estimates that from 2015 to 2030, the global requirement for new infrastructure assets will be US\$90 trillion, more than the value of the world’s existing infrastructure stock.⁴

In 2015, the majority of countries formally adopted an ambitious framework for both sustainable development (Sustainable Development Goals) and combating climate change (Paris Agreement). In particular, 189 countries committed to specific climate-change mitigation targets through their “Intended nationally determined contributions” (INDCs).⁵ In order to align with the Paris Agreement and United Nations Sustainable Development Goals, these infrastructure investments must take place through planning and development processes that consider social, economic and environmental sustainability at their core.

¹ <https://publications.iadb.org/bitstream/handle/11319/6848/Inter-American-Development-Bank-Sustainability-Report-2014.pdf>.

² Brookings Institution. “Driving Sustainable Development Through Better Infrastructure: Key Elements of a Transformation Program,” July 2015, available at <https://www.brookings.edu/research/driving-sustainable-development-through-better-infrastructure-key-elements-of-a-transformation-program>.

³ United Nations Environment Programme. “Sustainable Infrastructure and Finance.” June 2016, available at <http://unepinquiry.org/publication/sustainable-infrastructure-and-finance>.

⁴ New Climate Economy. *Better Growth, Better Climate*, 2014, available at http://static.newclimateeconomy.report/wp-content/uploads/2014/08/NCE_SynthesisReport.pdf.

⁵ Brookings Institution. “Driving Sustainable Development Through Better Infrastructure: Key Elements of a Transformation Program,” July 2015, available at <https://www.brookings.edu/research/driving-sustainable-development-through-better-infrastructure-key-elements-of-a-transformation-program>.

THE INFRASTRUCTURE DECISIONS WE MAKE IN THE NEXT FEW YEARS COULD CEMENT OUR ABILITY TO MEET THE PARIS GOALS – OR CONDEMN US TO A FUTURE IN WHICH GLOBAL TEMPERATURES RISE WELL ABOVE 2°C. IN THE LATTER SCENARIO, ENVIRONMENTAL CONDITIONS COULD BE SO HOSTILE THAT DEVELOPMENT GOES INTO REVERSE, LEADING TO RISING POVERTY AND SOCIAL CONFLICT.

LUIS ALBERTO MORENO AND NICHOLAS STERN⁶

To support these dual global agendas, a large portion of future required infrastructure will need to be built with environmental and social sustainability in mind. Although this could increase upfront capital costs by roughly 5%, sustainable infrastructure can also generate lower operating costs over the life of the investment, while also reducing risks and negative externalities.⁷ Since many long-lasting infrastructure assets are being built today, the imperative for incorporating such sustainability considerations into related investment decisions is a current one.

Current infrastructure spending of US\$2.5 trillion to US\$3.5 trillion per year across both the public and the private sectors is only about half the amount needed to meet the estimated US\$6 trillion annual infrastructure demand.⁸ Given governments' decreasing ability to finance infrastructure, these estimates imply that private spending in infrastructure would need to at least double to overcome this investment gap.⁹

The greatest potential for additional financing lies with the private sector, in particular with institutional investors (such as pension funds, investment managers and insurance companies). However, almost all countries have chronic infrastructure investment deficits despite an environment of record low interest rates and a large pool of global savings. As an example, the infrastructure gap in Latin America is believed to be significant. A range of studies estimate that the region needs to invest at least 5% of GDP in infrastructure per annum to meet demand (variously defined), which equates to additional infrastructure investment of about 2.5% of GDP annually.¹⁰

⁶ Luis Alberto Moreno is the president of the Inter-American Development Bank and Lord Nicholas Stern is professor of economics and government at the London School of Economics. <https://www.theguardian.com/public-leaders-network/2016/may/10/smart-infrastructure-sustainable-development-low-carbon-transport>.

⁷ United Nations Environment Programme. "Sustainable Infrastructure and Finance." June 2016, available at <http://unepinquiry.org/publication/sustainable-infrastructure-and-finance>.

⁸ McKinsey: *Financing Change: How to Mobilize Private-Sector Financing for Sustainable Infrastructure* (2016).

⁹ The UNEP & GIB Foundation working paper estimates the global infrastructure investment gap as equivalent to US\$2.5 trillion to US\$3.5 trillion a year or US\$39 trillion to US\$51 trillion over the next 15 years. This represents the difference between the current estimated infrastructure spending requirement and projected spending itself.

¹⁰ Inter-American Development Bank: *Financing Infrastructure in Latin America and the Caribbean: How, How Much and by Whom?* (2015).

BUILDING MOMENTUM

With increasing volumes of literature and mobilization efforts focused on this challenge, the Inter-American Development Bank commissioned Mercer to undertake an assessment of all current industry initiatives which categorise their efforts, review gaps and consider if they may be able to work together to more effectively bridge the sustainable infrastructure funding gap. This paper captures the key highlights of this analysis: the significant momentum that has been gained, how these initiatives are addressing the key barriers to sustainable infrastructure, and how to leverage this momentum to support the pace and scale of change needed to ensure that we are bridging the sustainable investment funding gap.

A total of 30 initiatives were identified as having the following characteristics:



FIGURE 1: GROWTH IN INFRASTRUCTURE INITIATIVES

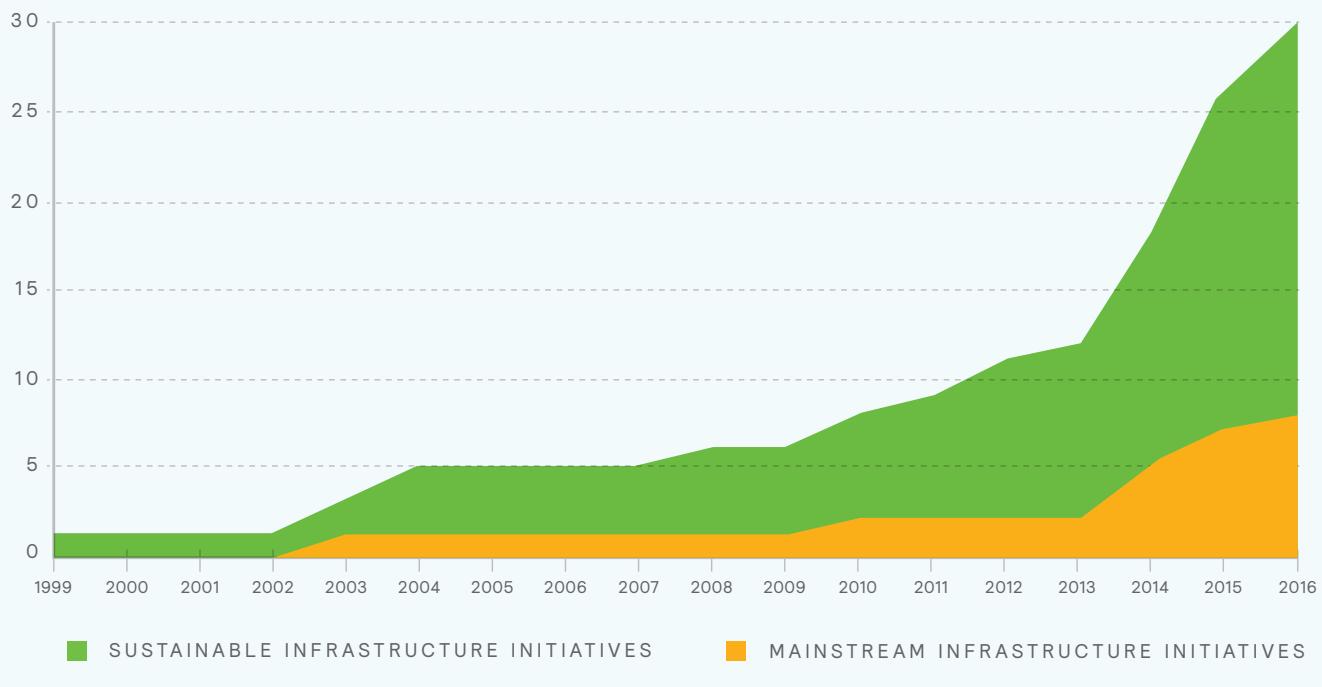


Figure 1 shows the cumulative number of major infrastructure initiatives over time and still active today (based on the year of establishment of each initiative) and shows a significant rise in the number of industry initiatives focused on fostering growth in *sustainable* infrastructure. For the purpose of this review, “mainstream infrastructure” initiatives do not have an explicit reference in their mission statement to sustainable infrastructure. All initiatives are identified in the Appendix.

Despite the funding gaps, public investment in infrastructure has declined since the global financial crisis.¹¹ Increasing recognition of the potential for private capital to help fill the gap has been a key driver for a number of initiatives that have launched since 2010.

¹¹ McKinsey: Bridging Global Infrastructure Gaps (2016)

CATEGORIZING THE INITIATIVES

The initiatives were organized into one of the three categories outlined below, based on the key role they each seek to play. A full list of the initiatives, along with a brief description and how each was categorized can be found in the Appendix.



INFLUENCERS

Those that provide **thought leadership and research** relating to sustainable infrastructure or those working to **influence public or industry policy** and/or the financial system to align infrastructure investment plans with INDCs and other environmental/social outcomes.

5 initiatives



MOBILIZERS

Those seeking to i) work with governments to **develop “bankable” projects** and/or ii) **convene investors** to channel more funds into sustainable infrastructure projects. In most cases, mobilizers are working with and convening multiple stakeholders.

13 initiatives



TOOL PROVIDERS

Those seeking to **enable integrated environmental or social analysis** of infrastructure projects into the investment and monitoring process, resulting in increased risk-adjusted returns and environmental/social outcomes.

12 initiatives

The **influencers**, which focus on influencing public or industry policy, generally have a **global** focus given the need for consistent policies around the world to support sustainable development. This said, much of the economic development and infrastructure financing required are in developing markets. No surprise then that most of the **mobilizers** focus on developing and financing bankable projects in **developing markets**. The focus of tool providers varies: some are concentrated in their **region of focus**, but most are either global or seeking to be global.

Many of the initiatives were instigated by governments, investors and international finance institutions (IFIs).¹² The origin of the **tool providers** has greater variety: the tools were developed by various stakeholder groups – often working in collaboration – including within industry and academia.

¹² International finance institutions include the World Bank and the various regional multi-lateral development banks.

BRIDGING THE SUSTAINABLE INFRASTRUCTURE FUNDING GAP

The funding gap is reflective of the range of existing barriers¹³ facing private-sector financing of sustainable infrastructure, which can be summarized as follows:

- **Lack of transparent project pipelines:**

Governments often fail to develop and communicate long-term infrastructure pipelines, leading to a poor estimation of infrastructure needs. This may be exacerbated by a lack of coordination or consistency between a country's environment, planning and finance ministries/departments.

- **High development and transaction costs:**

Investors with limited resources, time and expertise – such as pensions and insurance companies – can find it difficult to assess projects when standards are fragmented and the projects themselves can exhibit high variability in their profiles.

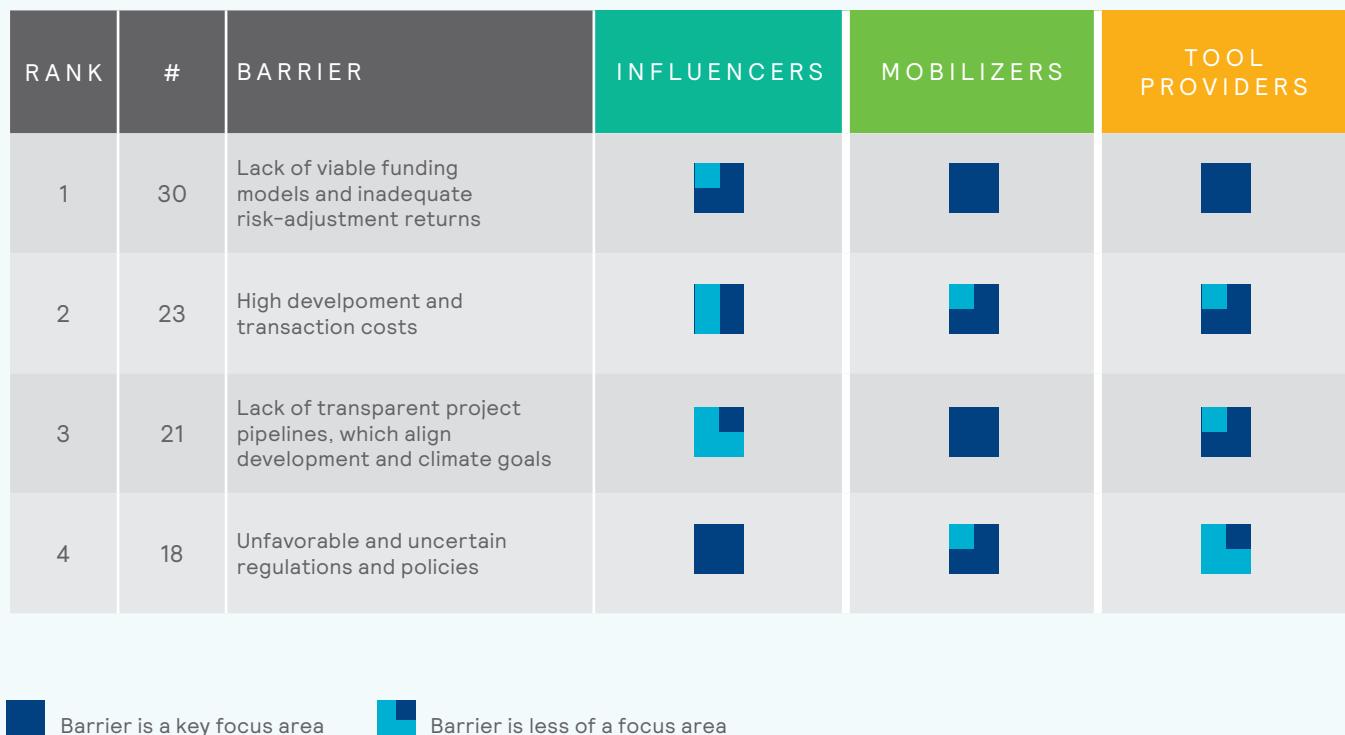
- **Lack of viable funding models and inadequate risk-adjusted returns:** Many investors do not invest in infrastructure projects simply because they do not offer adequate risk-adjusted returns or match with the investor's specific risk-return or other investment requirements. Additionally, large infrastructure investors may have difficulty accessing infrastructure opportunities below a certain scale due to minimum investment size requirements.
- **Unfavorable and uncertain regulations and policies:** Misaligned price signals and related policy uncertainty can result in investment in infrastructure that is not aligned with the Sustainable Development Goals (SDGs) and the Paris Agreement. Regulations on investment limits, capital adequacy, reserve requirements (Basel III, Solvency II etc.), the valuation of assets and liabilities and limits on foreign investment can discourage investors from making longer-term and cross-border investments. Due to the close link between and sensitivity of infrastructure assets to regulations, political and regulatory risks can have a depressing effect on infrastructure investment by increasing uncertainty in the eyes of investors.

¹³ These barriers draw heavily on those identified in the McKinsey paper Financing change: How to mobilize private-sector financing for sustainable infrastructure (2016)

Figure 2 illustrates the extent to which the initiatives in each category focus on the four key barriers to sustainable infrastructure identified earlier, including the number of initiatives focused on each barrier. The key observations here are:

- Much of the collective effort is focused on improving **financial barriers** (for example, high costs and inadequate risk-adjusted returns for investors).
- Influencers are focused on improving **polices and regulations**.
- Mobilizers are aiming to influence **all aspects of the value chain** in order to mobilize capital.

FIGURE 2: NUMBER OF INITIATIVES FOCUSED ON KEY BARRIERS

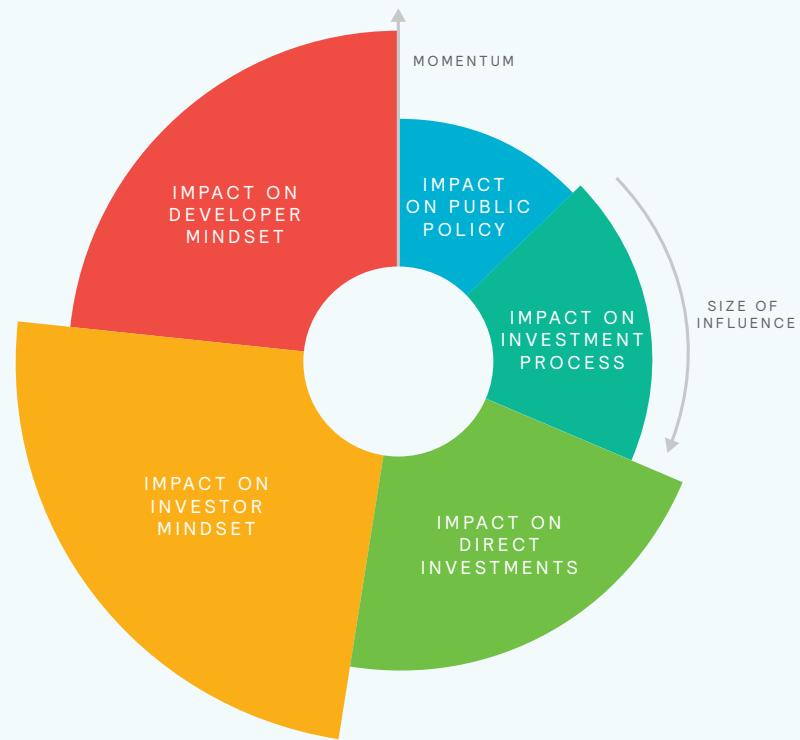


Source: Mercer

When considering the range of levers that initiatives focus on to mobilize more sustainable infrastructure development, we see a broad distribution across those identified, as illustrated in Figure 3. Since 2013, we have seen activities targeted at influencing the investor mindset gain significant momentum — a critical item given that investor allocations must sharply rise to close the funding gap.

In order to map the influence of each initiative, we first identified five key areas of focus, as shown in each piece of the pie in Figure 3. Initiatives were then assessed as to what extent they are influencing each of the key focus areas (that is, no impact, moderate or significant impact). This included a qualitative review of initiative activities, such as publications, meetings convened, partners and reported results. The width of the pie shows the overall size of influence, and the extent to which the pie piece pushes out away from the center demonstrates the momentum in focus on that key focus area since 2013.

FIGURE 3: INITIATIVE INFLUENCE ACROSS KEY FOCUS AREAS (INITIATIVES ESTABLISHED SINCE 2013)

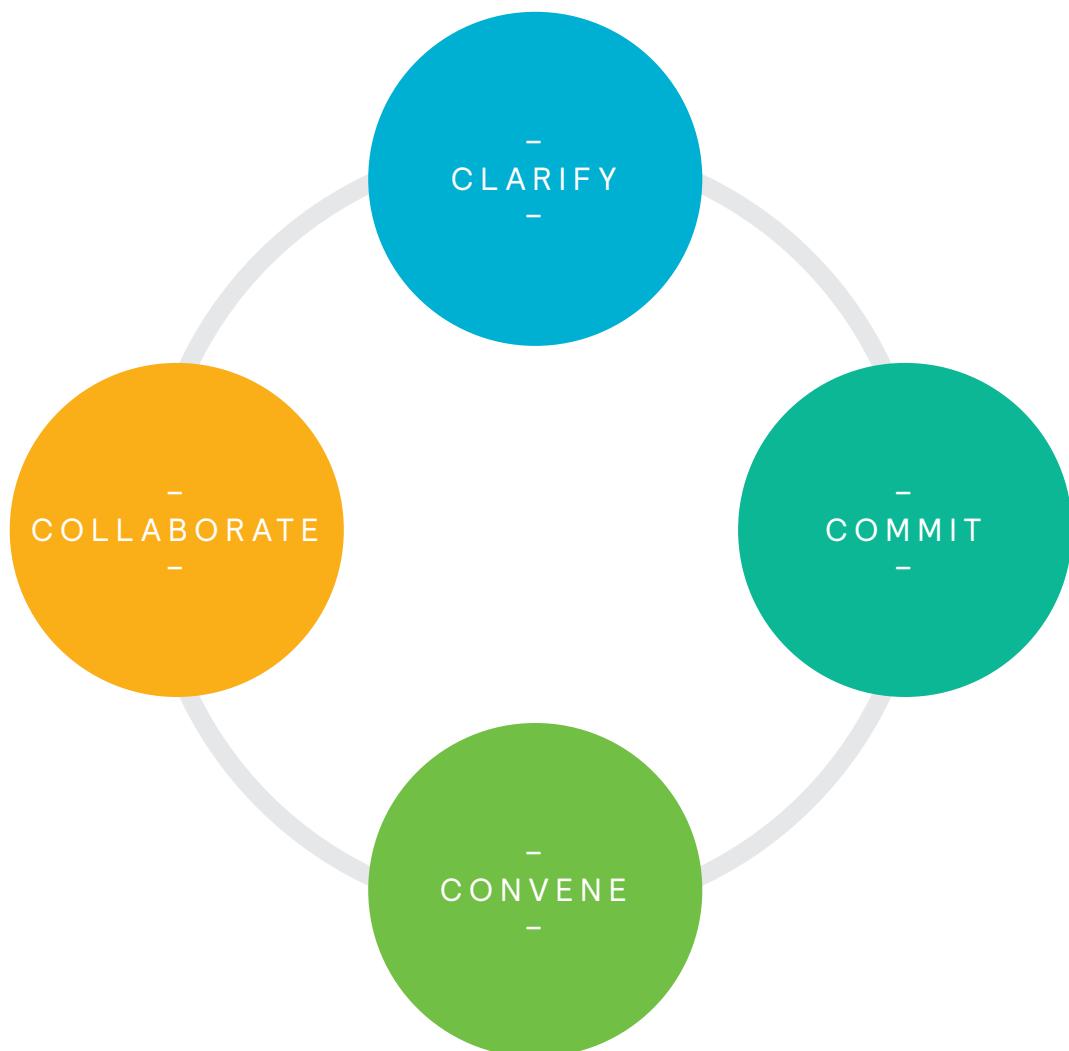


Impact on investor mindset (and developer mindset) refers to how the initiatives are collectively focused on shifting the investment (and development) industry mindset in relation to sustainable infrastructure — leading to more concrete changes and action. This may involve capacity building among the relevant stakeholder groups to support the prioritization of sustainable infrastructure. **Impact on public policy** refers to material influence on or changes in legislation/regulation or other public policy mechanisms that impact the prioritization of sustainable infrastructure. This could include influencing the alignment of development plans with NDCs, or influencing/regulations that require climate considerations to be included in infrastructure planning and investment process. **Impact on investment process** refers to the effort to price in the value (risk) of climate change considerations in long-term infrastructure projects influencing the process by which investors allocate capital to more deeply consider these issues. **Impact on direct investments** reflects how initiatives are becoming an actual conduit for the flow of funds to specifically address sustainable infrastructure.

LEVERAGING THE MOMENTUM

Although the mobilization of resources identified in this review is both impressive and encouraging, time is running short: the infrastructure that will be built over the next 15 years will dictate whether we are on track for a 2-degree Celsius (or lower) pathway as outlined in the Paris Agreement and will have a strong influence on whether growth in developing markets is inclusive.

We propose four steps to further align, support and leverage the identified initiatives:



1

CLARIFY

Clarify the principles for sustainable infrastructure investment:

Developing shared definitions and principles for sustainable infrastructure investment drives greater clarity and urgency across the industry, provides a more compelling alternative to “traditional infrastructure” framing and enables comparability for investors. Conversely, fragmentation leads to confusion and lowers impact.

2

COMMIT

Commit to sustainable infrastructure:

Those infrastructure initiatives that do not formally include a consideration of sustainable infrastructure should consider why this has not been incorporated, and review their mission and objectives accordingly.

3

CONVENE

Convene the conveners:

Planning, developing and financing global infrastructure is a major undertaking and it is certainly reasonable to assume that a range of complementary initiatives will be involved. However, joint impact would be optimized if the key groups were working toward a shared “grand plan,” enabling thoughtful division of labor and the cross-pollination of ideas

4

COLLABORATE

Encourage collaboration:

Many of the mobilizers share common missions and are working in parallel. Activity could be more effectively scaled by bringing these organizations together (see step 3), or though having IFIs or other groups acting more directly as liaisons between them (to facilitate co-investments, for instance).

These four key steps will help to ensure that a) everyone has a clearer understanding of what sustainable infrastructure is, and b) that efforts are more aligned toward achieving it. Coordination and collaboration, among the global initiatives we have identified, will be critical to ensuring that private investment strategies are aligned with the global commitments to the SDGs and the Paris Agreement, aiming to secure low-carbon, resilient and inclusive infrastructure for future generations. Together, we can build the bridge to a world where sustainable infrastructure is the norm.

APPENDIX

A photograph of a man in a dark camouflage military-style uniform. He is focused on a task, with his hands visible at the bottom right holding a pen over a white sheet of paper. In the foreground, several white wind turbine models with three blades each are positioned in a row, partially obscuring the man's face. The background is a plain, light-colored wall.

SUMMARY OF INFRASTRUCTURE INITIATIVES REVIEWED

Thirty infrastructure initiatives were included in this review, split into the three categories: influencers, mobilizers and tool providers. The vast majority of the initiatives have an explicit commitment to sustainable infrastructure in their mission statements or key objectives. Initiatives that are focused on infrastructure funding and investment but that do not have an explicit reference in their mission statement to sustainable infrastructure are considered to be “mainstream infrastructure” initiatives (and noted with an asterisk).



INFLUENCERS: provide thought leadership and research relating to sustainable infrastructure or work to influence public or industry policy and/or the financial system to align infrastructure investment plans with INDCs and other environmental/social outcomes

Energy Transitions Commission (ETC)	<p>The ETC was convened to help identify pathways for change in our energy systems to ensure both better growth and a better climate inspired by the work of the New Climate Economy. The aim is to provide an objective fact-base and set of insights to inform decision-makers, both public and private.</p> <p>www.energy-transitions.org</p>	2015
Global Infrastructure Investor Association* (GIIA)	<p>The GIIA is a global advocacy association representing equity investors in global infrastructure and those associated with the asset class. It will work in partnership with governments and regulators to achieve its shared ambition of increasing infrastructure investment.</p> <p>http://giiia.net</p>	2015
OECD Centre on Green Finance and Investment	<p>The Centre's mission is to help catalyze and support the transition to a green, low-emissions and climate-resilient economy. The Centre will leverage the OECD's policy and economics expertise and provide a global platform for engaging with key players and gaining the marketplace intelligence of private sector partners.</p> <p>http://www.oecd.org</p>	2016
Long Term Infrastructure Investors Association* (LTIIA)	<p>LTIIA works with a wide range of stakeholders, including infrastructure investors, policy-makers and academia, on supporting long-term, responsible deployment of private capital to public infrastructure around the world. It was founded by and works for investors.</p> <p>www.ltiia.org</p>	2014
New Climate Economy (NCE)	<p>The Global Commission on the Economy and Climate is a major international initiative to examine how countries can achieve economic growth while dealing with the risks posed by climate change. The NCE is its flagship project.</p> <p>http://newclimateeconomy.net</p>	2013



MOBILIZERS: seek to work with governments to develop “bankable” projects and/or ii) convene investors to channel more funds into sustainable infrastructure projects. In most cases, mobilizers work with and convene multiple stakeholders

Africa50	<p>Africa50 is an investment bank for Infrastructure in Africa that focuses on high-impact national and regional projects in the energy, transport, ICT and water sectors. It is a public-private institution that is commercially managed and that intends to pay dividends.</p> <p>http://www.africa50.com</p>	2014
Aligned Intermediary	<p>Aligned Intermediary is an investment advisory group that helps long-term investors accelerate and increase the flow of private, for-profit capital into climate infrastructure projects and organizations in the areas of clean energy, water infrastructure, and waste-to-value.</p> <p>www.alignedintermediary.org</p>	2015
Climate Investor One	<p>Born out of The Global Innovation Lab for Climate Finance – a global initiative that supports the identification and piloting of cutting-edge climate finance instruments,</p> <p>www.climatefundmanagers.com</p>	2015
Danish Climate Investment Fund (KIF)	<p>KIF offers risk capital and advice for climate investments in developing countries and emerging markets in Asia, Africa, Latin America and parts of Europe. It is managed by the Investment Fund for Developing Countries, which has participated in more than 1,200 investments in more than 100 countries in cooperation with Danish trade and industry.</p> <p>http://www.ifu.dk/dk/materiale/pdf/kif-fact-sheet</p>	2014
Global Climate Partnership Fund (GCPF)	<p>As a public-private partnership (PPP), GCPF uses public funding to leverage private capital in order to mitigate climate change and drive sustainable growth in developing and emerging markets. It mainly invests through local financial institutions but also directly.</p> <p>http://www.gcpf.lu/fund-facts.html</p>	2011
Global Green Growth Institute (GGGI)	<p>The GGGI is an international organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies. It is an interdisciplinary, multi-stakeholder organization that believes economic growth and environmental sustainability are not merely compatible objectives: their integration is essential for the future of humankind.</p> <p>http://gghi.org</p>	2010

Global Infrastructure Facility (GIF)*	GIF supports governments in the emerging markets and developing economies to bring well-structured and bankable infrastructure projects to market. It is a global open platform that facilitates the preparation and structuring of complex infrastructure PPPs to enable mobilization of private sector and institutional investor capital. http://www.worldbank.org/en/programs/global-infrastructure-facility	2015
Global Infrastructure Hub (GI Hub)*	The GI Hub has a G20 mandate to grow the global pipeline of quality, bankable infrastructure projects. It sits between the public and private sectors, understanding the roles each needs to play in creating a successful infrastructure market. http://www.globalinfrastructurehub.org	2014
Green Infrastructure Investment Coalition (GIIC)	The GIIC brings together leading organizations from across the investment chain. Its aim is to provide a platform of investors, multilateral development banks and advisors for countries seeking to finance their green infrastructure investments needs. It is focused on the emerging markets. http://www.giicoalition.org	2015
Matchmaker	Matchmaker's objective is to increase climate finance streams into urban mitigation projects. CDP and ICLEI, together with South Pole and Gold Standard, seek to develop a service to connect private investors and national/regional/international public finance institutions with urban mitigation projects. http://local.climate-kic.org/projects/matchmaker	2016
NEPAD-IPPF	NEPAD-IPPF supports the development of regional and continental infrastructure with grants to Regional African Member Countries of the AfDB, Regional Economic Communities and African infrastructure-related institutions to prepare high-quality regional and continental infrastructure projects in the energy, trans-boundary water resource, transport and ICT sectors. http://www.nepad-ippf.org	2004
Public-Private Infrastructure Advisory Facility (PPIAF)	The PPIAF was created in 1999 to act as a catalyst to increase private sector participation in emerging markets. It provides technical assistance to governments to support the creation of a sound, enabling environment providing basic infrastructure services by the private sector. http://www.ppiaf.org	1999
Sustainable Development Investment Partnership (SDIP)	The SDIP aims to mobilize US\$100 billion in financing over five years for infrastructure projects in developing countries. The partnership targets potential private investments by improving and enhancing instruments to reduce potential risks thereby contributing to closing the funding gap required to achieve the SDGs. http://www.sdiponline.org	2015



TOOL PROVIDERS: seek to enable integrated environmental or social analysis of infrastructure projects and/or into the investment process

Bloomberg New Energy Finance (BNEF)	BNEF provides analysis, tools and data for decision makers driving change in the energy system. It aims to deliver independent and comprehensive coverage on the future of the energy system, offering a view across sectors, technologies, geographies, business models and asset classes. https://about.bnef.com	2004
CEEQUAL / BREEM Infrastructure	CEEQUAL is the international evidence-based sustainability assessment, rating and awards scheme for civil engineering, infrastructure, landscaping and works in public spaces. In addition to its use as a rating system to assess performance, the rigor and flexibility of the scheme can significantly influence project or contract team decisions as they develop, design and construct their work. http://www.ceequal.com/ and http://www.breeam.com	2003
EDHEC Infrastructure Institute-Singapore*	EDHEC Infrastructure Institute-Singapore's mission is to create a global repository of financial knowledge and investment benchmarks about infrastructure equity and debt investment, with a focus on delivering useful applied research in finance for investors in infrastructure. http://edhec.infrastructure.institute	2016
Global Infrastructure Basel (GIB)	GIB is a Swiss foundation working to promote sustainable infrastructure through design and financing on a global scale. It envisions a world where sustainable and resilient infrastructure is the norm rather than the exception. http://www.gib-foundation.org	2008
GRESB Infrastructure	GRESB Infrastructure applies the GRESB mission, vision and process that have been developed for real estate to infrastructure investments. This is underpinned by GRESB's core competencies: systemic assessment for real asset companies and funds, objective scoring for ESG performance and peer benchmarking. https://www.gresb.com	2016
INFRADEV Clearinghouse*	INFRADEV enables developing country government officials and development agencies to work directly with private sector providers of capital and services needed to develop and finance infrastructure finance. It enables Risk Mitigation Product providers from the public and private sectors to provide information in one "marketplace" about their products that can be used to reduce these risks, and enable access to longer term, lower cost capital. http://www.globalclearinghouse.org/infradev	2010
Institute for Sustainable Infrastructure (Envision™)	Envision™ is a holistic sustainability rating system for all types and sizes of civil infrastructure. This includes the roads, bridges, pipelines, railways, airports, dams, levees, landfills, water treatment systems, and other components that make up our civil works. http://sustainableinfrastructure.org	2012

IRENA Navigator	IRENA Project Navigator makes it easier for project developers to initiate, develop, fund, and complete renewable energy projects around the globe. It helps developers overcome the barriers inherent in starting projects and, in doing so, facilitates the deployment of more renewable energy worldwide. https://navigator.irena.org/Pages/default.aspx	2015
Preqin*	Preqin is a source of data and intelligence for the alternative assets industry. Their products and services are used by more than 40,000 professionals globally for a range of activities including investor relations, fundraising and marketing, and market research. https://www.preqin.com/section/infrastructure/4	2003
SIF – International Infrastructure Support System (SIF-IISS)*	IISS is a public project management tool enabling public sector agencies to improve their project preparation activities. It is an online cloud based project preparation and management tool that provides templates for infrastructure projects, with the aim of improving the quality, consistency and transparency of project preparation. http://public.sif-iiss.org	2014
Sustainable Transport Appraisal Rating (STAR)	STAR is a rating system developed by the Asian Development Bank to measure a transport sector project's contribution to delivering economic, social and environmental objectives. STAR (or a modified version of it) is also used by other multi-lateral development banks. https://www.adb.org/documents/progress-report-2014-2015-mdb-working-group-sustainable-transport	2014
World Bank Renewable Energy Financial Instrument Tool (REFINe)	REFINe is an interactive web tool that helps users (including policymakers) better understand experiences with financial instruments to scale up renewable energy technologies. http://www-esd.worldbank.org/refine/index.cfm	2012

There are many other sustainable development and climate finance initiatives that are working to support infrastructure. Given that infrastructure is not their primary focus, they were not included in this review. Examples include:

- Action on Climate Finance
- Chatham House – Low Carbon Finance Group
- Climate Bonds Initiative (CBI)
- Climate & Development Knowledge Network (CDKN)
- Climate Policy Initiative (CPI)
- Coalition for Inclusive Capitalism
- FSB Task Force on Climate Related Financial Disclosures (TCFD)
- Green Bonds Principles (GBP)
- Global Investor Coalition on Climate Change (GICCC)
- Mission2020
- UNPE Financial Inquiry

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CONTACTS

INTER-AMERICAN DEVELOPMENT BANK

Amal-Lee Amin

amalleea@iadb.org
+1 202 623 1924

MERCER

Karen Lockridge

karen.lockridge@mercer.com
+1 416 868 2233

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APPENDIX V

Sample ESG Research

ESG PASSIVE RESEARCH

PLEASE NOTE THAT ANY DISTRIBUTION OF THIS ESG RESEARCH OUTSIDE OF YOUR ORGANISATION, WITHOUT THE EXPRESS WRITTEN CONSENT OF MERCER, IS STRICTLY PROHIBITED.

Manager:	Vanguard						
Title:	Assessment of voting, engagement and ESG initiatives in passive equities						
Author:	Sarika Goel						
Peer reviewer:	Jane Ambachtsheer, Alexis Cheang						
Strategies reviewed in this note:							
Product group/ category	Strategy name	Current rating**	Current ESG rating	Recommended ESG rating*			
Passive Products	Passive Equity Products	Preferred Provider	N	ESGp3			
<small>* This rating is being assigned following a detailed ESG review. Please see Passive memo for more detail on the rating guidelines for passive strategies.</small>							
<small>** For more information on Mercer's ratings please refer to your consultant or to the 'Guide to Mercer Ratings' on GIMD as appropriate.</small>							
Details of research meeting(s) covered by this note:							
Date	Location	On-site?					
15 April 2014	London	No					
Manager attendees:							
Glenn Booraem – Head of Corporate Governance Sarah Goller – Fund Financial Services Kerry Drew – Consultant Relations Carole Costello – Consultant Relations							
Mercer attendees:							
Sarika Goel, Jane Ambachtsheer, Jonathan Marshall							

Rationale for Rating

We are assigning and ESGp3 to Vanguard as we believe this manager is in the process of further developing its responsible investment policies. The corporate governance team has a clear set of governance-focused principles in place on which it focuses its voting and engagement efforts, but there is currently little evidence of engagement on environmental and social issues. There are a number of areas the team has identified for further enhancement which we believe will help to further integrate the firm's ESG and active ownership activities. However, we are unclear around the time frame for these initiatives which prevents us from awarding a higher rating. Vanguard has a relatively low profile in the industry, and is not regularly represented in industry discussions, events and membership groups.

Mercer ESG Evaluation Summary

Factor	Rating (-, =, + or ++)	Comments
Voting & Engagement Process	+	The voting and engagement process at Vanguard appears to have improved over the past few years, with the team working towards engaging to achieve more targeted outcomes based on their corporate governance principles. This has resulted in some efficiency in how the engagements are undertaken, as well as more positive feedback from companies; however, we would like to see clearer differentiation between reactive and proactive engagements. Vanguard has a strong focus on corporate governance activities, and collectively owns a significant amount of the US equity market, putting the firm in a position to exert its influence in engagements. However, we feel the firm is weak relative to peers in its approach to engaging on environmental and social issues. Furthermore, engagement efforts are currently focused mainly in the US, although effort to build some expertise outside the US is a work in progress.
Resource & Implementation	=	Effectiveness of engagement efforts appears to have improved with the targeted approach to engagement in place; however there is little data available that Vanguard has provided to highlight these outcomes. Furthermore, we are unclear about the level of expertise of resources to undertake engagement as Vanguard has not been forthcoming in providing detailed biographies. Whilst the number of resources may be sufficient for the current approach targeted for the US market, we wonder how much additional resources and expertise will be required for the intended initiatives the firm has in place.
ESG Integration & Internal Initiatives	=	There is little evidence of the corporate governance team going beyond voting and engagement activities to focus on integration at any further level; however this could be a function of all internally managed funds being passive. Having said that, we did not see much evidence of the team working proactively with its sub-advisors on ESG integration activities.
Industry Collaboration/ Firm-wide commitment	=	Whilst Vanguard has a clear set of governance principles which it follows for voting and engagement purposes, this is primarily directed at a company level, with little work being done at the industry or regulatory levels to demonstrate collaboration with other investors. Given the potential level of influence that Vanguard has, this could be enhanced. Vanguard is currently evaluating the merits of signing up to initiatives such as the UN PRI; however we were not given a time scale as to when a decision might be made.

Overall assessment	We are assigning an ESGp3 rating to Vanguard's voting and engagement activities. The firm has made a number of enhancements over the past few years to achieve more targeted outcomes from their engagement; however there are a number of initiatives that have been identified as potential areas for improvement, such as increasing the voting and engagement efforts outside the US in a more formalised manner, enhancing client reporting and communications, and ESG integration. We are disappointed to see very little focus around engagement on environmental and social issues, and would like to see further enhancements in policies around these topics to consider potential upgrade to the ESGp rating.
ESGp3	Relative to other passive managers, we believe Vanguard would need to demonstrate enhancements along all four factors in order for us to consider a higher rating. Some of this is a work in progress.

Further Details

Resources

The voting and engagement topics will typically go through three levels of approval including: the fund board, the proxy oversight committee, and the corporate governance team. The fund board has the ultimate voting authority but delegates this to the proxy oversight and corporate governance teams.

The Proxy Oversight Committee consists of a number of senior executives across Vanguard, including the Chairman, CEO, general counsel, the Fund's CFO, Glenn Booraem (controller), and some other representatives from the investment teams, as well as some external managers. This committee functions in two capacities, namely framing the policies and guidelines and addressing specific issues where there is no policy in place. All other activities are undertaken by the Corporate Governance team. This team consists of seven senior analysts and six junior analysts reporting to Glenn Booraem (who also has responsibility for fund accounting operations). This team is responsible for liaising with proxy voting firms, aggregating analysis on proxy issues and undertaking the voting for each stock. The team will typically review the proxy voting firm's recommendations, although these are not always taken into account, if they are not consistent with Vanguard's principles. The engagement efforts are led by Booraem, Goller, or a senior member of the investment team; whilst most of the junior analysts accompany them for learning purposes. Surprisingly, when asked for more detailed biographies on the individuals in the team, we were told that Vanguard does not have detailed biographies available for the entire team, except for Booraem, and Goller (see appendix). This begs the question of how experienced even the senior members are in order to undertake engagement activities, and how dedicated the resources are in this area.

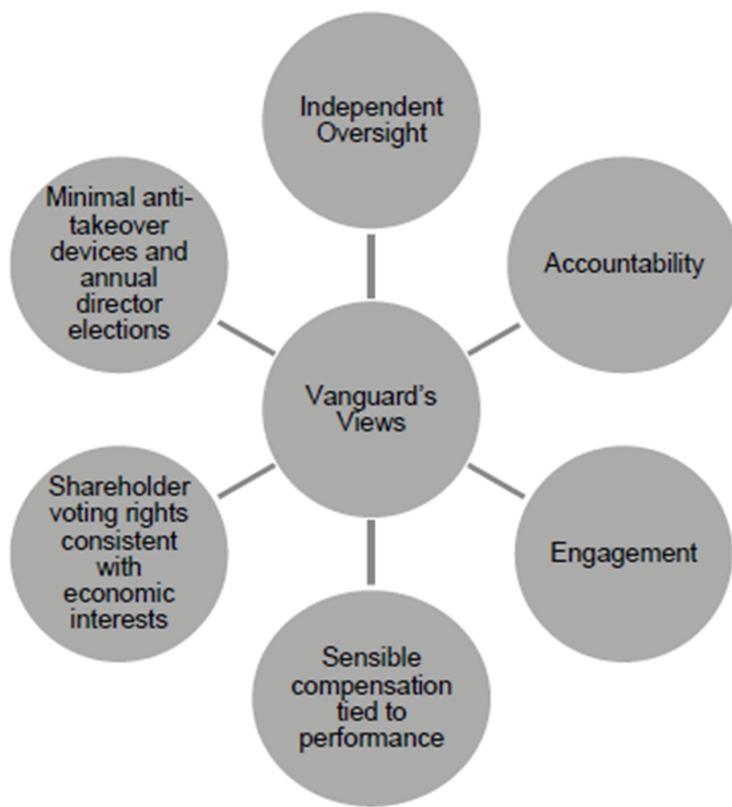
The roles are not split by sector specialisation, and all analysts tend to be generalists, although senior analysts will typically be responsible for voting on non-US holdings. The allocation of the analysts' time is typically driven by the complexity of the issue or significance of the company in Vanguard's overall exposure. The more senior analysts also tend to deal with the more complex issues. Engagement efforts have increased over the past four years, from approximately 150 in 2010 to around 600 in 2013. Given this increase, we question whether the current level of senior analysts will be adequate going forward.

Booraem feels the current level of analysts is adequate for the voting and engagement efforts. Currently the majority of the firm's assets are based in the US market, although Booraem highlighted that this is rapidly changing, with growing exposure to the UK, and other European markets. Whilst he has indicated future potential hiring as the firm expands on mandates outside the US, he was vague in his responses as to what areas specifically he would like to address and did not highlight any specific plans at this point. Furthermore, he feels the emphasis will continue to be on governance-related issues. We did not get a sense of how much of a priority the team places on environmental and social issues for engagement over the near future.

The team makes use of Glass Lewis and ISS for their proxy voting research, although they do not always follow these recommendations. The firm's primary focus around social issues is to monitor companies for any potential breaches in human rights issues, and highlighted that research here includes securities filings, proxy reports from ISS and Glass Lewis, news reports, human rights activist publications, and other third party materials. However, policies appear vague, and in our view, the team does not tend to focus on environmental and social issues to a large extent.

Voting & Engagement Process

The current voting and engagement process is mainly focused on governance related topics, which has always been the case. Vanguard's voting and engagement process is predicated on six broad governance principles as depicted below. Details of the policy are publicly available on the company's website.



Whilst Booraem suggested that environmental and social issues for engagement are seen as important, we did not get the impression that this is or will be a key focus point over the near future, which is disappointing. Vanguard provides an overall

policy on social and environmental concerns and notes that it has a formal procedure to monitor potential issues around human rights which may prompt engagement or potential divestment; however, overall we wonder how much the team has engaged with clients or other teams to get views on creating more in-depth policies around environmental and social issues.

Engagement is primarily done at the company level, and typically focuses on those companies where Vanguard has the greatest exposure. According to Booraem, the volume of engagement has increased with approximately 600 direct engagements held throughout 2013. These can take a number of different approaches including:

- a) **Reacting to particular issues (during AGM season)** - This is typically in response to a particular ballot matter where research has identified an issue and the team would like to get deeper understanding.
- b) **Engagement outside the annual general meetings** - This is typically driven by ongoing dialogue with companies, and follow-up outside the voting season. This centres on Vanguard's observations or where companies would like to talk about their developments. If a company did not get the vote it was seeking from Vanguard, the company management would typically follow up with Vanguard on areas requiring further work in order to get the requisite approval.
- c) **Proactive Outreach to portfolio companies.** This is typically on a more proactive basis to identify specific issues they would like to address, mainly from a governance perspective, and usually focusing on one of the six principles identified above. For example, they focused on executive compensation and board structure as an area of engagement and sent targeted letters to over 300 companies to take action.

Whilst the three approaches are outlined above, there appears to be less differentiation between the second and third forms of engagement. Booraem admitted that they haven't key very good records on how many engagements are truly proactive. Approximately half the engagements occur during the AGM season and are on a reactive basis, with the majority involving the team responding to specific issues. The remaining engagements occur outside the AGM season, and typically involve broader discussions around corporate governance issues. Engagements are typically based on Vanguard's exposure to the company shares. Given the passive manager's ownership of approximately \$1.4 trillion in equity AUM (of which over \$1 trillion is in the US market), Vanguard is well-placed to exert influence in its engagement efforts and is working towards being more proactive. The team's approach to engagement has been improved in that the team aims to be more targeted in its outreach to portfolio companies in engaging on specific issues.

Booraem indicated the firm has approximately 35 external sub-advisors on a number of actively managed mandates and may consult with them where Vanguard has significant exposure to further gain support. The team has clear policies on its website discussing where it stands on corporate governance issues, but has little to no policies around environmental and social issues. According to Booraem, the general tendency is to abstain from voting on these resolutions. Overall, the firm takes a view as to the impact a proposal can have on the long-term value of the company in order to determine how to vote and where to engage. We would like to see some greater thought and policies around how environmental and social issues are addressed.

Booraem highlighted further areas of enhancements, and specifically would like to extend engagement to markets outside the US, where Vanguard has a growing footprint. The initial focus would be to extend governance focused engagements to these outside markets, before establishing engagements to focus on topics related to environmental and social issues. Operationally, the firm already has a number of regional specific policies in place, thereby can leverage those perspectives, and be able to start getting into more directed engagement efforts outside the US. However, Booraem was not specific regarding the key regions to target, although he highlighted this will be driven by where the firm has the most exposure after the US. We would expect them to add to resources as the number of targeted engagements increase in and outside the US market. UK based resource would be a natural next step, but Vanguard did not raise this as a possibility.

Implementation - Effectiveness of Voting & Engagement activities

The firm overall manages approximately \$3 trillion in assets, of which almost two thirds are passively managed and one third actively managed. Of the actively managed strategies the majority is sub-advised by 35 external managers. Vanguard retains the voting authority for all internally and externally managed funds, leading to potentially significant influence on the US market.

Overall, Booraem feels the team has become more efficient in the manner in which it targets areas for engagement. Where before the team was sending relatively standard letters to over 1,000 companies at a time, it has now become more tailored in its approach and focused on the company circumstance when contacting the company. This has been a positive move as the team has now received more responses and acknowledgements from companies. Furthermore, Booraem believes the number of companies taking action in response to these letters has also increased, which he feels is a positive. He noted that one third of companies have responded to the letters that are sent, where majority of these responses include agreement to present Vanguard's perspective to the Board, and approximately 25 companies have made the requested change based on Vanguard's suggestions. Over the past two years the team has undertaken over 600 direct engagements in the various forms. According to Booraem, there is been an increase in the frequency and impact of the engagements, both on governance and compensation specifically driven by the activity around 'Say on Pay'; however we were not provided with any specific data on the effectiveness or impact of these engagements. Furthermore, Vanguard currently does not maintain records of engagements broken down by category, although this is not surprising as majority of the engagements are focused on governance topics. As the team builds its capabilities around environmental and social engagements, we would expect this to become more transparent.

ESG Integration

There appears to be little further work being done on ESG integration beyond the voting and engagement. This is partly due to the rationale that Vanguard primarily manages assets on a passive basis, whilst active mandates are managed externally (although Vanguard retains the voting power for these externally managed strategies). However, it did not appear that Vanguard collaborates with its sub-advisors any further beyond engagement topics on particular governance issues, as highlighted above. Given the effectiveness of collaboration that we have seen amongst other large managers between the passive and active management teams, we would like to see evidence of communication between Vanguard and other external managers.

In addition, the firm is working with FTSE on two SRI funds that primarily take a screening approach. However, the firm does not appear to take much initiative around other product development (such as other ESG or low-carbon indices).

Client Reporting/Communications

Client communication is adequate, although the firm is looking to enhance its efforts in this area. Currently the team discloses the direction of the votes and any key observations, but has typically refrained from adding any further commentary. The team prepares special reports to the Board twice per year, once before the proxy season begins and once after the season, highlighting the results, any trends in voting, and the status on engagements. Booraem would like to start publishing more regularly the outcomes of some of these engagements, as he feels the company has had some success.

Whilst the firm has typically prepared annual reports on governance activities (namely, proxy voting), going forward the reporting will also include elements of engagements. Given the number of other areas of intended enhancements mentioned during the meeting (increasing coverage to markets outside the US, etc.) and the vague responses around additional hires, we are unclear as to when these changes will likely occur.

Industry Collaboration and Firm-wide commitment

The corporate governance team will typically be involved in, and respond to any public submissions that take place, however, Vanguard is not significantly involved in other industry initiatives. Whilst this is disappointing, given the influence the firm can exert with the exposure it has to the US market, Vanguard is evaluating whether to join initiatives such as the United Nations Principles for Responsible Investment (UNPRI), but would like to ensure that signing up to this initiative remains consistent with the firm's views on shareholder value.

Booraem contributes to various initiatives. In the past he has been part of the New York Stock Exchange's Proxy Working Group Commission on Corporate Governance which reviewed a number of governance changes and the impact this had on the relationship between directors, management and shareholders. This Commission resulted in a consensus on a number of principles around corporate governance. More recently, Booraem contributed to the Shareholder Director Exchange, which created guidelines for effective shareholder/director engagement.

Vanguard appears to be part of only a few collaborative organisations such as Regnan (an Australian based firm focused on governance research and engagement) and is looking at other areas for collective engagement (beyond the PRI) they would like to be involved in. However, when asked, they did not mention any specific organisations. The corporate governance team contributes to a number of other US organisations such as the Conference Board and National Association of Corporate Directors. However, we are surprised that they are not members of some of the key US collaborative organisations we would expect them to participate in (such as the Council of Institutional Investors), given their US exposure.

Appendix

The following biographies have been provided by Vanguard:

Glenn Booraem is a Principal of the Vanguard Group, Inc. and the Controller of each of the Vanguard Funds. He has worked for Vanguard since 1989, where he currently oversees the firm's corporate governance program covering more than US\$1.5 trillion in equity market value. He is a periodic speaker on governance to industry groups, and previously served on the New York Stock Exchange's Proxy Working Group and Commission on Corporate Governance. In addition to his governance-related duties, Booraem is responsible for fund accounting operations, security valuation, and fund compliance monitoring for the Vanguard funds. Booraem earned a B.B.A. from Temple University, and is a graduate of the Advanced Management Program at Harvard Business School.

Sarah Goller is responsible for Vanguard's corporate governance program and oversees daily operations of governance and proxy voting matters for Vanguard investment portfolios. Her position involves assisting Vanguard's Proxy Oversight Group with policy decisions, managing a team of governance analysts, and ensuring accurate execution of Vanguard's global voting and engagement program. Goller's team meets regularly with company representatives, including portfolio company directors and executives, on governance matters such as executive compensation, director elections, and Vanguard's corporate governance philosophy. Prior to her current role, she worked as an analyst in the Portfolio Review Department, which is responsible for overseeing Vanguard's 100-plus mutual funds, assessing fund performance, and monitoring Vanguard's external advisors. Goller has also worked in Vanguard's Corporate Strategy and Advice Services Departments. She is a graduate of the University of Notre Dame and is a CFA charter holder.

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- Certain investments, such as illiquid, leveraged or high-yield instruments or funds and securities issued by small capitalization and emerging market issuers, carry additional risks that should be considered before choosing an investment manager or making an investment decision.
- For higher volatility investments, losses on realisation may be high because their value may fall suddenly and substantially.
- Where investments are not domiciled and regulated locally, the nature and extent of investor protection will be different to that available in respect of investments domiciled and regulated locally. In particular, the regulatory regimes in some domiciles are considerably lighter than others, and offer substantially less investor protection. Where an investor is considering whether to make a commitment in respect of an investment which is not domiciled and regulated locally, we recommend that legal advice is sought prior to the commitment being made.

APPENDIX W

Draft Investment Policy Statement

Draft Investment Policy Statement

Pension Reserve Fund
June 2017

Contents

Contents	i
1. Purpose and Background	1
2. Allocation of Responsibilities	2
2.1 Ministry of Finance	2
2.2 Central Bank of Chile	2
2.3 Custodian Bank	2
2.4 Financial Committee	3
2.5 Staff	3
2.6 External Investment Managers	3
2.7 Investment Consultants	4
3. Investment Objectives	5
4. Policy Guidelines	6
4.1 Asset Allocation	6
4.2 Securities Guidelines	6
5. Standards of Performance	11
5.1 Termination	11
5.2 Performance Benchmarks	11
6. Communications and Reporting	12
6.1 Investment Managers	12
7. Evaluation and Review	13
7.1 Evaluation	13
7.2 Meetings	13

1. Purpose and Background

The Pension Reserve Fund (“PRF”, or the “Fund”) is one of two Chilean sovereign wealth funds. It was created through the Fiscal Responsibility Law of 2006, which established the regulations and institutional framework for the accumulation, management and operation of the fiscal savings generated from the application of the structural balance rule¹. This law stipulated the creation of the PRF, which received its first contribution on 28 December 2006.

The purpose of the PRF is to complement the financing of fiscal liabilities in the area of pensions and social welfare. Specifically, the Fund backs the state guarantee for old-age and disability solidarity pension benefits, as well as solidarity pension contributions, as established under the Pension Reform of 2008.

The Fiscal Responsibility Law of 2006 and the Pension Law of 2008 establishes the rules on Fund contributions, withdrawals and the use. There are specific contribution and withdrawal formulas described in these laws.

The purpose of this Investment Policy Statement (the “Policy”) is to establish roles and responsibilities, investment objectives, and policies and procedures that taken together will create a high probability that objectives on the PRF are met in a prudent manner.

This Policy outlines guidelines and requirements in the following areas:

- Defining and documenting responsibilities of parties accountable for the management and administration of the Fund’s investments
- Defining the Fund objectives and linking those to the Fund’s investment strategy
- Outlining investment performance objectives and standards
- Establishing investment guidelines and monitoring procedures for the Fund’s assets

In general, it is understood that this Policy is intended to incorporate sufficient flexibility so as to accommodate current and future economic and market conditions and changes in applicable accounting, regulatory, and statutory requirements.

If any term or condition of this Policy conflicts with any term or condition of the Investment Management Agreement (IMA), the terms and conditions of the IMA shall control.

¹ In summary, the structural balance rule is a way to reduce volatility in fiscal spending by detaching it from the cyclical fluctuations of economic activity and the price of copper. The targets change over time, and each Presidential Administration is to announce its objective for the structural balance rule in its first year.

2. Allocation of Responsibilities

This section describes and delineates the responsibilities of the key parties to the Fund's investment process. The formal framework of responsibilities is established by law.

2.1 Ministry of Finance

The Ministry of Finance ("MoF") is responsible for overseeing all aspects of the investment and administration of the Fund. Its responsibilities are determined by law, and include:

- Complying with all aspects of pertinent law, regulations, and rulings that relate to the PRF.
- Setting and regularly reviewing policies, objectives and guidelines for the investment of the Fund's assets.
- Selecting qualified professionals to assist in the implementation of the Fund's investment program.
- Determination of which portions of the Fund's assets should be managed by external investment managers, and managing relationship and contracts with such managers
- Evaluating the Fund's performance and the performance of the professionals hired to assist the MoF in managing the Fund's assets.

Under the law, the MoF has the authority to delegate fulfillment of investment and administrative tasks to others. Reasonable care shall be exercised in selecting and monitoring such individuals or firms.

2.2 Central Bank of Chile

Subject to law and the request of the Finance Minister, the Central Bank of Chile ("CBC") can perform the following function in relation to the PRF as fiscal agent:

- Manage portfolios
- Delegate management of portfolios to external managers
- Open separate accounts
- Maintain transaction and operations registers
- Contract services of custodian bank and manage that contract
- Prepare reports and statements on the management of portfolios
- Process appropriate payments to outside vendors

2.3 Custodian Bank

The custodian bank for the Plan is responsible for:

- Fulfilling all the regular duties of a custodian as required by applicable laws (and as further defined in the custodial services agreement).
- Safekeeping of assets, timely settlement of securities transactions, timely crediting of all income and principal realizable by the Fund, and the daily sweep of excess cash from manager accounts into a suitable cash management vehicle.
- Reporting monthly (or as required) to the Ministry of Finance and Central Bank of Chile on transactions of the Fund.
- Delivering assets of the Fund to a successor custodian or as otherwise directed in proper instructions within a reasonable period of time of termination.

2.4 Financial Committee

The Financial Committee is an external advisory board, whose members have a vast experience in economic and financial areas, created to advise the Minister of Finance on the analysis and design of the PRF. Their responsibilities include:

- Advising the Finance Minister, when requested, on the long-term investment policy of the sovereign wealth funds, including the selection of asset classes, benchmarks, the acceptable range of deviation, eligible investments and the inclusion of new investment alternatives;
- Recommending to the Finance Minister regarding specific instructions on investment and custody, tender processes, the selection of Fund managers and the structure and content of reports;
- When requested, assessing the structure and content of the reports submitted to the Ministry of Finance by the agencies entrusted with the management and custody of the Fund and to express an opinion on the quality of management and compliance with established investment policies;
- Assessing the structure and content of the quarterly reports prepared by the Ministry of Finance; and
- When requested, general advisement on all matters relating to the investments of the Fund.

2.5 Staff

The Fund Administration staff is responsible for:

- Acting as the liaison between the MoF, CBC, Financial Committee and external vendors.
- Day-to-day communications with all outside parties to the investment program.
- Carrying out activities as delegated by the MoF and CBC.

2.6 External Investment Managers

Investment managers are expected to discharge their duties solely in the interests of the Fund's beneficiaries. The investment managers are given full discretionary authority to accomplish the investment objectives of their portfolio, subject to the guidelines set forth in this Policy. Subject to the agreement between the Fund and the Investment Manager, the responsibilities of the investment managers include:

- Determining and implementing investment strategy according to the style for which they were hired.
- Implementing security selection and timing decisions.
- Voting all proxies received.
- Providing reports and data as requested by various parties.
- Meeting with various parties, as requested.

2.6.1 Trading and Execution

In placing security transaction orders on behalf of the PRF, the investment manager shall use its best efforts to obtain execution of orders through responsible brokerage firms at the most favorable prices and at reasonable, competitive commission rates.

2.6.2 Proxy Voting

The investment managers shall be responsible for voting proxies solicited by, or with respect to, the issuers of securities held as investment assets. All proxies shall be voted in whatever manner deemed by the investment managers to be in the best interests of the PRF's goals and objectives.

2.7 Investment Consultants

From time to time, the Fund will engage with outside consultants to advise and engage on various aspects of managing the Fund. Specific responsibilities of the outside consultants will be subject to the agreement between the Fund and the Investment Consultant, but could include items such as:

- Assisting the MoF in establishing a relevant investment policy.
- Measuring and reporting investment performance of assets.
- Monitoring manager compliance with the Fund's investment policy.
- Providing investment expertise and analysis, as needed by the MoF.
- Keeping the MoF informed of current investment trends and issues and material changes in the regulatory environment.
- Assistance with asset allocation/liabilities studies.
- Meeting with the MoF, as requested.

3. Investment Objectives

The investment objective of the Fund is to seek a target real rate of return, considered from the perspective of Chilean inflation. In line with the above analysis, we would propose, subject to discussion with the MOF, to focus on potential real return targets of 1%, 2%, 3% and 4%.

From a risk perspective, we will also consider this from the perspective of maximum losses in CLP terms in any given year at the 95th percentile and also from the perspective of the likelihood of the fund value falling below various thresholds at various times within the 20-year projection period. For example, we will examine the probability of the projected portfolio values falling below the initial starting value threshold after 5 years, 10 years and 20 years, being the proposed time horizons discussed above.

We also recommend that the investment objectives be summarized in a risk dashboard

Comment [TC1]: Subject to final investment objectives selected.

4. Policy Guidelines

4.1 Asset Allocation

In recognition of the Fund's objectives and capital market expectations, the following asset allocation guideline has been approved and deemed appropriate for the Fund:

Comment [TC2]: TBD

Asset Class	Policy Target	Range
Broad Market Equity (including EM)		
Sovereign Bonds (Nominal)		
Inflation-Linked (Sovereign)		
Investment Grade Corporates		
Agency Residential MBS		
Global High Yield		
Infrastructure		
Real Estate		

Rebalancing of the Fund's assets toward the policy targets will be done when the actual allocations differ materially from policy targets and as business needs allow. When the time comes, rebalancing will be initiated through written instruction to the Fund's custodian and investment managers. Asset allocation will be measured at market value in accordance with the Fund's custodian statements.

4.2 Securities Guidelines

The objective for passive mandates is to obtain monthly results similar to that of the listed benchmark. An ex-ante tracking error budget shall be defined at 50 basis points for passive fixed income mandates and at 60 basis points for equity mandates. The only eligible issuers and currencies shall be those included in the listed benchmark.

4.2.1 Equities

Equity investments in any one company shall be limited to the greater of a) 5% of the market value of portfolio at time of purchase or b) the applicable benchmark weighting of the security plus 2%.

Portfolios are expected to be well diversified with respect to industry and economic sectors, within the context of the managers' benchmark index. Both industry and country diversification are desirable. Decisions as to turnover and number of holdings are left to manager discretion, subject to the usual standards of fiduciary prudence.

Exchange Traded Funds (ETF's) and equity index linked securities are permissible up to 10% of the portfolio.

Cash and short-term investments shall not exceed 10% of the manager's portfolio (exclusive of pending purchases, sales, or currency hedges). At no time should cash be used for market timing purposes.

Permissible investments include common or preferred shares of corporations listed and traded on principal stock exchanges. These may include securities convertible into common stocks; real estate investment trusts (REIT); Depository Receipts, specifically Global Depository Receipts (GDRs) and American Depository Receipts (ADRs); foreign currency denominated securities convertible into common stocks of non-U.S. corporations; futures and options on futures on foreign stock indexes; warrants and rights; and short-term investments.

For the purpose of managing currency, hedging currency risk and to effect securities transactions, permissible investments include foreign currencies in both spot and forward markets and options, futures, and options on futures on foreign currencies. Equity investments may be made in emerging country markets (as defined by the MSCI indexes) up to a maximum of 30% of the portfolio, measured at market value.

4.2.2 Fixed Income

Permissible domestic fixed income investments include debt instruments of any U.S. entity denominated in U.S. dollars, including U.S. dollar denominated sovereign and supra-national bonds, Yankee and Eurodollar bonds; mortgage pass-through certificates; collateralized mortgage obligations; asset-backed securities; and commercial mortgage-backed securities.

No single issuer of fixed income or cash equivalent securities (with the exception of the U.S. Government and its Agencies) shall account for more than 10% of the market value of the fixed income securities in a manager's portfolio. The

investment manager shall not hold more than 10% of any company's outstanding debt.

Investment grade issues should be emphasized; with a minimum quality rating of "BBB" by Standard & Poor's or rated comparably by a recognized rating service. Provided however, up to 20% of active manager portfolios may be invested in issues rated BB or B, but not below B, by Standard & Poor's or rated comparably by a recognized rating service. This restriction applies to combined holdings of dollar-denominated U.S. issues, dollar-denominated non-U.S. issues, and non-dollar denominated issues.

In the event of a split rating, the lower rating shall apply.

Any security downgraded below its approved quality level should be disposed of in an orderly market manner and in the best interest of the Plan.

Non-dollar bonds are permitted in the portfolios of active managers, but may comprise no more than 20% of the total market value. Investment in non-dollar bonds will be limited to the countries included in the Barclays Global Treasury Majors ex-US Index.

Permissible international fixed income investments include foreign currency denominated issues of foreign governments, including but not limited to national, state, provincial and local government, their agencies and instrumentalities; supranational organizations; and foreign corporations; foreign currency denominated securities of U.S. issuers; futures and options on futures on foreign bond and short-term securities. For the purpose of managing currency, hedging currency risk and to effect securities transactions, permissible investments include foreign currencies in both spot and forward markets and options, futures, and options on futures on foreign currencies.

The weighted average duration of each fixed income portfolio is expected to remain within a range of 80% to 120% of the designated benchmark. Portfolios are expected to be well diversified. Decisions as to turnover and number of holdings are left to manager discretion, subject to the usual standards of fiduciary prudence.

Comment [TC3]: This is included only for reference at this point since this is directed at active mandates.

4.2.3 Real Assets

TBD

4.2.4 Cash and Short-Term Investments

Debt securities of any U.S. entity not otherwise prohibited, with a maximum average maturity of one year are considered qualifying cash and short-term investments and include U.S. Government and Agency obligations, bank-issued

Certificates of Deposit, Bankers Acceptances, Commercial Paper, and Bank Pooled Short-Term Funds.

Rated cash and short-term securities must be rated in the highest short-term rating category by a majority of the nationally recognized security rating organizations assigning a rating to that issue such as “P-1” by Moody’s or “A-1” by Standard & Poors.

All bank-issued securities must carry a minimum rating of “B/C” or better by Fitch rating service.

4.2.5 Derivative Products

The Fund recognizes that derivatives can be useful tools that enable investment managers to modify the risk/return characteristics or duration of portfolios under their control in a cost-effective manner.

Investment managers may use swaps, stock index futures, financial futures, and options on such futures prudently in a total portfolio context to manage a portfolio's risk/return profile. In no case will the manager allow the risk of the total portfolio to be greater than the risk level associated with a fully invested portfolio of common stocks, or fixed income obligations as appropriate, given the manager's designated role. Traditional active managers may use derivatives only to hedge existing risks in the portfolio.

4.2.6 Securities Lending

The PRF may agree to securities lending programs with the PRF custodians, as long as the custodians agree to specific custodian guidelines. This will include the obligation to restitute the pertinent securities or, failing that, the market value thereof.

External Managers shall neither execute nor agree any securities lending programs.

4.2.7 Prohibitions

Investment in instruments issued by Chilean issuers is not permitted, nor can investments be made in instruments denominated in Chilean pesos.

Derivatives may not be used to increase exposure to financial instruments beyond the market value of the portfolio under management.

External Managers may contract futures, forwards or swaps of currencies whose aggregate nominal amounts shall not exceed 10% of the portfolio managed by each of them.

In the specific case of the equity Externally-Managed Portfolios: (i) Mutual funds and Exchange Traded Funds (ETFs) may not represent, as a whole, more than the aggregate participation of Egypt, Philippines, India, Poland, Russia, Thailand, Taiwan and Turkey in the benchmark applicable to the Equity portfolio detailed in Table 1 plus 2%; (ii) The External Managers shall not invest in the local markets of Chile, Egypt, Philippines, India, Peru, Poland, Russia, Thailand, Taiwan, and Turkey; (iii) Investment in China shall only be made either through the Hong Kong stock exchange or any other exchanges where the stocks in the benchmark are traded, excluding the local markets of China, Chile, Egypt, Philippines, India, Peru, Poland, Russia, Thailand, Taiwan, and Turkey.

The External Managers shall not invest in their own equities or corporate bonds, or those of their affiliates.

5. Standards of Performance

Within this section, all references to returns net of fees shall mean the rate of return earned after deducting investment management fees. References to returns gross of fees shall mean the rate of return earned before taking into consideration the cost of investment management.

5.1 Termination

It is the Fund's intention to maintain long-standing relationships with its managers and to avoid unnecessary and costly manager turnover. However, it may be necessary, from time to time, to terminate a relationship. Termination can occur due to a change in the Fund's investment strategy or for reasons specifically related to investment manager performance. Absent overriding factors for keeping a manager, the following factors may result in termination:

- A significant change in the structure, management style, or personnel of the investment manager's organization.
- A lack of confidence that the manager can produce acceptable results in the future.
- Failure to achieve the performance standards set for that manager's style classification.

Regardless of the foregoing, the Fund reserves the right to terminate an investment manager for any reason in accordance with the time requirements set forth in their respective investment management agreements.

5.2 Performance Benchmarks

Comment [TC4]: Ultimately dependent on final portfolio structuring selected.

Investment Strategy	Relative Market Index 3 and 5 Years	Comparative Manager Universe Median 3 & 5 Years
Broad Market Equity (including EM)		
Sovereign Bonds (Nominal)		
Inflation-Linked (Sovereign)		
Investment Grade Corporates		
Agency Residential MBS		
Global High Yield		
Infrastructure		
Real Estate		

6. Communications and Reporting

6.1 Investment Managers

On a quarterly basis, each Investment Manager will provide the MoF with a list of the assets held in the Fund, transactions that occurred during the quarter, a report of capital gains and losses, and a summary of the investment performance of the account, before and after fees.

On an annual basis, the investment managers will provide a report on the various transaction charges incurred on behalf of the Fund. The report, prepared in a form acceptable to the MoF, is to show shares traded, brokerage firms utilized, total trading costs, and cost per share.

On an annual basis, the investment managers will present a copy of their proxy voting policy and report on the manner in which all proxies were voted.

Report immediately, in writing, any material changes in the firm's ownership, investment personnel (including, but not limited to, senior management, portfolio managers, analysts, and traders) and investment style and/or approach.

As needed, submit recommended changes to this Policy in writing to the MoF. Such recommendations should, where possible, quantify the benefit of the suggested changes.

7. Evaluation and Review

7.1 Evaluation

Investment management of the PRF will be evaluated against the Fund's investment objectives and investment performance standards. Performance will be measured and evaluated quarterly. Performance will be evaluated on a long-term basis, in light of the investment environment and investment style of each manager. Evaluation will take into consideration both rates of return and volatility of returns.

This Policy will be evaluated annually to ensure its continuing relevance.

7.2 Meetings

Each investment manager will meet upon request with the MoF, or designated sub-committee thereof, to review the investment performance of Fund assets allocated to that investment manager, discuss current and expected changes in investment strategy and any changes in the firm.

A qualified representative of the trustee and custodian bank will meet upon request with the MoF or designated sub-committee thereof to review its role and services as Custodian in administering the Funds.

Other outside vendors (such as investment consultants) will meet with the MoF as requested to review and discuss project specific issues.

APPENDIX X IMPORTANT NOTICES

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Mercer (US) Inc.
1301 Fifth Avenue, Suite 1900
Seattle, WA 98101
USA