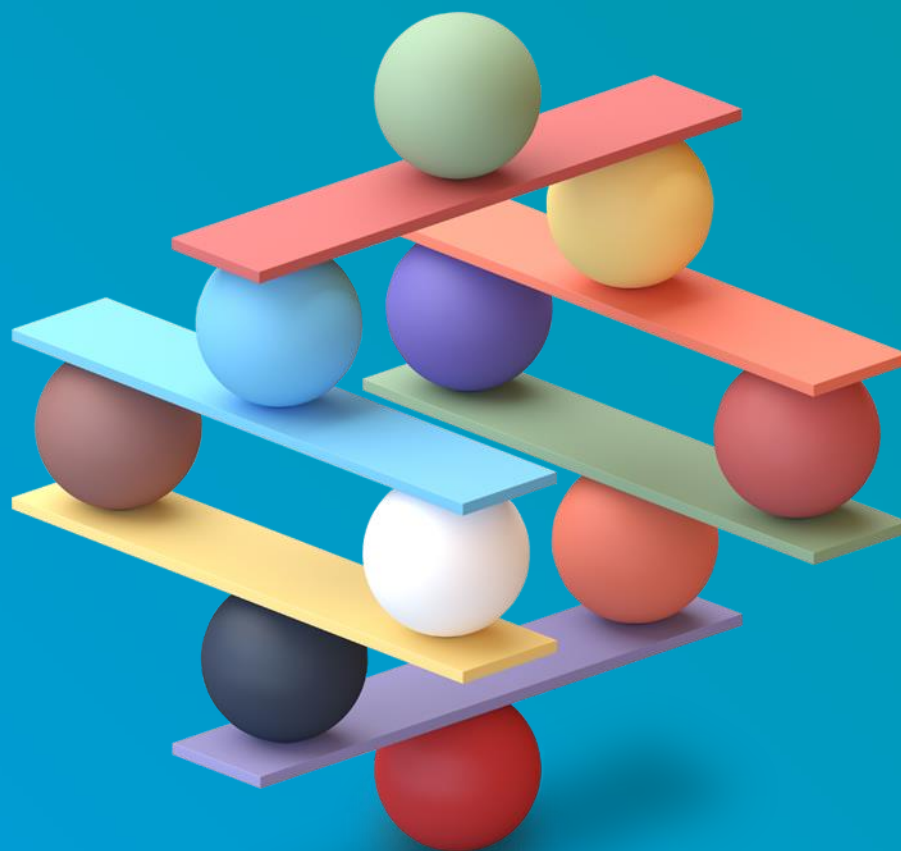


# Ministerio de Hacienda

## Pension Reserve Fund - Strategic Asset Allocation Study

**Ministry of Finance - Chile**

Revised: July 28 2025



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## Section 1

# Introduction

The Ministerio de Hacienda (Ministry of Finance - “MoF”) of the Republic of Chile has retained Mercer Investments LLC (“Mercer”) to provide an evaluation of the investment policies of the Pension Reserve Fund (“PRF”). The Congress of Chile passed legislation in 2024 directing that the PRF adjust its investment model from a fund whose purpose was to support the Treasury in meeting its fiscal pension obligations to an endowment model. Under the new model, the PRF will be focused on growing its longer-term spending power and making regular payment out of the assets to support the state pension program.

*“The MoF established the Pension Reserve Fund (PRF) at the end of 2006, which currently has a market value of approximately US\$ 9 billion. The policy purpose of the Fund is to support the financing of the Universal Guaranteed Pension and the Solidarity Pillar of Disability. The PRF is currently invested in Global Sovereign and Government Related Bonds (34% of the portfolio allocation), Global Sovereign Inflation Linked Bonds (8%), US Mortgage-Backed Securities (6%), Global Corporate Bonds (13%), Global High Yield Bonds (8%) and Global Equities (31%). The Minister of Finance is responsible for defining the investment policy of the Fund and the Financial Committee (FC) for advising the Minister on all aspects related to the PRF’s investments.*

*Recently, in July 2024, the Congress approved a series of changes that will make the PRF operate as an endowment. Specifically, this reform states that the Minister of Finance must define a withdrawal rule that meets two objectives: i) that the annual amount of withdrawals from the Fund must be stable and predictable; and ii) that the Fund’s value must be maintained over the long-term, adjusting for inflation. Therefore, this rule sets the expectation that a certain amount of resources should be withdrawn each year, but should be estimated in such a way that the annual amount is not highly volatile and that preserves the Fund’s capital in real terms over the long-term. Considering these recent developments, the MoF has decided to hire a Consultant with international experience (Consultant) to recommend a new Strategic Asset Allocation (SAA) for the Fund. “*

Mercer’s analysis and recommendations included in this report focus on two related topics: 1) Perform a strategic asset allocation (“SAA”) review and study to determine the most effective asset allocation to provide long term growth of real purchasing power of the PRF and 2) develop a spending policy to provide a stable and growing stream of distributions from the PRF. These two topics are closely related as the investment policy drives both the return and volatility of the PRF asset pool, including its ability to grow above inflation and its ability to support a stable pattern of withdrawals. The spending policy is linked to the asset allocation, as it must be designed to have spending amounts that do not exceed the real growth of the asset pool and still provide a stable spending amount that grows over time.

This study consisted of two main components. The first encompassed the development of a spending and investing framework for the PRF. This included a review of the experience of other institutional investors with similar objectives to the Pension Reserve Fund (PRF). Given the legislative requirement for the PRF moving forward to include a spending component, we focused on peer programs that aim to maintain purchasing power of assets while allowing for an annual target spending rate (See Section 2). Additionally, this review included refining and testing a withdrawal rule and target withdrawal rate for consideration (Section 3). Also covered at this stage was a discussion on the investment objectives and risk tolerances (Section 7) and review of the capital market assumptions (Section 4) to be utilized in modeling. The second stage developed the strategic asset allocation policies to be considered (Section 5), and incorporated the combined impact (Section 6) of spending policy and asset allocation through simulations, back testing and stress testing of the combined asset allocation and spending methodology

and rates, and recommended benchmarks and alternatives (Section 9) to assess the achievement of the investment objectives set forth.

This report is self-contained, consolidating all material provided in earlier reports and reflecting any updates as relevant to reflect discussions and communications with the MoF and the FC.

## Section 2

# Experience of other institutional investors

In this section, comparisons are made to other institutional investors with a similar spending objective as the Pension Reserve Fund (PRF). Given the legislative requirement for the PRF moving forward to include a spending component, we focus on comparisons to peer programs that have constructed their policies to maintain purchasing power of assets, while allowing for an annual target spending rate. A variety of characteristics are shown to permit a comparison of how these plans are structured relative to the PRF.

## Comparisons to Sovereign Wealth Fund Peers

The below table outlines information about the peers that we are utilizing for comparison purposes. This diverse group of peers includes sovereign wealth funds that are pension oriented but have a spending element.

*Note on opportunity set for peer comparisons: some sovereign wealth funds have integrated a spending component into the management of the program, but that peer set is not large. While Mercer believes these are valid comparisons, they should be considered along with other large institutional programs with similar objectives.*

Country / Fund	Use of Assets
<b>Australia: Future Fund</b>	“The Future Fund is an Australian Government investment fund, set up to strengthen the Commonwealth’s long-term financial position by making provision for unfunded superannuation liabilities that will become payable during a period when an ageing population is likely to place significant pressure on the Commonwealth’s finances.”
<b>Ireland: Future Ireland Fund</b>	“The FIF is a long-term savings fund which is intended to grow over time, and to remain locked away until at least 2041. The NTMA will invest and manage the Fund on a commercial basis to seek optimal financial return such that the capital of the Fund, and any investment return earned, is available to be withdrawn by the Government from 2041 onwards. Once withdrawn, it will be a matter for the Government to decide how that money is spent by the Exchequer.”
<b>Marshall Islands: Trust Fund</b>	“The Purpose of the Fund is to contribute to the economic advancement and long-term budgetary self-reliance of the Republic of the Marshall Islands by providing an annual source of revenue, after Fiscal Year 2023, for assistance in education, health care, the environment, public sector capacity building, private sector development, and public infrastructure described in Section 211 of the Compact...”
<b>Mongolia: Future Heritage Fund</b>	Future Heritage Fund legislation has been proposed to use mineral revenue to establish the Future Heritage Fund that would support social services or public investments.

Country / Fund	Use of Assets
<b>Norway: Government Pension Fund Global</b>	“The fund was set up to shield the economy from ups and downs in oil revenue. It also serves as a financial reserve and as a long-term savings plan so that both current and future generations of Norway get to benefit from our oil wealth.”
<b>Singapore: GIC</b>	“The reserves support Singapore’s current spending needs through its contribution to the annual Budget. About one-fifth of Government spending is funded by the investment returns of our reserves through the Net Investment Returns Contribution (NIRC).”
<b>State of Alaska: Alaska Permanent Fund Corporation</b>	“The Fund’s current two-account structure comprises the Principal, the permanent, non-spendable part of the Fund, and the ERA {earnings reserve account}, which is spendable through legislative appropriation. Based on the two-account structure, spendable amounts are limited to the realized earnings available in the ERA.”

The below table highlights additional details of the establishment of these Funds, their size, and the objective of the investment assets.

	Fund Name	Type of Fund	Year Est.	Estimated Size (\$USD)	Investment Objective
<b>Chile</b>	Pension Reserve Fund	Pension Fund	2006	\$9.1B	Finance future pension liability, as of July 2024 will operate as an endowment
<b>Australia</b>	Future Fund	SWF	2006	\$141B	Finance future government expenditures
<b>Ireland</b>	Future Ireland Fund	Long-Term Savings	2024	\$8.6B	Finance future government expenditures
<b>Marshall Islands</b>	Trust Fund	Trust Fund	2003	\$684M	Government revenue
<b>Mongolia</b>	Future Heritage Fund	SWF	2024	Not available	Supplement existing budgetary institutions
<b>Norway</b>	Government Pension Fund	SWF	1990	\$1.7T	Financial reserves and savings
<b>Singapore</b>	GIC	Endowment	1981	>\$100B	Buffer against crisis, supplemental budget, and macroeconomic stability
<b>State of Alaska</b>	Alaska Permanent Fund Corporation	SWF	1976	\$80.8B	Finance future government expenditure, including resident dividends

The below table details the spending component of these funds as well as the benchmarks used for the Plans.

	Spending Methodology	Spending Rate/Target	Type of benchmarks used
<b>Chile</b>	N/A: Being developed with this study	N/A: Being developed with this study	Weighted asset class index
<b>Australia</b>	“to discharge unfunded Commonwealth superannuation liabilities once the balance of the Future Fund is greater than or equal to the Target Asset Level, or from 1 July 2020, whichever is earlier; or, meet expenses associated with the investment function and administration of the Future Fund.”	Target above CPI is 4-5%	CPI +4-5%
<b>Ireland</b>	“No withdrawals from the FIF are permitted until 2041 at the earliest. From 2041 onwards, the Government may opt to withdraw. Once money is withdrawn from the fund, it will be a matter for the Government to decide how that money is spent by the Exchequer.”	Long-Term Savings	Fixed income index (ICE BofA 0-3 year AAA-AA All Euro Government Index)
<b>Marshall Islands</b>	<p>“<u>Sector and Individual Support Distribution Cap</u>”: Smoothed spending methodology utilizing a rate multiplied by the moving average net position at the end of the most recently available completed three fiscal years.</p> <p>“<u>Extraordinary Needs Distribution Cap</u>”: Smoothed spending methodology utilizing a rate multiplied by the end of the most recently available completed two fiscal years (between 2028-2030) and the most recently available completed three fiscal years (from 2031 and beyond).</p>	4.0% and 5.0% respectively	Weighted asset class index
<b>Mongolia</b>	25-50% of mineral revenues would be saved until 2030, afterwards 10% of FHF’s net investment income of portfolio assets withdrawn.	Equates to 0.2%-0.5% annually	Not available
<b>Norway</b>	Budget surpluses are transferred to the fund, while deficits are covered with money from the fund. On average, the government is to spend only the equivalent of the real return on the fund.	Estimated to be 3% of fund	Reference portfolio
<b>Singapore</b>	Spending limit of 50% of the net income returns (NIR) and up to 50% of the Net Investment Income (NII) derived from past reserves from the remaining assets. This amount is based on the income from GIC, MAS, and Temasek portfolios.	Not applicable	Reference portfolio
<b>State of Alaska</b>	Realized income is deposited into an earnings reserve account (ERA). A percentage of the average market value of the ERA for the first five of the preceding six fiscal years.	5.00%	(1)Traditional weighted asset class, (2)TAA weighted asset class, (3) CPI +5% annualized

## Observations from Sovereign Wealth Fund Comparisons

While the size of these funds vary, we consider all of these to allow for a comparison given similar objectives. Each of the plans above have an established spending policy that supports the objectives as set by their respective governmental institutions. The capital that is to be withdrawn may be spent differently, but each have established a policy to ensure the longevity and purchasing power of the assets.

Given unique needs for each of the programs identified, these comparisons are valuable, but not prescriptive.

We note the similarities and differences amongst the peers shown and observe that no single approach will be correct for every situation.

## Comparisons to US E&F Peers

The United States has one of the highest number institutions that are classified as “endowments and foundations” (E&F) relative to other countries. Endowments and Foundations generally have an objective of maintaining their purchasing power over time (ie growing above inflation) while also providing steady spending and withdrawals. Multiple organizations have been established to survey these institutions and provide holistic and robust peer set comparisons. The asset allocation and spending policy of endowments and foundations also provide a good comparison for the PRF given similar objectives and the organizations’ focus on spending.

Data from two peer sets are considered below:

1. **NACUBO-Commonfund Study of Endowments (“NACUBO Study”)**. The 2023 publication has data from 688 surveyed institutions with assets represented totaling \$USD 839 billion.

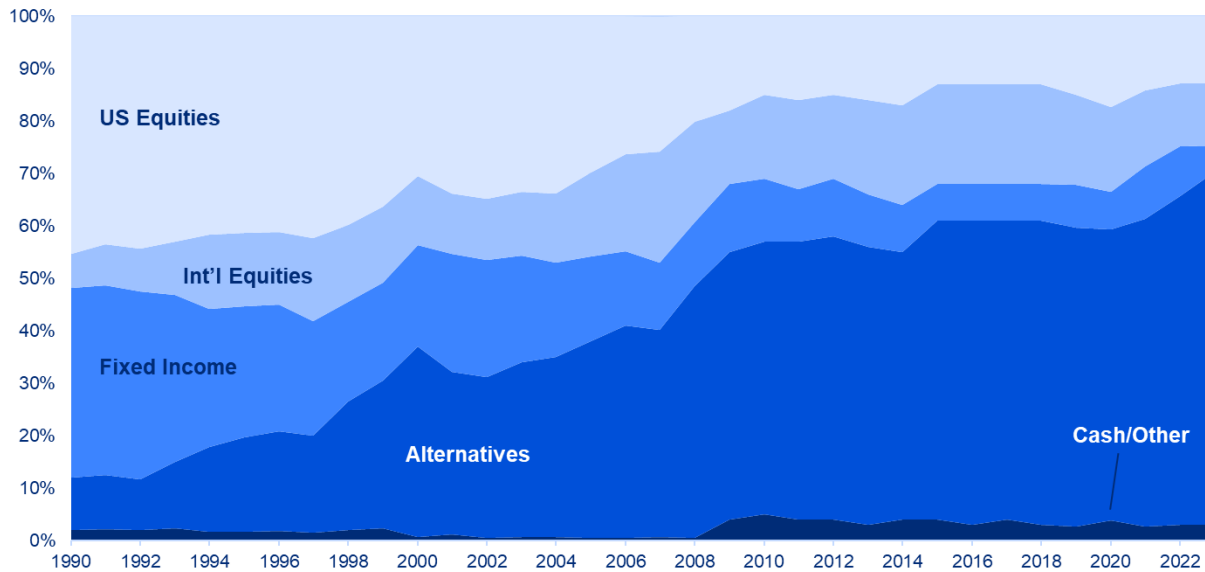
We utilize this peer data for various investor types given the robustness of data and when there are shared and similar objectives. The comparison, however, is not perfect for the PRF given it is focused on higher education endowment pools, given this is the sector primarily surveyed by NACUBO.

2. **Council on Foundations-Commonfund Study of Foundations (“Council on Foundations Study”)**. The 2023 publication has data from 291 participating foundations (182 private and 109 community) with assets represented totaling \$USD 126 billion.

The study differentiates between community and private foundations. Community foundations pool investments among donors and aims to make charitable grants within a specific geographic region. Private foundations can be established by an individual, company or group of individuals and are private in nature. To be considered a US Foundation, however, the organization must follow regulations to spend annually, to maintain their not-for-profit status.

Endowment Peers – Asset Allocation Data (from NACUBO Report)

The below chart indicates the asset allocation of the largest subset of peers from the NACUBO report, and how these peers have adjusted their allocations over time.



Source: 2023 NACUBO-Commonfund Study of Endowments. From 1990 through 1997, largest NACUBO reporting institution category exceeded \$400 million. For 1998 through 2022, the largest category exceeded \$1 billion. For 2023, the largest category exceeded \$5 billion.

Endowment Peers – Spending Data (from NACUBO Report)

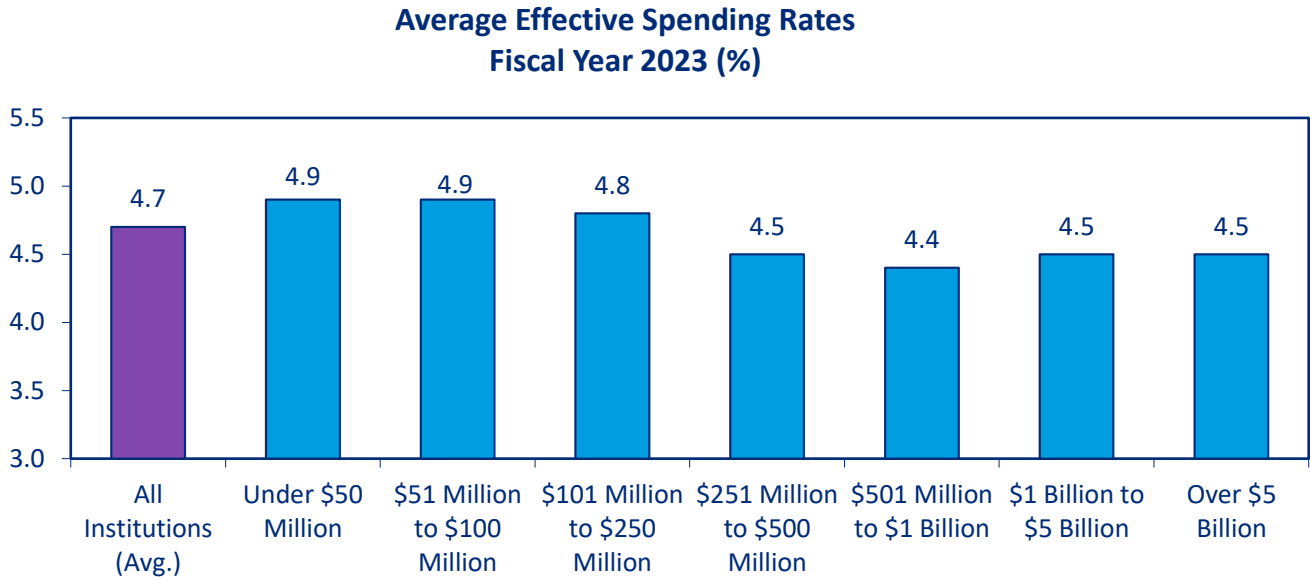
The below table indicates spending data for this subset of endowment peers.

	Total Institutions	\$USD 1-5 Billion	Over \$USD 5 Billion
<b>Total Institutions</b>	<b>688</b>	<b>109</b>	<b>29</b>
<b>Responded Institutions</b>	<b>672</b>	<b>104</b>	<b>28</b>
<b>Spend all current income</b>	1.2%	1.9%	0.0%
<b>Spend a specified percentage of a moving average of the endowments market value</b>	77.1%	61.5%	42.9%
<i>Average percentage specified by those using moving average</i>	<b>4.8%</b>	<b>4.5%</b>	<b>4.8%</b>
<b>Spend a pre-specified percentage of the beginning year market value</b>	2.5%	1.0%	0.0%
<b>Average pre-specific percentage spent</b>	4.6%	4.0%	-
<b>Use a weighted-average or hybrid method</b>	10.1%	26.0%	21.4%
<b>Decide on an appropriate rate or dollar amount each year</b>	4.3%	1.0%	0.0%
<b>Other</b>	10.7%	12.5%	39.3%

Note: Only the larger cohorts of peers pulled out for this study, given the larger size of the PRF portfolio. Respondents had the option to select more than one response. Source: 2023 NACUBO Study of Endowments

Endowment Peers – Effective Spending Rate by Peer Size (from NACUBO Report)

The below table indicates spending rates for endowment peers.

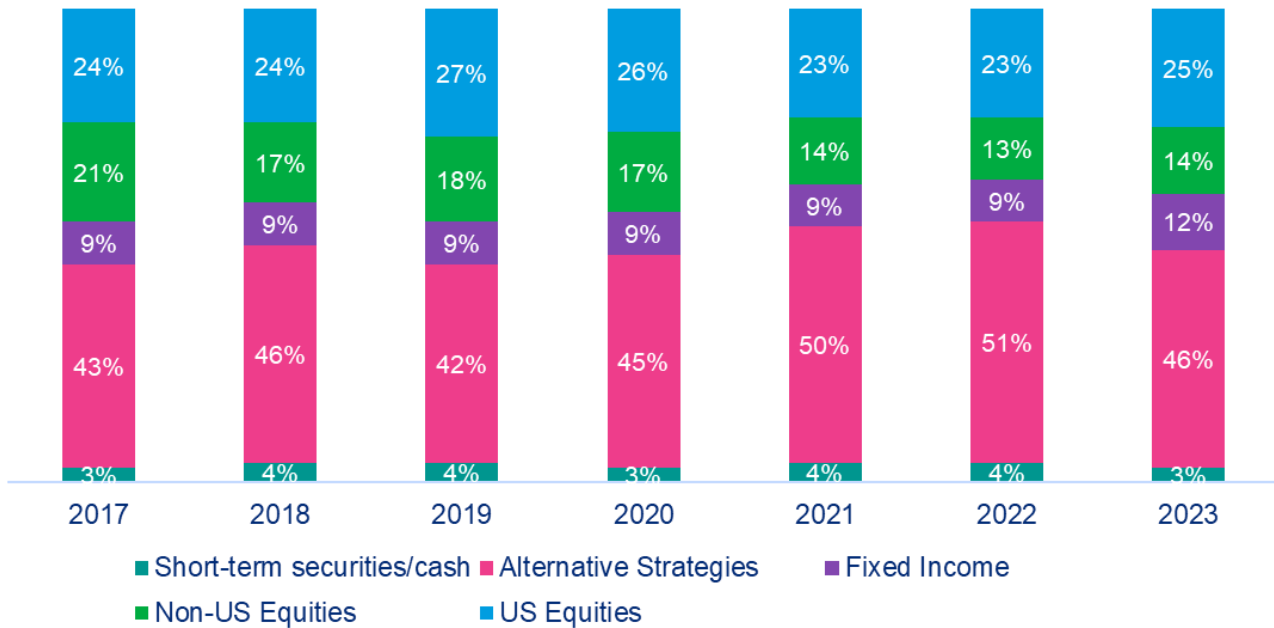


Source: 2023 NACUBO Study of Endowments, \$USD

Private Foundation Peers – Asset Allocation Data (from Council on Foundations Report)

The below chart indicates the asset allocation of peers from the Council on Foundations report.

### Private Foundations Asset Allocations



Survey information is based on 2023 Council on Foundations-Commonfund Study of Foundations.  
Data as of December 31, 2023

### Private Foundation Peers - Spending Data (from Council on Foundations Report)

The below table indicates spending data for this subset of foundation peers.

	Total Foundations	\$USD 101-500 Million	Over \$USD 500 Million
<b>Total Institutions</b>	182	93	30
<b>Spend all current income</b>	1%	2%	0%
<b>Specified percentage of a moving average</b>	34%	27%	43%
<i>Average Percentage specified by those using moving average</i>	<b>5.2%</b>	<b>5.3%</b>	<b>5.0%</b>
<b>Decide on an appropriate rate each year</b>	24%	22%	30%
<b>Grow distribution at predetermined inflation rate</b>	0%	0%	0%
<b>Spend a pre-specified percentage of beginning market value</b>	3%	0%	3%
<b>Last year's spending plus inflation with upper and lower bands</b>	1%	2%	0%
<b>Weighted average or hybrid method (Yale/Stanford Rule)</b>	1%	2%	0%
<b>Meet US Internal Revenue Service (IRS) minimum of 5%</b>	61%	64%	53%
<b>Other</b>	10%	19%	0%

*Note: Only the larger cohorts of peers pulled out for this study, given the larger size of the PRF portfolio. Respondents had the option to select more than one response. Source: 2023 Council on Foundations-Commonfund Study of Foundations*

### Community Foundation Peers - Spending Data (from Council on Foundations Report)

*The below table indicates spending data for this subset of foundation peers.*

	Total Foundations	\$USD 101-500 Million	Over \$USD 500 Million
<b>Total Institutions</b>	<b>109</b>	<b>43</b>	<b>19</b>
<b>Spend all current income</b>	1%	0%	0%
<b>Specified percentage of a moving average</b>	79%	84%	68%
<i>Average Percentage specified by those using moving average</i>	<b>4.4%</b>	<b>4.6%</b>	<b>4.3%</b>
<b>Decide on an appropriate rate each year</b>	9%	12%	16%
<b>Grow distribution at predetermined inflation rate</b>	1%	0%	0%
<b>Spend a pre-specified percentage of beginning market value</b>	4%	0%	5%
<b>Last year's spending plus inflation with upper and lower bands</b>	1%	2%	0%
<b>Weighted average or hybrid method (Yale/Stanford Rule)</b>	1%	0%	5%
<b>Meet US Internal Revenue Service (IRS) minimum of 5%</b>	2%	2%	5%
<b>Other</b>	6%	2%	16%

*Note: Only the larger cohorts of peers pulled out for this study, given the larger size of the PRF portfolio. Respondents had the option to select more than one response. Source: 2023 Council on Foundations-Commonfund Study of Foundations*

### Observations:

From an asset allocation perspective, E&F's have increased their allocation to alternatives steadily over time. The largest E&F investors have allocations to alternatives in excess of 50% of their total portfolio. While this is not feasible for many investors, the organizations that are willing and able to take on illiquidity have (generally) increased their allocations in order to improve their probability of long term success from a return perspective.

Most **endowments** utilize a spending calculation methodology that is based on a percentage of a moving average of the market value, with the largest cohort that has been surveyed also adopting a hybrid method. The hybrid or other categorization captures organizations that have adopted mission-specific policies that accomplish unique goals for calculating distributions.

The rate at which endowments spend (spending rate), has historically been fairly consistent through time and effective spending has generally ranged from 4-5% of the assets.

Many **private foundations** have also formalized their spending methodology to be a percentage of a moving average of the market value.

Spending rates for foundations are generally consistent, regardless of private or community status. Stated spending rate for 2023 was: 4.5% for community foundations and 5.0% for private foundations. This has varied through the years, but not deviated too widely given IRS regulations and expectations from both donors and organizations.

## Conclusions

Most sovereign wealth funds manage portfolios to achieve a goal that was prescribed during their creation by the creating entity (respective legislature). Recently, SWF peers have been integrating a more formal spending/withdrawal component into their methodologies in order to support additional objectives of their governments.

When creating the methodologies for withdrawing assets, most SWF peers have focused on building a program that is expected to preserve purchasing power over time. The exact methodology utilized, and discretion that government officials have, varies widely. Given the variability in methodologies utilized by other SWFs, Mercer recommends looking towards traditional endowments and foundation organizations as a starting point to develop a policy that achieves the goals of the PRF. Most E&F organizations have an objective to maintain purchasing power, and they have developed spending policies with the goal of a regular withdrawal to support the organization or community grants. While policies differ in this peer set as well, the overarching theme is that a smoothing policy or a hybrid policy is often used, to ensure long-term viability of the assets.

With these spending policies in place, it is unsurprising that large peers (SWF and E&F) have increased the allocation to alternatives in their asset allocation. The intent is that by increasing this allocation, expected return increases, and the probability of achieving the goal of growing real spending increases. While not viable for all organizations, some E&F peers have alternative allocations in excess of 50%.

**SWFs have developed similar objectives for portfolios and have implemented a variety of spending/withdrawal rate methodologies. E&F organizations are reasonable peers to look to for guidance and have generally relied upon a smoothed spending rule or hybrid rule. Larger SWF and E&Fs have customized this smoothing methodology based on unique needs of the spend over time. The exact rate to be used should be dependent on the needs of the PRF and is to be determined later in the study.**

### Section 3

# Withdrawal rule and target withdrawal rate

In this section, we first address the development of a spending policy for the PRF.

There are two components of a spending policy to be evaluated: the spending methodology used in the policy, and the spending rate that is used in the policy. We will review common methodologies and address the benefits and challenges of each methodology as well as the rate that will ensure long-term, real sustainability of the Fund and provide for a stable pattern of withdrawals over time.

The July 2024 Congress-approved PRF reform states that the Minister of Finance must define a withdrawal rule that meets two objectives:

- 1) The annual amount of withdrawals from the Fund must be stable and predictable.
- 2) The Fund’s value must be maintained over the long-term, adjusting for inflation.

## Methodologies for Consideration

Determining the appropriate spending methodology needs to balance the competing objectives around increasing the market value and minimizing volatility in the spending amount.

We compare four main methodologies:

- **Simple Average:** Spending amount is a set percentage of year-end market value
- **Smoothing (Rolling Average):** Spending amount is a set percentage of rolling average market value (typically 12 or 20 quarters)
- **Corridor (Banded Inflation):** Spending increases at an assumed rate (a fixed rate or relative to an external metric such as CPI), with a cap and floor on the effective spending rate
- **Hybrid:** Spending is determined by a combination of the prior year’s spending adjusted for inflation (80% of formula ) and the most recent market value using a rate \* portfolio market value (20% of formula).

	Pros	Cons
<b>Simple</b>	Most direct link to the current portfolio market value.	Less consistency in the level of withdrawal over time.
<b>Corridor</b>	Corridor bounds the withdraw amount, which provides stability.	Disconnected from portfolio market value when corridor applies. Floor may increase probability of ruin (potentially offset somewhat by a ceiling).

	Pros	Cons
<b>Smoothing</b>	<p>Change in withdrawal year over year is limited given smoothing of historic total portfolio market value.</p> <p>Withdrawal grows alongside portfolio growth.</p>	Withdrawal may vary annually and change materially over a 10-year period. Limited ability for principal to grow, due to withdrawals growing in-line with market growth.
<b>Hybrid</b>	Ensures a fairly consistent growth of withdrawals (increases at the rate of inflation), and accounts for recent market value of the portfolio.	Multiple subsequent years of challenging markets may lead to a decline in principal given the consistent increase in withdrawal. The major driver of the change of the withdrawal is inflation, which may not fully reflect the current state of the portfolio.

## Selecting a Withdrawal Methodology for PRF

Various qualitative and quantitative items are assessed to assist in selecting a withdrawal rate that is appropriate for the PRF.

**PRF-specific requirements.** The below two requirements have been established by Congress and are primary objectives for the withdrawal methodology and rate that is to be established.

- Stability of the amount withdrawn annually, as this is a main objective of the Congress-approved requirements.
- After accounting for the withdrawal, the purchasing power of the Fund is maintained over time, as this is a main objective of the Congress-approved requirements.

We have utilized quantitative analysis of two metrics to assess the suitability with the requirements for PRF:

- Probability of Ruin: probability that the asset value and spending begins to decline and cannot recover
- Consistency of spending amounts over time

Method	Probability of Ruin	Consistency for Withdraw within 5-10 years	Comments
<b>Simple</b>	Low	Low	Given direct link to 1-year market value, low chance for ruin, but high volatility of withdraw
<b>Corridor</b>	Medium*	Medium**	Methodology may force a higher effective rate without adjusting based on market value. Success highly dependent on the range in place.
<b>Smoothing</b>	Low	High	Modest levels of withdraw change year-over-year, and low theoretical chance of ruin given direct market value link.
<b>Hybrid</b>	Low	High	Most of withdraw pre-set given rate of inflation (indicating consistency), but modestly takes into account current market value.

\*A wide range would best accomplish this goal of reducing chance of ruin.

\*\* A tighter range would best accomplish this goal of consistency over time

### Observations on Spending Methodologies:

At a minimum, the methodology should partially adjust spending to account for market value volatility. By having the formula account for recent market value level, the probability of ruin decreases because the spending is lowered when market values decline, providing time for recovery.

For the **simple** methodology, the realized volatility of spending out of the PRF has the potential to be high. The **simple** methodology is exposed to the full volatility of market movements, as it is a simple proportional withdrawal of fund assets at the end of each year. In order to provide a stable spending pattern using this methodology, the asset allocation would need to be very conservative (such as 100% cash) and would provide challenges in maintaining purchasing power. Given the PRF is aiming to have a consistent spend out of the program as well as long term real growth, Mercer would not recommend this methodology as a result.

The **corridor** methodology has some of the same challenges of the **simple** approach, in that it allows spending amounts that may be high when asset values are falling. It is also challenging to accomplish both goals as set out for the PRF – the tighter the spending corridor, the higher the spending stability but a tighter corridor increases probability for ruin. Mercer would not recommend this methodology as a result.

For the **smoothing** methodology, there is a low probability of ruin since the equation directly ties to recent market values of the portfolio. However, there is less consistency of the spending amount longer-term, if the principal and market value declines or increases at more extreme levels. There is some consistency year over year since the base market value the spending rate is applied to is an average, however there is less certainty of a long-term increase in the spending if stability is a priority, as the volatility of the portfolio will need to be low (to promote stability) which will likely require lower longer term returns. This will limit long term growth in assets and spending.

**The hybrid methodology is the most suitable for the PRF.** The level of spending will be driven by a deflator (typically inflation is utilized here - see Appendix F for additional analysis on deflators) applied to the prior year's spending, promoting stability of spending, and will also be adjusted by recent market value in order to keep spending and asset values aligned. The probability of ruin can be managed by incorporating the deflator's expected year-over-year growth into how the portfolio is structured to ensure long-term return success.

The formula for the hybrid methodology is as follows:

$$80\% * [\text{prior year withdrawal} * (1 + \text{Deflator})] + 20\% * [\text{rate} * \text{prior year-end market value}]$$

Notes:

- Prior year withdrawal = The amount effectively withdrawn in the prior year.
- Note for Year 1: Prior year withdrawal = Rate \* market value of the prior year.
- Deflator: Addressed in a following section, but recommendation is to utilize Chilean Inflation.
- Rate = Addressed in the next section, but recommendation is to utilize 3%.

## Rates for Consideration

The withdrawal rate is directly utilized within the spending methodology and is a key input to determine the risk posture needed for the assets to protect long-term purchasing power.

The guidance provided for this study does not include a required minimum level of withdrawal per year. Therefore, there is a large range of potential withdrawal rates to be considered. However, given the mandate to transition the portfolio to be similar to an endowment moving forward, Mercer evaluated rates that are above 2% and below 5%, consistent with typical endowment practice. Rates of 2-5% are also generally supportable by the expected real returns of likely investments, though this is examined in more depth in Section 5, step 5. This allowed narrowing to a range of options that may be suitable to achieve the overarching objectives of the program moving forward.

## Selecting a Withdrawal Rate for PRF

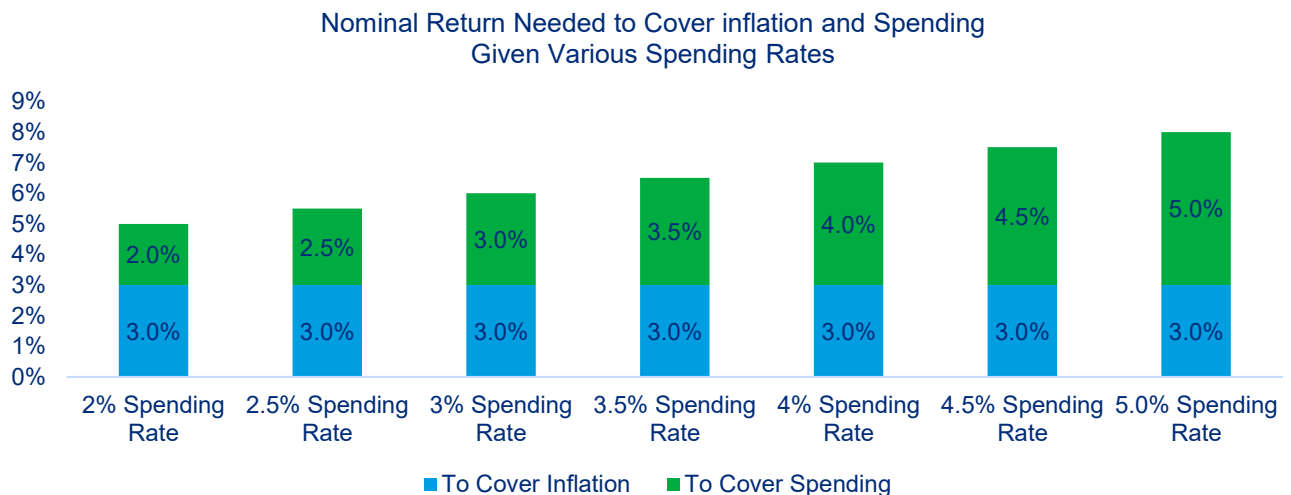
The selected rate will be utilized in two ways:

- 1) For year one, the rate is utilized to determine the first year of spending. The rate multiplied by the market value of the assets will be year one spending.
- 2) On a year-by-year basis within the spending formula, the rate is used capture changes in the market value of the portfolio. In the formula, the rate calculates 20% of the following-year spending amount.

The other significant impact the rate has for the program is that it will guide the real return target for the portfolio. The higher the rate, the higher the real return “hurdle”. The portfolio needs to achieve this “hurdle” to ensure long-term preservation of capital and purchasing power after spending. The higher the real return hurdle is, the higher the nominal expected return needed from the portfolio. Put another way, the higher the real return hurdle, the larger the allocation needs to be to more growth-oriented assets for the program to achieve the return hurdle.

The below chart highlights how withdrawal rates within this range impact the return hurdle for the total portfolio. In this we assume a Chilean inflation rate of 3.0%. There are two observations we would note here.

- 1) Given the total return hurdle has the spending rate as a component, we see a direct correlation and linear relationship between the two.
- 2) With a 5% spending rate, the total return needed from the portfolio is CPI+5%. We assume a 3% CPI rate for Chile long term, giving a nominal return target of 8%. Under current market expectations and the desire for spending stability, this is a difficult hurdle to outperform when attempting to build portfolio that is diversified across a variety of asset classes.



*Note: Inflation assumed to be 3% and utilized as the metric to measure if the program maintains purchasing power.*

### Observations on Spending Methodologies:

After assessing the real and nominal return needs, relative to portfolio expectations across various growth asset classes, Mercer recommends **utilizing a 3% spending rate**, given

- A 3% spending rate, alongside expected inflation will imply a real return target of 3% and a nominal return target of 6%. *These targets are similar and in-line with other peers that have a spending policy.*
- When comparing this to other rate options:
  - A 4% rate would imply a 7% nominal return target, which would be challenging to achieve with a limit of 20% allocated to alternative, illiquid assets. These are the highest returning asset classes, and with a 20% limit on these assets the achievable spending rate will be lower than would be possible with a higher allocation.
  - A 2% rate would imply a 5% nominal return target, which is lower than what most long-term endowment-like portfolios aim to achieve. While achievable, this may inadvertently drive the portfolio to have a lower risk and return posture than necessary to maintain purchasing power. With a goal to construct an endowment-like portfolio for long term growth, a higher return target is appropriate.

## Conclusions

There are two main objectives that the withdrawal rule aims to accomplish:

- 1) Stability of the annual withdrawal
- 2) Ability to maintain purchasing power over time

To accomplish these objectives, we would recommend the following:

**A hybrid spending methodology.** This methodology would be expected to accomplish the two objectives, as set forth in the legislation, of stable spending amounts and maintaining purchasing power. Our findings suggest that this hybrid methodology is one of the optimal methodologies if any investor is aiming to minimize spending volatility. The hybrid methodology also incorporates the current market value, which would help ensure that purchasing power is maintained.

**A 3% spending rate.** This rate would help the portfolio successfully sustainably withdraw capital over time while moving towards an endowment-like portfolio. The rate is utilized when adjusting the spend for the current portfolio market, and also when calculating the amount withdrawn in year 1.

The formula for the hybrid methodology is as follows:

$$80\% * [\text{prior year withdrawal} * (1 + \text{Deflator})] + 20\% * [\text{rate} * \text{prior year-end market value}]$$

- Prior year withdrawal = The amount effectively withdrawn in the prior year.
- Note for Year 1: Prior year withdrawal = 3% \* market value of the prior year.
- Deflator: Addressed in a following section, but recommendation is to utilize Chilean Inflation.
- Rate = 3%.

The spending rules above also indicate that the portfolio would have a similar nominal return goal to traditional endowments. The total nominal return target is close to the traditional E&F organization's return target. This indicates the portfolio is in-line with the goals of a typical endowment, but modestly more conservative. As noted below the overall nominal target is similar, to slightly more conservative than the traditional E&F:

- Typical US E&F Institution Nominal Return Target: 4.5% spending rate + 2.2% USD inflation rate = **6.7% total nominal return target in local currency**
- PRF Nominal Return Target: 3% spending rate + 3% CLP inflation rate = **6.0% total nominal return target in local currency**

## Section 4

# Capital Market Assumptions

### Overview

*Mercer's Capital Market Assumptions are used to establish our Capital Market Outlook. This section of the report provides an overview of Mercer's approach. Additionally, we have included recent whitepapers on our private market assumptions process in Appendix A (The Art and Science of CMAs and their role in portfolio construction, Private Investigations: A building block approach to Private Market Assumptions, and Real assets, real returns: Modelling real estate and infrastructure).*

The analysis phase of this study utilizes Mercer's capital market assumptions and modeling tools to evaluate the future outcomes of the Strategic Asset Allocation and spending policies under consideration. In this study, we utilized a stochastic, or simulation approach, to evaluating asset allocations and outcomes. This stochastic approach allows for the generation of a distribution of potential outcomes and enables the analysis to capture extreme events through risk measures such as Conditional Value at Risk (CvaR<sup>1</sup>) and cycles in markets in order to provide a robust analysis of the policies under consideration.

Our asset allocation work begins with modeling the capital markets. A global committee with specialists and representatives from each region in which we work coordinates our capital market models and assumptions. This global team is responsible for oversight of the process, development of key models, techniques and formulas and the setting of core assumptions. Regional teams are responsible for the development of local assumptions within this global framework. Our capital markets process has a long-term focus and seeks to be transparent, forward-looking and market aware. We use this framework and a consistent set of models to produce consistent data for our teams to utilize in modeling client outcomes.

Quarterly, our team produces stochastic and mean-variance assumptions for over 120 different asset classes. This includes determining expected 10-year and 20-year returns, expected volatility/standard deviations and correlations for all those asset classes.

The process begins by establishing long-term assumptions for core economic variables such as GDP growth and inflation, and equilibrium assumptions for market variables such as interest rates, credit spreads, earnings growth and equity valuations. When developing these variables, we look at economic relationships and market histories and apply our forecast of future conditions. We then develop an equilibrium return for each asset class. Next, we determine current market conditions for those variables and assume they transition to equilibrium levels over the next decade. Finally, we calculate a long-term return composed of the transition period return and the equilibrium return. Our risk and correlation assumptions are developed based on historical analysis as well as an assessment of future conditions.

We apply our capital markets models to a wide variety of possible future conditions through a stochastic simulation, which models multiple regions of the world simultaneously and varies the paths that capital markets may follow and incorporates the relationships across regions and variables. The model utilizes a regime-switching approach that generates 2,000 different paths of annual return outcomes over 20-year periods to stress test significant shifts in the economic and capital market environment, producing "fat tail" events to reflect market experience. Rather than assuming a static correlation or relationship

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<sup>1</sup> Conditional Value at Risk (CvaR) is the average of the worst 5% of outcomes. This captures the magnitude and size of tail risk.

between asset classes, it produces a dynamic (stochastic) one in which the relationship between asset classes can change over time.

## Applying Capital Market Assumptions

When discussing capital market assumptions, the expected median asset class returns gain the most attention. However, as noted above, capital market assumptions also encompass asset class return distributions, correlations, as well as expectations for key economic variables such as economic growth, inflation, and yield curves.

In theory, a small set of statistical assumptions for each asset class (mean return, standard deviation and correlation) include all the information needed to put together portfolios spanning multiple asset classes and time frames. The most common utilization of such statistics is through mean variance optimization. We can certainly derive mean variance optimization assumptions from our stochastic model output by taking the stochastic results for each asset class and calculating the median or mean returns, volatility, and correlations between each return stream. An efficient frontier can be constructed that represents the combination of assets that will deliver the highest expected return for any given level of volatility. Although this appears powerful:

- The composition of a simple mean variance the efficient frontier can be very sensitive to small changes, or errors, in the assumptions.
- The optimization process tends to allocate aggressively to assets that have the highest Sharpe ratio, or a low correlation to other assets. Often this can lead to ‘assumption error maximization’ rather than ‘return maximization’.
- Standard mean-variance optimization optimizes on volatility based on the standard deviation. This may not be the relevant risk metric for many investors. Maximum drawdown, peer or benchmark relative performance, achieving real growth of principal, or liability surplus are just a sample of the alternative optimization objectives we see from investors.
- Standard mean-variance optimization does not capture the impact of having a different time period, or periodicity, for conceptualizing risk. It would for example not be able to incorporate sequencing risk, which is crucial when also considering withdrawal policies.
- Mean-variance optimization is based on normal distributions and loses some of the information embedded in a stochastic forecast, namely the shape of the distribution and any fat tails or skew.

Each limitation can be addressed through various adjustments or constraints to the optimization process. Here is where we turn to portfolio construction principals and utilize our stochastic assumptions to provide a more holistic picture of the range of risk. We also augment the analysis with scenario testing and framing constraints through the PRF’s lens – considering investment beliefs, liquidity, fees, peer allocations, spending policy, implementation hurdles, etc.

The below table outlines the key asset class assumptions, denominated in CLP, used for the study. All analysis was conducted in and all data is presented in CLP unless otherwise noted. Currency is modeled through a Purchasing Power Parity (PPP) framework. Relative inflation is the primary driver of currency movements. We have also incorporated starting relative PPP deviation, assuming that currencies trend towards PPP fair valuation over a 20-year time horizon. Please see Appendix B for more details on the currency translation approach. The below table reports high level descriptive statistics for these asset classes. In the modeling, we used stochastic simulations to generate robust results. The private market modeling in this study utilized smoothed or “Net Asset Value” return streams. These represent the reported returns, net of typical management fees, that are likely to be experienced by an investor in private markets. Importantly, these cannot be compared directly to traditional public volatility measurements to represent the fundamental risk of the investment. Private market investments may have similar or higher levels of fundamental risk when compared to public market investments but the less frequent valuation of these assets results in lower realized volatility.

Asset Class	Short Name	Geometric Return	Std. Deviation	Return/Risk
Global All Country Large+Mid Cap Equity	Equity – All Country	6.51%	17.28%	0.376
US High Yield Fixed Income	Fixed Income – US HY	5.45%	13.96%	0.390
US Senior/Leveraged Loans	Fixed Income – Senior Loans	5.05%	13.05%	0.387
Emerging Markets Govt FI – Hard Currency	Fixed Income – EMD	5.82%	15.79%	0.369
Global High Yield	Fixed Income – Global HY	5.59%	12.70%	0.440
Global Aggregate Fixed Income	Fixed Income – Global Aggregate	4.18%	9.42%	0.444
Global Corp Fixed Income	Fixed Income – Global Credit	4.59%	11.81%	0.389
US Credit Fixed Income	Fixed Income – US Credit	4.30%	13.64%	0.315
Global Government Fixed Income	Fixed Income – Global Government	3.95%	11.45%	0.345
US Mortgage-Backed Fixed Income	Fixed Income – US MBS	4.10%	13.43%	0.305
US Long Government Fixed Income	Fixed Income – US Long Government	4.38%	18.89%	0.232
US Intermediate Government Fixed Income	Fixed Income – US Government	3.89%	14.25%	0.273
Global Inflation Linked Fixed Income	Fixed Income – Global ILS	3.95%	10.38%	0.380
Private Equity - Total	Private Equity – Total	9.68%	14.34%	0.675
Private Debt – Core	Private Debt – Core	6.84%	12.99%	0.527
Private Real Estate – Global Core	Real Assets	6.86%	15.26%	0.450
Infrastructure – Core	Infrastructure – Core	7.18%	13.81%	0.520
CPI - Chilean Inflation	Inflation - Chile	3.01%	2.52%	1.195

Correlation Matrix		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Global All Country Large+Mid Cap Equity	1.000	0.581	0.554	0.389	0.629	0.236	0.425	0.382	0.181	0.279	0.108	0.181	0.231	0.701	0.408	0.415	0.412	-0.152
2	US High Yield Fixed Income	0.581	1.000	0.910	0.809	0.990	0.751	0.886	0.904	0.705	0.855	0.640	0.790	0.633	0.761	0.860	0.728	0.692	-0.459
3	US Senior/Leveraged Loans	0.554	0.910	1.000	0.723	0.898	0.647	0.789	0.803	0.636	0.792	0.498	0.718	0.726	0.802	0.953	0.809	0.773	-0.380
4	Emerging Markets Govt FI – Hard Currency	0.389	0.809	0.723	1.000	0.798	0.774	0.837	0.852	0.745	0.839	0.712	0.813	0.612	0.639	0.750	0.674	0.636	-0.475
5	Global High Yield	0.629	0.990	0.898	0.798	1.000	0.767	0.899	0.891	0.721	0.833	0.631	0.766	0.649	0.764	0.839	0.723	0.683	-0.453
6	Global Aggregate Fixed Income	0.236	0.751	0.647	0.774	0.767	1.000	0.956	0.921	0.993	0.924	0.911	0.941	0.754	0.578	0.740	0.705	0.655	-0.545
7	Global Corp Fixed Income	0.425	0.886	0.789	0.837	0.899	0.956	1.000	0.981	0.929	0.953	0.867	0.936	0.743	0.710	0.831	0.767	0.720	-0.559
8	US Credit Fixed Income	0.382	0.904	0.803	0.852	0.891	0.921	0.981	1.000	0.889	0.977	0.875	0.959	0.699	0.710	0.852	0.767	0.726	-0.562
9	Global Government Fixed Income	0.181	0.705	0.636	0.745	0.721	0.993	0.929	0.889	1.000	0.909	0.893	0.932	0.785	0.561	0.744	0.716	0.663	-0.544
10	US Mortgage-Backed Fixed Income	0.279	0.855	0.792	0.839	0.833	0.924	0.953	0.977	0.909	1.000	0.857	0.989	0.755	0.678	0.875	0.798	0.754	-0.560
11	US Long Government Fixed Income	0.108	0.640	0.498	0.712	0.631	0.911	0.867	0.875	0.893	0.857	1.000	0.905	0.557	0.459	0.603	0.567	0.532	-0.566
12	US Intermediate Government Fixed Income	0.181	0.790	0.718	0.813	0.766	0.941	0.936	0.959	0.932	0.989	0.905	1.000	0.740	0.616	0.828	0.764	0.720	-0.566
13	Global Inflation Linked Fixed Income	0.231	0.633	0.726	0.612	0.649	0.754	0.743	0.699	0.785	0.755	0.557	0.740	1.000	0.611	0.796	0.779	0.730	-0.303
14	Private Equity - Total	0.701	0.761	0.802	0.639	0.764	0.578	0.710	0.710	0.561	0.678	0.459	0.616	0.611	1.000	0.815	0.784	0.775	-0.340
15	Private Debt – Core	0.408	0.860	0.953	0.750	0.839	0.740	0.831	0.852	0.744	0.875	0.603	0.828	0.796	0.815	1.000	0.867	0.829	-0.425
16	Private Real Estate – Global Core	0.415	0.728	0.809	0.674	0.723	0.705	0.767	0.767	0.716	0.798	0.567	0.764	0.779	0.784	0.867	1.000	0.814	-0.378
17	Infrastructure – Core	0.412	0.692	0.773	0.636	0.683	0.655	0.720	0.726	0.663	0.754	0.532	0.720	0.730	0.775	0.829	0.814	1.000	-0.321
18	CPI - Chilean Inflation	-0.152	-0.459	-0.380	-0.475	-0.453	-0.545	-0.559	-0.562	-0.544	-0.560	-0.566	-0.566	-0.303	-0.340	-0.425	-0.378	-0.321	1.000

## Conclusions

As will be shown in the next section, a robust portfolio construction process needs to combine both the qualitative art of incorporating forward-looking investment views with the quantitative science of capital market assumptions, always bearing in mind the specific objectives and constraints of the investor. Additional information about our capital assumption process can be found in the appendix.

# Section 5

## Strategic Asset Allocation (SAA)

### Introduction

While prior sections discuss the withdrawal rule and return objectives (Section 3), these are interconnected with the strategic asset allocation. Objectives and constraints should dictate the appropriate portfolio for the PRF. The SAA needs to align with the key objectives, including return need, risk tolerance, ability to accept illiquidity, and spending profile.

In this section, we walk through the following steps to prudently evaluate asset allocations for the portfolio. The following Section will then reincorporate spending policy for a combined analysis.

Step 1: Evaluate the **asset class universe** for consideration in the candidate portfolios.

Step 2: **Develop efficient frontiers** using reasonable portfolio constraints as a guide for asset class benefits and considerations.

Step 3: **Refine asset allocations utilizing additional constraints** that would align with the key objectives of the PRF moving forward.

Step 4: **Back testing** the allocations to ensure expectations align given historical experiences and return patterns.

### Step 1: Asset Class Universe

The asset class universe considered for this analysis consists of both traditional and alternative assets. Asset classes were evaluated based on their ability to support the PRFs objectives and on the feasibility of their implementation. Key considerations in the asset class selection were:

- Long term return
- Stability of return
- Contribution to diversification
- Correlation with CLP inflation
- Liquidity

The below sections outline the specific asset classes that are modeled alongside narrative of the asset class use within the portfolio.

### Broad Public Equities

Asset Classes Modeled	Global All Country All Cap Equity
	Global All Country Large+Mid Cap Equity
	Global Developed Large Cap Equity
	Global Developed Small Cap Equity
	Emerging Markets Equity

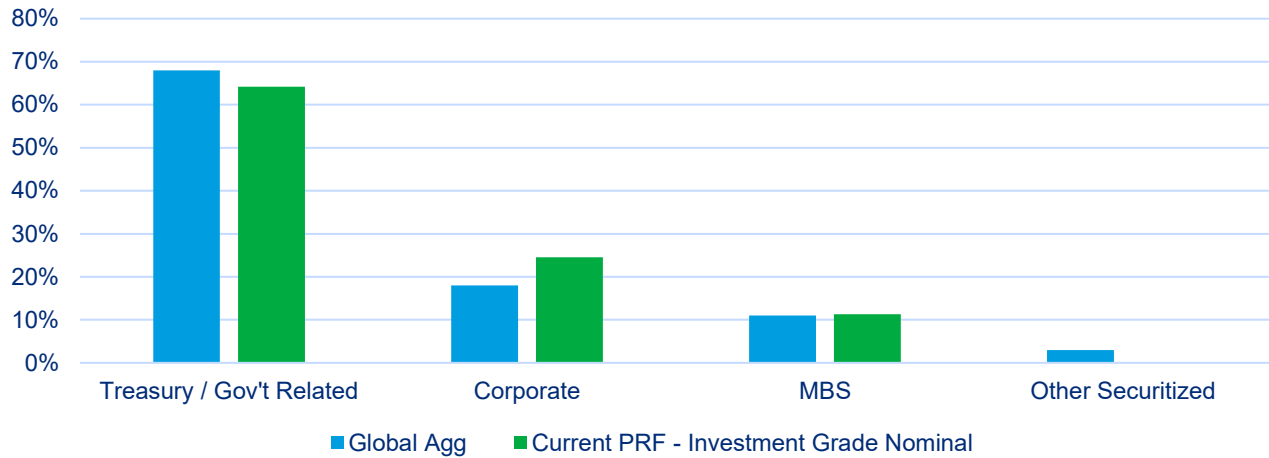
While the broad public equity universe can be sliced into various segments, the Global All Country Large+Mid Cap equity segment provides substantial coverage and the large cap focus allows for efficient exposure without the liquidity concerns of small cap. The additional forward-looking return premium associated with small caps is modest while the forward-looking risk increases. Active management for any small cap exposure may be prudent to balance the return premium and additional risk. Ultimately the level and type of small cap exposure is an implementation decision and does not materially affect the strategic asset allocation to broad public equities.

## Credit & Sovereign Debt

<b>Asset Classes Modeled</b>	<b>US High Yield Fixed Income</b>
	<b>US Senior/Leveraged Loans</b>
	<b>Emerging Markets Govt FI – Hard Currency</b>
	<b>Global High Yield</b>
	<b>Global Aggregate Fixed Income</b>
	Global Corp Fixed Income
	US Credit Fixed Income
	Global Government Fixed Income
	US Aggregate Fixed Income
	US Mortgage-Backed Fixed Income
	US Long Government Fixed Income
	US Intermediate Government Fixed Income
	<b>Global Inflation Linked Fixed Income</b>

Similar to the approach within broad public equities, we utilized the Global Aggregate asset class to represent public investment grade fixed income in the initial round of modeling. The sector breakouts of global aggregate are similar to how the PRF currently allocates capital within the existing portfolio, as shown below. Inflation Linked Securities, High Yield, Emerging Market Debt, etc. are modeled distinctly.

### Investment Grade Fixed Income Components (Allocations today vs. Global Aggregate Index)



Bloomberg Global Aggregate allocation as of 12/31/2024.

## Alternatives

Asset Classes Modeled	<b>Private Equity - Total</b>
	Private Equity – Buyout
	<b>Private Debt – Core</b>
	Private Debt - Core Plus
	<b>Private Real Estate – Global Core</b>
	US Real Estate - Core
	<b>Private Infrastructure – Core</b>

Alternatives include Private Equity, Private Debt, Private Real Estate, and Private Infrastructure. These asset classes are relatively illiquid and have a longer investment period, which allows investors to potentially capitalize on the illiquidity premium available to the providers of long-term capital. Additionally, alternative investments are only open to accredited investors – providing a broader opportunity set than the public markets. Private markets investments may also benefit from valuation smoothing to dampen portfolio volatility – though we model our assumptions on a look-through basis to the underlying economic volatility when setting strategic targets.

### Private Equity

Private equity focuses on investing in privately owned companies through a negotiated process. Most strategies involve a transformative, value-add, active strategy to increase value and generate profits for investors. Private equity is mainly focused on generating returns through capital appreciation rather than income. There are various subsectors within private equity that have different risk and return profiles.

Typical strategy types include:

- **Buyout**, which make majority equity investments in more mature operating cash flow generating companies typically acquired with the use of financial leverage.

- **Growth**, which make minority equity investments in more mature companies that are growing quickly. These companies use capital to expand or restructure operations, enter new markets or finance a major acquisition without a change of control.
- **Venture**, which make equity investments in the launch, early development, or expansion of an often technology related business.

For our opportunity set, we have excluded the riskier growth and venture strategies but included buyout strategies. We have also included assumptions for a broadly diversified 'Core' program of private equity funds with a conservative risk profile. A core program would generally allocate to all three major strategy types, with smaller (~10-15%) allocations to the riskier venture and growth strategies and the bulk allocated to buyout strategies.

### Private Debt

Private debt is a form of debt financing where non-banks lend money directly to borrowers. Private debt lending happens on a bilateral, negotiated basis where lenders partner with borrowers to create bespoke solutions. By working directly with borrowers, private credit lenders typically have more flexibility to negotiate terms, covenants and pricing, which can lead to higher yields and greater protection for investors versus traditional credit markets.

Similar to Private Equity, we have focused on the more conservative end of the private debt market through a core-oriented private debt program. Core programs are more driven by income than appreciation and seek to provide debt financing to private companies with enterprise values between \$50mm and \$1.5bn, on average, while maintaining seniority in the capital stack which leads to a lower risk profile focused on capital preservation. Typical core programs are focused on senior direct lending strategies but may also make smaller allocations to asset-based lending strategies.

### Private Real Estate

Private real estate refers to an investor taking an unlisted equity or debt interest in a property, collection of properties or property related businesses. Real estate offers a diversified income stream from leases and ancillary income. Contractual leases and increasing capital flows may provide protection during normal and high inflationary periods. As above, we have focused on a broadly diversified, core-oriented program.

### Private Infrastructure

Infrastructure is defined as the basic physical and organizational structures needed for the operation of society or enterprise. Sectors include social infrastructure, energy, utilities, transportation, and communications. Private infrastructure is expected to provide downside protection, inflation protection, stable cash flows through rate regulation, and portfolio diversification benefits.

As with the other alternative asset classes, risk profiles vary significantly based on the underlying asset exposure. Two common classifications are greenfield and brownfield. Greenfield refers to new growth-focused projects on unused lands with no previous infrastructure or development while yield-focused brownfield refers to either continuing projects or redevelopment and repurposing of previously developed sites or structures.

Core-oriented programs generally focus on brownfield investments in developed markets, including regulated assets, public-private partnerships (PPPs), energy transition, and infrastructure debt.

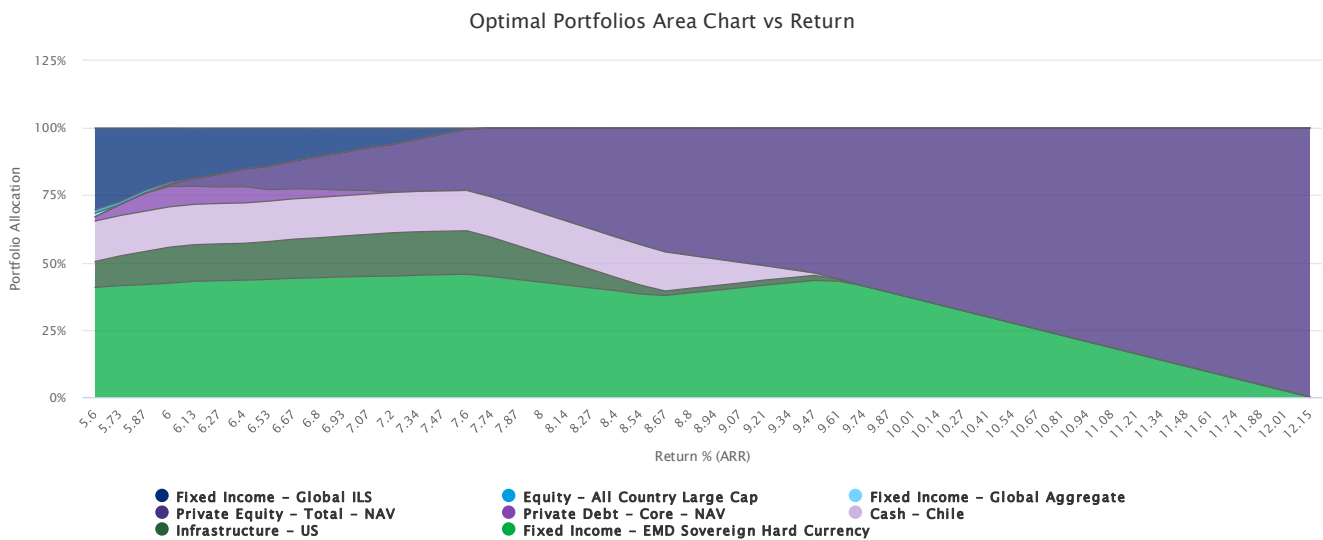
## Step 2: Efficient Frontier Optimization

Stochastic optimization was used to determine which asset class combinations were most effective in delivering high returns with lower risk of negative returns.

- Optimization may create portfolios that are not feasible from an implementation standpoint
- An unconstrained optimization was first performed to set a baseline
- Constraints were placed on the optimization to ensure the portfolios produced were feasible to implement
- The optimal constrained portfolios were further refined for applicability for PRF

### Unconstrained Optimization

We began with an unconstrained optimized efficient frontier utilizing the candidate asset classes. As discussed in Section 4 (Capital Market Assumptions), mean-variance optimization has numerous limitations and should not be the sole determinant of portfolio construction. Therefore, we use a stochastic optimization process which finds the optimal portfolios across simulated trials – allowing for tail risk to be more adequately captured (optimizing for return per unit of tail risk (CvaR), as opposed to unit of variance). This provides an informative starting point for analysis. At this stage, we are less interested in the frontier itself (risk and return metrics) as we are the ‘optimal’ allocations. The below chart shows these allocations at varying levels of expected return.



As we can see in the chart above, an unconstrained optimization would derive a portfolio primarily consisting of emerging market debt and private equity. The unconstrained efficient frontier, despite being improved through the use of stochastic optimization, still faces several limitations, such as not considering portfolio liquidity and implementation issues. To address these concerns, we begin to consider constraints to limit the model to feasible asset allocation selections.

Specifically, we added additional constraints either appropriate for or mandated by PRF:

- **Private Assets Capped at 15%.** Private assets are both return enhancing and risk reducing but come at the cost of illiquidity and an increased governance burden.
- **Chilean Cash Capped at 15%.** The efficient frontier provides optimal portfolios across the risk spectrum and cash is utilized among the lower risk options in combination with high risk assets. However, given the desire for positive real returns the portfolio will need to primarily rely on non-cash assets.
- **Private Assets Composition (Private Equity  $\leq$  60%).** Given the constrained private assets allocation, the optimization process seeks to allocate to the highest returning private asset class (private equity) first. While private equity plays an important role, there is an important diversification benefit to including other alternatives, such as real assets. Additionally, real assets provide greater inflation sensitivity that is important for the PRF given the spending objective. As such, we have constrained the private assets portfolio to include no more than 60% private equity.
- **Fixed Income Structure (HY and EMD  $\leq$  25% public FI).** Sub-investment grade and emerging market bonds can be less liquid than their investment-grade counterpart, exacerbating drawdowns in a downside scenario. While one of the key risk measures utilized, Conditional Value at Risk (CvaR which is (the average of the worst x% of outcomes representing the magnitude of downside risk) accounts for the weight in the tail of the distribution, we believe it is prudent to maintain diversification through a balanced profile of higher and lower quality bonds. in the tail of the distribution, we believe it is prudent to maintain diversification through a balanced profile of higher and lower quality bonds.

### Observations:

Efficient frontiers are a starting point and are not intended to be the primary driver of the analysis. That said, this exercise provides valuable guiding insights. Key observations are:

The private markets constraint is warranted, as the unconstrained frontier quickly utilizes a large amount of private equity.

- Private Equity will be the primary component of the private market allocation
- Infrastructure and Real Estate may also be effective. Given the oversight required, limited private markets budget, and additional burden of utilizing new private market asset classes, Private Debt may not be sufficiently additive to the program to include.

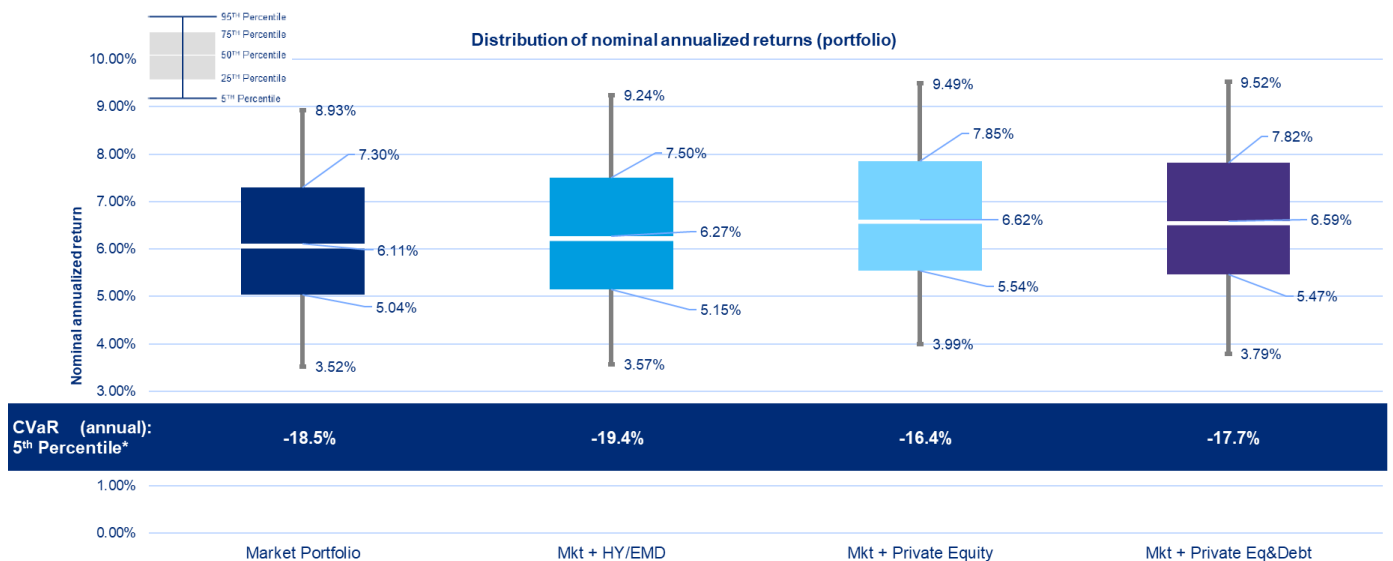
The broad Global Aggregate serves as an appropriate baseline for the Investment Grade portfolio.

- On the lower-risk side of the frontier, the cash allocation was constrained and the model used both Global Inflation-Linked and Global Aggregate fixed income. Further analysis will determine the most effective allocation of the investment grade structure.
- Global Inflation Linked Securities are an effective lower risk asset class and may be substituted for the Chilean Cash allocation.

### Understanding Key Trade Offs

Another approach to building an effective asset allocation is to start with a relatively generic baseline asset allocation (a standard “market portfolio”) that is representative of the standard starting point for portfolios, and then make changes to enhance the portfolio. We built from a starting public market portfolio (70% Equity / 30% Bonds) that is a typical endowment reference portfolio, and improved on

that baseline by adding in additional asset classes under consideration while retaining the 70%/30% split between equities (public and private) and fixed income (Global Aggregate, Global High Yield, Emerging Markets Debt – Sovereign (Hard Currency), and Private Debt) asset classes.



Market Portfolio = 70% Global Equity / 30% Global Aggregate

Mkt + HY/EMD = 70% Global Equity / 20% Global Aggregate / 5% Global High Yield / 5% Emerging Market Debt Sovereign (Hard Currency)

Mkt + Private Equity = 55% Global Equity / 15% Private Equity / 30% Global Aggregate

Mkt + Private Eq&Debt = 62.5% Global Equity / 7.5% Private Equity / 22.5% Global Aggregate / 7.5% Private Debt

**Observations:**

The constrained efficient frontier has provided a guide for initial asset allocation decisions, during the portfolio construction process. Key takeaways before construction:

Adding growth fixed income – in the form of **high yield** and **emerging market debt** – shifts the full distribution of returns upwards incrementally. This trade-off can be seen as adding incremental value.

Exchanging 15% public equity for **private equity** significantly enhances returns while dividing the illiquid allocation between private equity and private debt is less beneficial. This leads Mercer to focus the illiquidity budget on private equity and private real assets.

On the lower-risk side of the frontier, Global Inflation-Linked Securities are beneficial but phase out of the frontier at return levels necessary to achieve a sustainable spending rate. This asset class will be considered further later in the materials.

**Step 3: Allocations for Consideration for PRF**

With the baseline knowledge around trade-offs for the asset allocations, we begin to build portfolios and refine given two additional constraints set forth by the Finance Committee; Private markets and inflation-linked securities.

**Refinement of Illiquidity Budget to Construct Initial Portfolio Options**

The private markets constraint is warranted, as the unconstrained frontier quickly utilizes a significant amount of private equity. The PRF Finance Committee has indicated that they are more comfortable

utilizing a 15% limit on private markets. Reducing the Private Markets exposure to 15% and reallocating to the other risk assets reduces the expected real return marginally (by 11 basis points in our ultimate recommended portfolio). However, the range of outcomes is also narrowed because private market allocations are subject to wider dispersion of outcomes as a function of their more concentrated and idiosyncratic nature.

We are strong advocates for private market exposure in general. However, we recognize the complexity and nuances associated with private markets and believe the overall threshold should be within the Financial Committee's comfort level.

### Initial Portfolio Options

Taking the above into consideration, alongside our best thinking, we have outlined below three different portfolio options:

	Current	Portfolio Option 1	Portfolio Option 2	Portfolio Option 3
<b>Fixed Income</b>	<b>69.0%</b>	<b>41.0%</b>	<b>29.0%</b>	<b>15.0%</b>
Global Government	34.0%	21.0%	16.0%	10.0%
Global Credit	13.0%	6.0%	4.0%	3.0%
US MBS	6.0%	4.0%	3.0%	2.0%
Global High Yield	8.0%	5.0%	3.0%	-
Emerging Market Debt-Sovereign (Hard Currency)	-	5.0%	3.0%	-
Global Inflation-Linked Bonds	8.0%	-	-	-
<b>Public Equity</b>	<b>31.0%</b>	<b>44.0%</b>	<b>56.0%</b>	<b>70.0%</b>
<b>Private Assets</b>	<b>-</b>	<b>15.0%</b>	<b>15.0%</b>	<b>15.0%</b>
Private Equity	-	9.0%	9.0%	9.0%
Private Real Estate	-	6.0%	6.0%	6.0%
<b>TOTAL</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Utilizing our long-term return and risk expectations as well as our calculated correlations between asset classes, we highlight expected results below for each portfolio.

	Current	Portfolio Option 1	Portfolio Option 2	Portfolio Option 3
Geometric 20-year Return	5.3%	6.4%	6.6%	6.8%
Risk (Return Standard Deviation)	10.7%	12.0%	12.9%	14.2%
Sharpe Ratio	0.137	0.209	0.209	0.206
Range of Expected Return (75 <sup>th</sup> to 25 <sup>th</sup> Percentiles)*:	4.3% - 6.5%	5.2% - 7.6%	5.4% - 7.9%	5.5% - 8.1%
CVaR (annual): 5 <sup>th</sup> Percentile*	-15.2%	-16.2%	-17.5%	-19.9%

\*An outcome of stochastic modeling

### Observations:

All portfolios reduce the allocation to fixed income relative to the current PRF SAA, which is expected given the higher return objectives and in-line with traditional endowment and foundation portfolios. In lieu of the fixed income, there are additional allocations to public equity versus the current portfolio, and a new allocation to private assets.

**Private Assets:** The total allocation to private assets is 15% across all three portfolio options. All portfolio options utilize private equity as the primary illiquid, alternative asset class to complement and provide a diversified return driver to public equities and bonds. The ratio between private equity and private real assets is 60%/40%.

### Expectations

- Versus the current policy, all portfolios add between 1.1% - 1.6% of expected return and come with modestly higher risk (standard deviation) of 2.2% - 4.5%.
- By introducing private markets, the efficiency of the portfolio, as measured by the expected Sharpe ratio ((Return minus Cash) / Risk), improves materially.
- By having a higher risk profile and by introducing private markets, the range of expected return shifts higher and all three options have a similar 25<sup>th</sup> percentile return (within 0.5%).
- The downside risk (measured here with a 5<sup>th</sup> percentile CVaR value) is worse with the portfolio options given the higher risk profile and more reliance on public equity returns as a component of the total return.

### Refining allocation to Inflation-Linked Securities

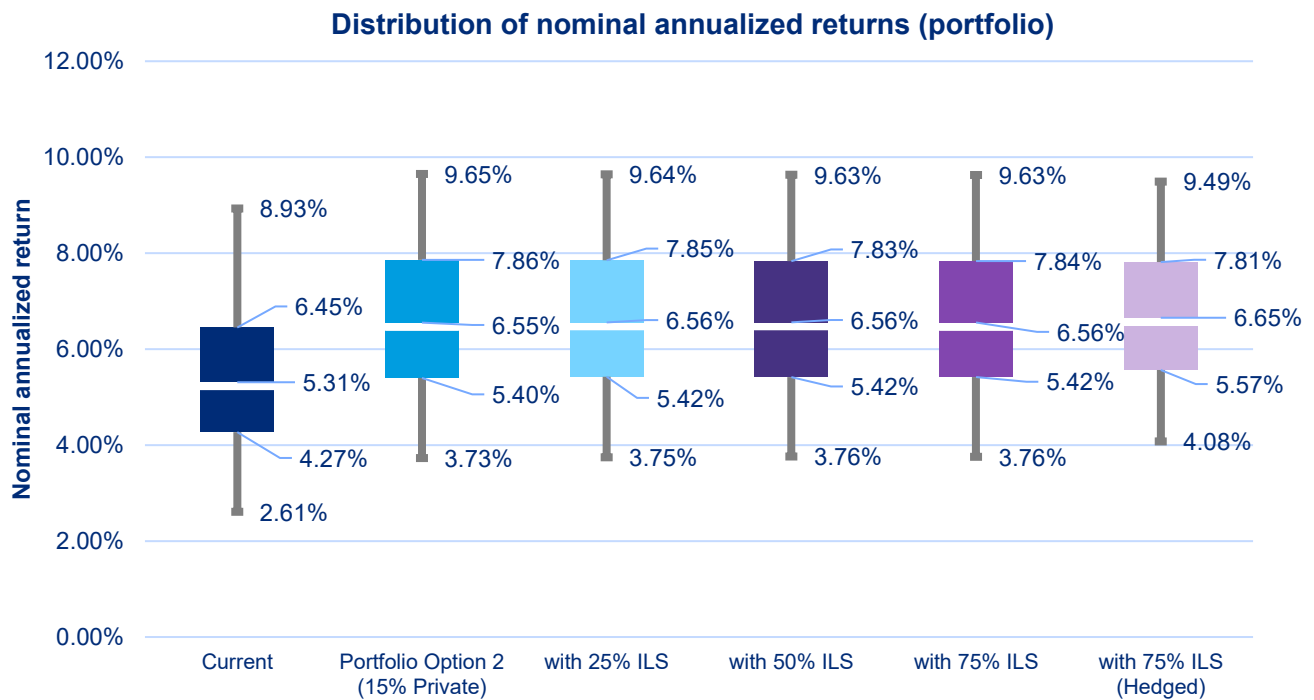
There are various considerations when thinking about including Inflation-linked securities (ILS) in the portfolio. Theoretically, the portfolio would benefit from an ILS allocation under an environment of unexpected inflation. This is more of a “scenario benefit”, rather than a consistent return benefit given a similar risk and return profile similar to global government fixed income assets. However, there is little opportunity cost to holding ILS vs. traditional global government bonds in normal market environments in terms of returns.

There is also a liquidity consideration: The inflation-linked market is significantly smaller and has lower overall liquidity compared to traditional government bonds. If underlying liquidity is not a concern, then this less liquid market would not be significant issue.

When modeling ILS into the allocations, the source of the funds is traditional (nominal) global government bonds.

- Inflation-Linked Bonds can benefit portfolios that have an objective and spending rate tied to a deflation/inflation.
- Global government fixed income and Global ILS have very similar expected returns.
- While ILS is more correlated to inflation than global government, the difference is slight due to other risk factors – duration, real rates, currency – that result in the correlation of both global government and global ILS to inflation being negative.

The below chart highlights the impact of including ILS. The % shown for each portfolio is the level of which the global government allocation is reduced, to fund ILS.



From here we refine the allocations and narrow down the universe of possibilities to three unique portfolios:

**Portfolio Option 2** is the same portfolio as previously outlined. Relative to the current portfolio, this option includes a 15% weight to private assets, an increased allocation to public equity, and a more diversified allocation within fixed income.

**Portfolio Option 2 with ILS begins with the Portfolio Option 2, with one change:** Reduces the weight to global nominal government bonds and replaces it with an allocation to global government inflation-linked bonds. *The allocation to nominal global government is reduced by 8% (absolute) and global government inflation linked securities (ILS) is added at an 8% (absolute) weight.*

**Portfolio Option 3** is the same portfolio as previously outlined. Relative to the current portfolio, this option includes a 15% weight to private assets, an increased allocation to public equity, and a more diversified allocation within fixed income. Versus Portfolio Option 2, this portfolio has a higher expected risk level and higher expected return.

	Current	Portfolio Option 2	Portfolio Option 2 - 50% ILS	Portfolio Option 3
<b>Fixed Income</b>	<b>69.0%</b>	<b>29.0%</b>	<b>29.0%</b>	<b>15.0%</b>
Global Government	<b>34.0%</b>	16.0%	8.0%	10.0%
Global Credit	<b>13.0%</b>	4.0%	4.0%	3.0%
US MBS	<b>6.0%</b>	3.0%	3.0%	2.0%
Global High Yield	<b>8.0%</b>	3.0%	3.0%	-
Emerging Market Debt-Sovereign (Hard Currency)	-	3.0%	3.0%	-
Global Inflation-Linked Bonds	<b>8.0%</b>	-	8.0%	-
<b>Public Equity</b>	<b>31.0%</b>	<b>56.0%</b>	<b>56.0%</b>	<b>70.0%</b>
<b>Private Assets</b>	-	<b>15.0%</b>	<b>15.0%</b>	<b>15.0%</b>
Private Equity	-	9.0%	9.0%	9.0%
Private Real Estate	-	6.0%	6.0%	6.0%
<b>TOTAL</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Utilizing our long-term return and risk expectations as well as our calculated correlations between asset classes, we highlight expected results below for each portfolio.

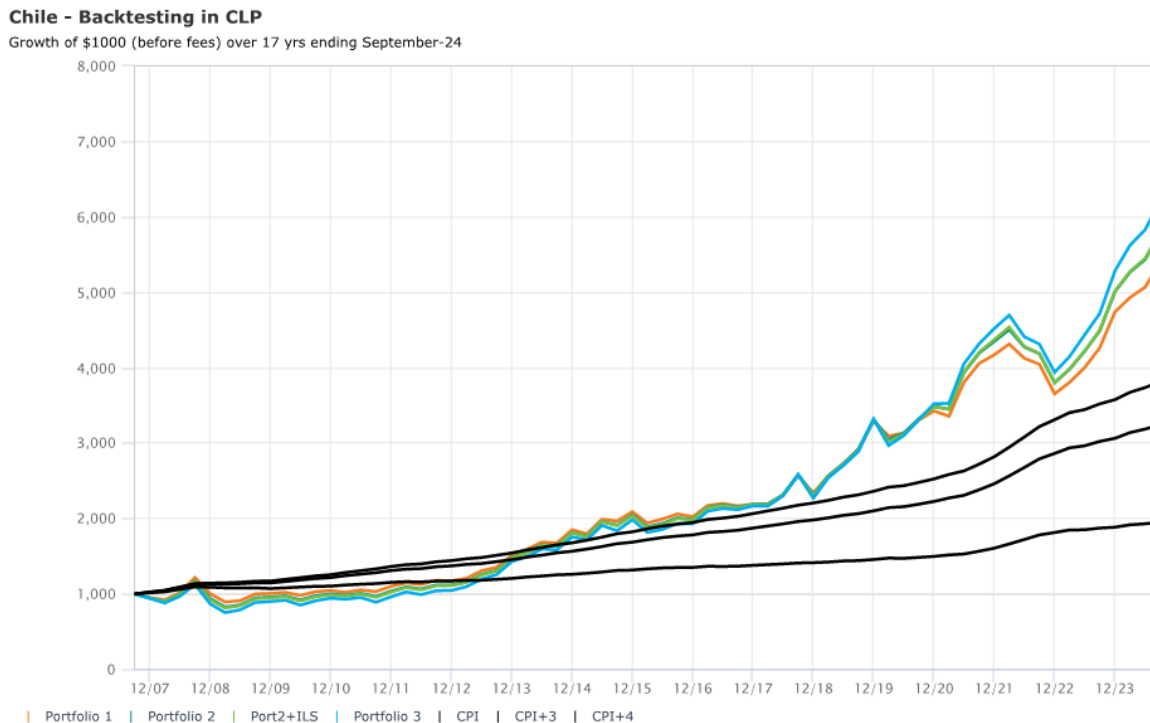
	Current	Portfolio Option 2	Portfolio Option 2 - 50% ILS	Portfolio Option 3
Geometric 20-year Return	5.3%	6.6%	6.6%	6.8%
Risk (Return Standard Deviation)	10.7%	12.9%	12.9%	14.2%
Sharpe Ratio	0.137	0.209	0.210	0.206
Range of Expected Return (75 <sup>th</sup> to 25 <sup>th</sup> Percentiles)*:	4.3% - 6.5%	5.4% - 7.9%	5.4% - 7.7%	5.5% - 8.1%
CVaR (annual): 5 <sup>th</sup> Percentile*	-15.2%	-17.5%	-17.9%	-19.9%

\*An outcome of stochastic modeling

### Step 4: Back Testing

Back testing is valuable to ensure that the portfolios have performed as expected over various time periods, historically. This is not intended to be prescriptive on asset allocation, but modeling can help ensure that the allocations produce results that would have outperformed the key benchmarks over the long-term. (See Appendix D for the return series used for back testing.)

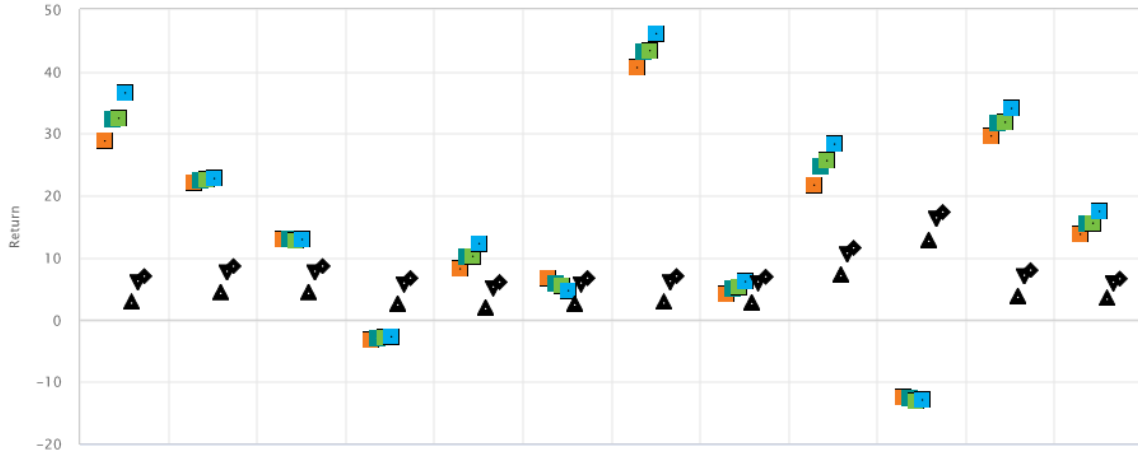
The chart below indicates the cumulative value creation of each of the portfolios in light of CPI + 3%.



The charts below indicate the annual returns of the portfolios.

Chile - Backtesting in CLP

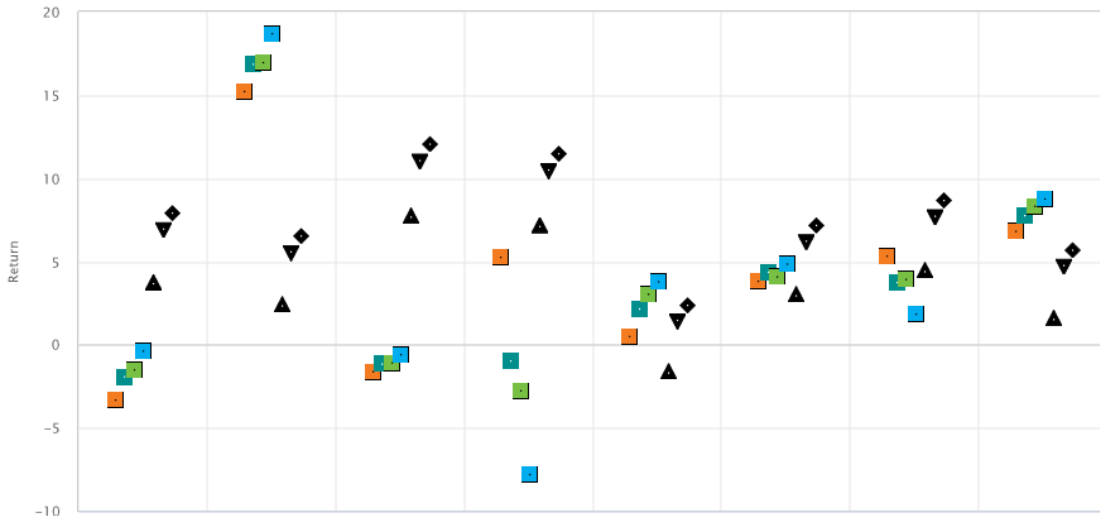
Return in \$US (before fees) over last 12 calendar years ending September-24



	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)	2022 (%)	2023 (%)	9 mths to 9/2024 (%)
Portfolio 1	28.9	22.1	13.0	-3.2	8.2	6.7	40.7	4.2	21.7	-12.4	29.7	13.8
Portfolio 2	32.4	22.4	13.0	-2.9	10.1	5.8	43.2	5.1	24.8	-12.6	31.7	15.5
Port2+ILS	32.5	22.7	12.8	-2.8	10.3	5.5	43.4	5.3	25.7	-13.1	31.9	15.6
Portfolio 3	36.6	22.8	13.0	-2.7	12.3	4.7	46.2	6.2	28.4	-12.9	34.1	17.5
CPI	2.9	4.5	4.5	2.6	2.0	2.6	2.9	2.8	7.3	12.9	3.9	3.5
CPI+3	6.1	7.6	7.6	5.7	5.1	5.7	6.1	6.0	10.6	16.3	7.0	5.9
CPI+4	7.1	8.7	8.7	6.8	6.1	6.8	7.1	7.0	11.6	17.4	8.0	6.6

Chile - Backtesting in CLP

Return in \$US (before fees) over last 8 calendar years ending December-12

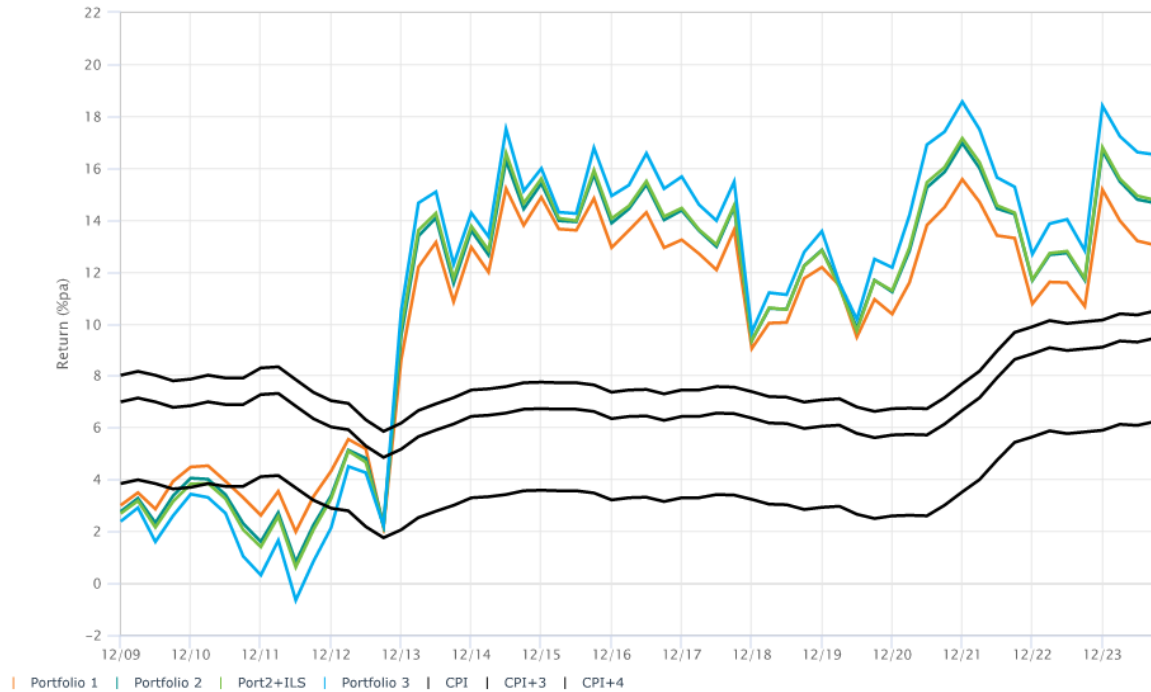


	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)
Portfolio 1	-3.3	15.2	-1.6	5.3	0.5	3.8	5.3	6.8
Portfolio 2	-1.9	16.9	-1.1	-1.0	2.2	4.4	3.8	7.8
Port2+ILS	-1.5	17.0	-1.1	-2.8	3.0	4.1	3.9	8.3
Portfolio 3	-0.4	18.7	-0.6	-7.8	3.8	4.9	1.9	8.8
CPI	3.8	2.4	7.8	7.2	-1.6	3.0	4.5	1.6
CPI+3	6.9	5.5	11.0	10.4	1.4	6.2	7.7	4.7
CPI+4	7.9	6.5	12.1	11.5	2.4	7.2	8.7	5.7

The below chart indicates the consistency of each portfolio outperforming the CPI + 3 benchmark.

**Chile - Backtesting in CLP**

Rolling 5 yr Return in \$US (before fees) over 15 yrs ending September-24



**Observations:**

Cumulatively, over the long-term, the portfolio is set to grow at a rate to exceed the CPI + 3% return hurdle. Annual years are informative to see when the portfolio would have outperformed and underperformed. In assessing annual returns, there are no surprises, and most years, the portfolio outperforms the CPI + 3% benchmark. The portfolios being considered would have historically outperformed the primary benchmark, **consistently**, when assessing rolling long-term periods.

## Section 6

# Combined Analysis: Interaction of Strategic Asset Allocation and Spending Policy

## Introduction

Following Steps 1-4 from the prior section, we reincorporate spending policy to examine the combined effect from interaction of asset allocation and spending policy.

Step 5: **Incorporate the spending methodology** into the model to ensure the program withdrawal expectations align with key objectives.

Step 6: **Stress testing** the allocations during potentially challenging market events.

## Step 5: Spending Implications

With the spending methodology, rate and asset allocations to be analyzed identified, this section reviews the simulated results over a 20-year horizon across 2,000 simulations. This step is to ensure the withdrawal and spending from the PRF is consistent with the goals set forth with the mandate.

### Spending model assumptions:

**Asset Allocation.** The current asset allocation and three portfolio options, detailed in the prior section are modeled.

**Spending Methodology.** The hybrid spending methodology is utilized.

**Spending Rate.** Mercer models a 3%, 4% and 5% spending rate to evaluate outcomes under different rate assumptions.

**Year One Portfolio Market Value.** The market value Mercer modeled is CLP 8.1T<sup>2</sup>.

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<sup>2</sup> The PRF has indicated that 8.1T is the appropriate asset value to utilize for the study. This value excludes the loan up to \$ 900 million to the Fondo Autónomo de Protección Previsional (FAPP).

**Year One Spending Amount.** We assume that the initial “spend” from the portfolio will be equivalent to the spending rate multiplied by the prior year market value of the portfolio. The below table outlines what this year one spending amount equates to, after utilizing a particular spending rate.

Spending Rate	Year 1 Spending Amount, in CLP
3%	243B
4%	324B
5%	405B

**Deflators.** The primary deflator that is modeled is Chilean CPI. Mercer also assessed Nominal GDP as a deflator, the results of which can be found in Section 6. The below table provides additional information on the two deflators and the assumed, projected growth rate of each.

Deflator	Description	Projected Growth Rate	Assumption Sources
<b>Chilean CPI</b>	Measures the monthly variation in the prices of a basket of goods and services representative of the consumption of urban households in all the regional capitals and metropolitan areas within Chile.	3.0%	IMF, Consensus Economics
<b>Nominal GDP*</b>	Measures the variation in Chile’s Gross Domestic Product in current prices, reflecting the total value of all goods and services produced.	5.0%	IMF, Consensus Economics

\*Nominal GDP = CPI + Real GDP Growth

## Modeling Output:

Note: All values in CLP. Spending values in billions; Market Value in trillions

Shading represents if the spending or market value maintains purchasing power after the twenty years. Red indicates that purchasing power is not maintained; green indicates that purchasing power is maintained

3% Spending Rate Year 1 Spending: 243B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	377	452	453	463
Spending – Year 20 (MM Real)	205	249	250	255
Market Value – Year 20 (B Nominal)	12.3	15.9	15.9	16.5
Market Value – Year 20 (B Real)	7.1	8.9	8.9	9.2

4% Spending Rate Year 1 Spending: 324B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	421	508	510	519
Spending – Year 20 (MM Real)	229	279	280	286
Market Value – Year 20 (B Nominal)	9.6	12.6	12.6	13.1
Market Value – Year 20 (B Real)	5.3	7.1	7.1	7.3

5% Spending Rate Year 1 Spending: 405B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	436	527	529	539
Spending – Year 20 (MM Real)	237	290	291	296
Market Value – Year 20 (B Nominal)	7.3	9.7	9.7	10.1
Market Value – Year 20 (B Real)	4.0	5.5	5.5	5.7

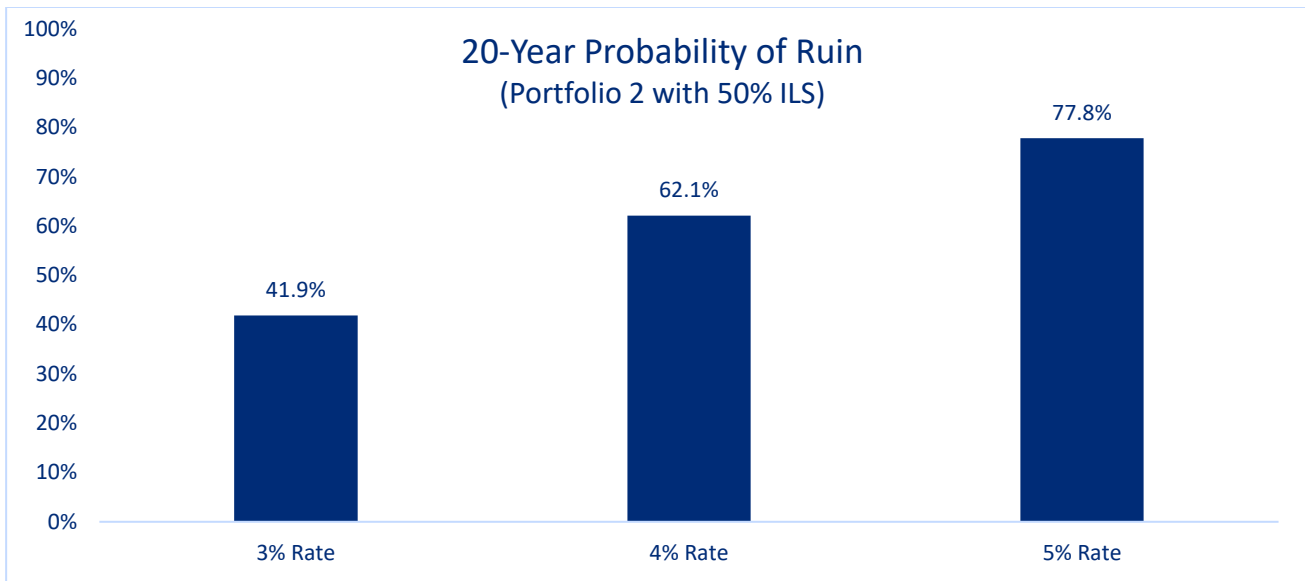
Note: Average outcome across simulations shown in table

The range of outcomes for **real market value** and **real spending** can be found in appendix E.

In addition to expectations above, another key metric that is measured is probability of ruin for the portfolio.

**What is the Probability of Ruin?** The probability that the real market value of the portfolio does not maintain purchasing power over a long-term period.

**What are we assessing?** We assess the probability of ruin over a 20-year period, with the three different spending rates.



**Assumptions:** Hybrid spending methodology; CPI used as the deflator

**Observations:**

Utilizing a **3% spending rate**, Mercer expects the portfolio market value and spend to maintain purchasing power over time with any of the options shown. With a **4% spending rate**, the expected outcomes indicate a decline in purchasing power for the PRF. Portfolio allocation 3 is the only option where the market value modestly maintains overall purchasing power with a 4% rate. It is difficult to maintain real purchasing power with a **5% spending rate** given the limitation of a 15% allocation to private assets.

There is a low expected probability of ruin when utilizing a 3% spending rate – indicating the highest probability of successfully maintaining purchasing power.

## Step 6: Stress Testing

Mercer modeled the portfolios through four primary stress events.

Stress Event	Description
Equity Bear Market	50% Equity decline over 2 years then recovery
Sharp Rate Rise	Global interest rates rise 4% over 2 years, affecting bonds and equities

Stress Event	Description
Chilean Inflation Spike	Inflation increases in Chile by 21% relative to base case over 5 years, weakening CLP and increasing foreign asset returns in CLP
Secular Equity Decline	Equity valuations fall to historic average levels, a decline of 30% from September 2024 levels, with no recovery.

The results of the stress tests indicate how the portfolio results would be different relative to base case expectations.

	Base Case	Equity Bear Market	Sharp Rate Rise	Chilean Inflation Spike	Secular Equity Decline
20 Year Return	7.3%	7.5%	7.4%	8.4%	6.5%
10 Year Return	7.1%	7.4%	7.2%	9.2%	5.5%
Ending MV	19.3T	19.8T	19.3T	23.6T	16.0T
Ending MV (Real)	10.5T	10.7T	10.5T	10.5T	8.7T
Total Spend	7.1T	7.0T	6.9T	8.5T	6.1T
Total Spend (Real)	5.0T	4.9T	4.8T	4.9T	4.3T
Max Decline in Spend	0	-7.2B	-25B	0	-1.7B

### Observations:

Market value has historically rebounded within three years after a challenging one or two year period. As shown, this rebound has allowed the portfolio to maintain real value over the long-term (after accounting for short-term stress from volatility)

Each downside scenario has a modest impact on spending the following year, but manageable. This is mainly due to the fact that spending is primarily driven by inflation changes (and not market value changes).

## Conclusions

**Mercer recommends utilizing a 3% spending rate** within the spending formula and methodology. This analysis confirmed that a 3% spending rate allows for adequate spending out of the plan and a prudent portfolio can be constructed to support this spend while maintaining purchasing power. Utilizing a 4% or 5% spending policy would imply that a portfolio with a more aggressive risk tolerance would be needed, and is not recommended given the portfolios under consideration.

**Mercer recommends utilizing CPI as the deflator.** Further analysis of the selection of CPI as the deflator can be found in a proceeding section, but CPI is a viable deflator and a prudent portfolio can be constructed to maintain purchasing power utilizing this metric.

### **Mercer recommends adopting Portfolio Option 2 with ILS** for the following reasons:

**First** – This portfolio asset allocation and risk tolerance is in-line with similar endowments and foundations globally, which is a goal of the PRF during this analysis.

**Second** – The real return expectation of the portfolio is in-line with the desired level of spend and accounts for expected inflation. This implies that the portfolio is expected to maintain real purchasing power (real market value) relative to today's real value.

**Third** – The risk level that is expected from the portfolio is tolerable to the Committee. The range of outcomes and drawdown metrics that are expected would be acceptable to the Committee should there be a bear market.

**Fourth** – This portfolio will support a consistent spend out of the PRF over time. This level of pesos that is expected to be withdrawn is acceptable to PRF leadership and the Finance Committee.

**Fifth** – The allocation, historically, has seen success in outperforming the key metric of success (CPI + 3%) for the portfolio, consistently. Backward-looking models indicate a return stream that is in-line with expectations during different market environments.

**Sixth**– Forward-looking draw-down metrics during base case and stressed environments are consistent with expectations and tolerable for the PRF. While stress events could have a material impact on market value, these events do not inhibit the program to achieving long-term success when it comes to spending and market value. long-term of an impact on long-term success of the program.

### **Recommended Portfolio:**

	<b>Portfolio Option 2 – 50% ILS</b>
<b>Fixed Income</b>	<b>29.0%</b>
Global Government	8.0%
Global Credit	4.0%
US MBS	3.0%
Global High Yield	3.0%
Emerging Market Debt-Sovereign (Hard Currency)	3.0%
Global Inflation-Linked Bonds	8.0%
<b>Public Equity</b>	<b>56.0%</b>
<b>Private Assets</b>	<b>15.0%</b>
Private Equity	9.0%
Private Real Estate	6.0%
<b>TOTAL</b>	<b>100.0%</b>

## Section 7

# Deflators

### Introduction

A deflator is used to compare a quantity at two different points in time when the underlying measurement basis for the quantity varies with time.

The quantity being measured is most often nominal values of money. Inflation causes differences in the real value of money in terms of purchasing power over time, so a deflator, generally based on price inflation measurements, is used to convert “nominal” values of money at a given point in time into “real” values of money which are comparable across time. Real values can purchase the same quantity of goods at two different points in time.

PRF desires to monitor the value of its assets over time to ensure that the beneficial value the assets can provide to Chile and its population are maintained.

The beneficial value of the PRF could be measured using different bases, such as purchasing power (inflation), economic growth (GDP), benefit per current worker or benefit per retiree.

The following analysis compares the value of the fund over time using these different deflators.

### Deflators Under Consideration

Deflator	Description	Impact
<b>Chilean CPI</b>	Measures the monthly variation in the prices of a basket of goods and services representative of the consumption of urban households in all the regional capitals and metropolitan areas within Chile.	Maintains the direct purchasing power of the PRF's assets.
<b>Nominal GDP (CPI + Real GDP Growth)</b>	Measures the variation in Chile's Gross Domestic Product in current prices, reflecting the total value of all goods and services produced.	Maintains the fund relative to the size of the Chilean economy.
<b>CPI + Working Age Population Growth</b>	CPI + growth in the working age population.	Maintains the spending power of the fund relative to the working age population. This can help control for the denominator effect – where a growth in the number of future beneficiaries could result in lower spending power per beneficiary when using other deflators.
<b>CPI + Retirement Age Population Growth</b>	CPI + growth in the retirement age population.	Maintains the spending power of the fund relative to the retirement age population. This can help control for the denominator effect – where a growth in the number of current beneficiaries could result in lower

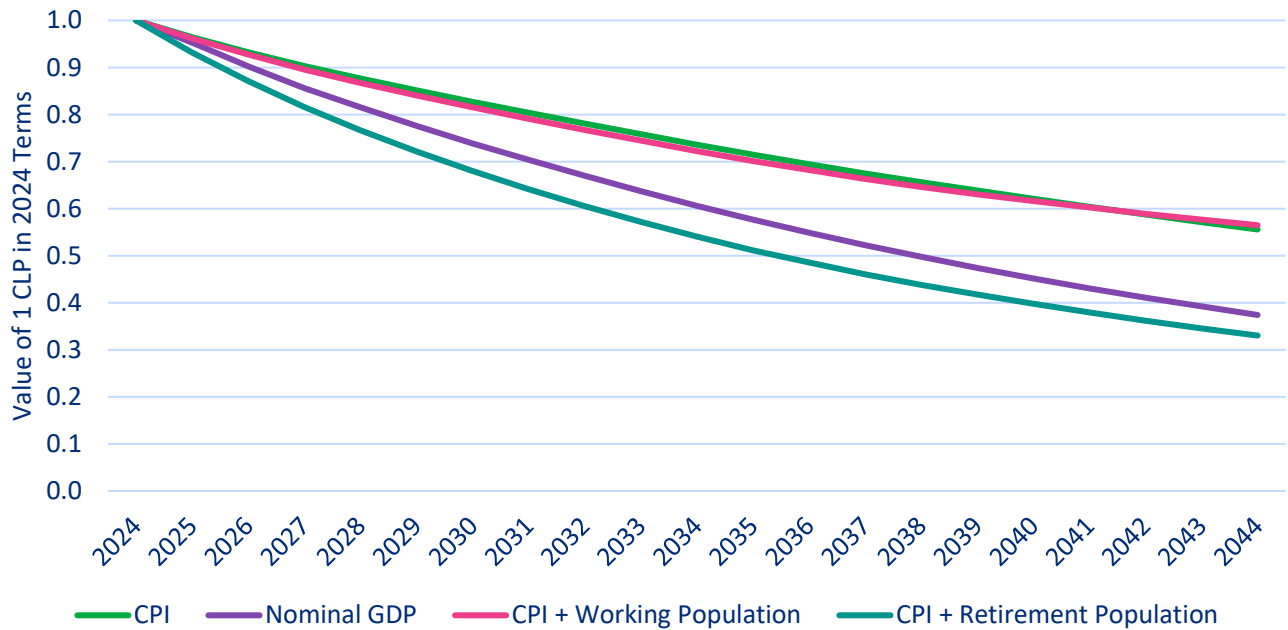
Deflator	Description	Impact
		spend per beneficiary when using other deflators.

Deflator	Projected Growth Rate
Chilean CPI	3.0%
Nominal GDP (CPI + Real GDP Growth)	5.0%
CPI + Working Age Population Growth	2.9%
CPI + Retirement Age Population Growth	5.7%

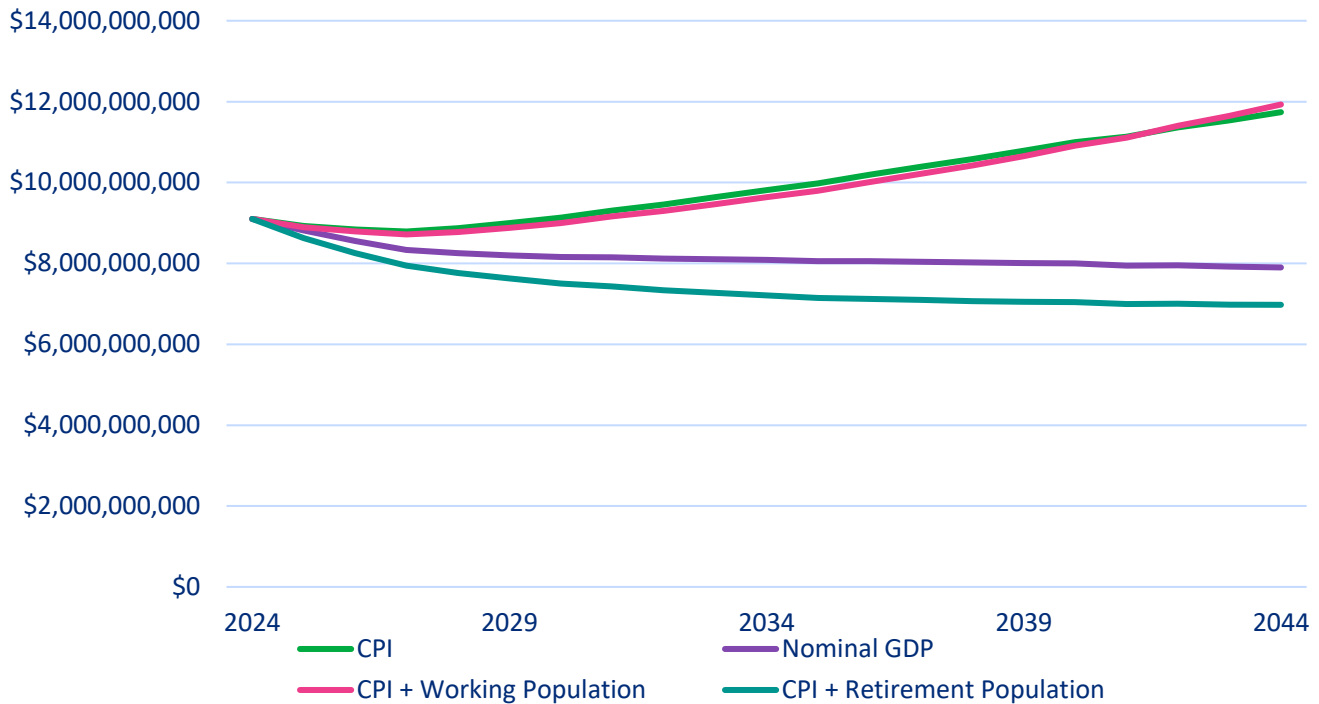
Assumption sources: IMF, Consensus Economics. For CPI + Working Age Population Growth and CPI + Retirement Age Population Growth also United Nations data utilized.

## Deflators Over Time

The below chart indicates the real value of one CLP in 2024 terms.



The below chart indicates the real value of portfolio option 2, after spending, utilizing each of the deflators being considered.



The CPI deflator is the most straightforward measurement, as it is the value in pesos over time and uses the familiar measure of CPI. However, it does not consider changes in the productive capacity of the country, the distribution of benefits over retirees or the changes in size of the workforce contributing to the country’s output.

CPI + GDP (Nominal GDP) captures changes in the output of the country and its ability to support spending. This measure is beneficial for measuring the ability of the country to contribute to the fund, adjusted for its economic output and fund spending. However, this measure does not relate its value to the population the fund supports,

CPI + Working Age Population captures the growth in the number of workers the fund will need to support in the future and is thus a measure of future spending growth required. It provides a measure of the growth in contribution capacity of the current workforce. However, it presents a disconnect between the value of the fund at a given point in time and the change in fund “obligations” in terms of retirees.

CPI + Retirement Age Population captures the growth in retirees over time and thus links the fund’s value to its obligations in constant dollars. It provides a reasonable basis for measuring the relationship of retirees to fund assets at a given point in time. However, it does not provide an indication of the fund’s ability to support future retirees.

## Conclusions

Objective: Measure the value of the PRF in consistent terms to permit monitoring of the program's health. For PRF this will enable monitoring the PRF after spending relative to its initial value and potentially relative to the economy or population.

- CPI - Indicates whether the PRF is maintaining its value relative to inflation after spending
- CPI + GDP (Nominal GDP) – Indicates whether the PRF is maintaining its value after spending relative to the economy
- CPI + Working Age Population – Indicates whether PRF is maintaining its value after spending relative to current workers and future retirees
- CPI + Retirement Population - Indicates whether PRF is maintaining its value after spending relative to current retirees

Conclusion: CPI is the most straightforward deflator and is unambiguous in its meaning. It can be used along with other analysis and measures to evaluate the sufficiency of the PRF, but as a single measure is the most universal for measurements over time.

A secondary deflator that is assessed in the modeling work is to use Nominal GDP. This secondary deflator was selected because of its ability to measure real GDP growth of the Chilean economy and the dynamics of the economy, in addition to inflation. This value is higher than CPI, and thus, will be harder to achieve real results (after spending). Please refer to Appendix G for the additional analysis utilizing nominal GDP as the deflator.

# Section 8 Implementation Considerations

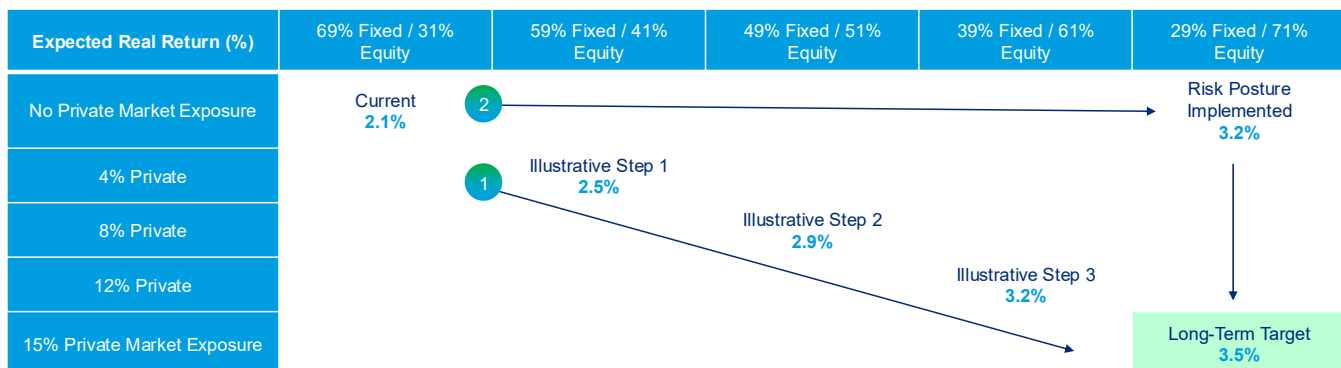
The recommended asset allocation represents a meaningful shift from the current portfolio. It will not be feasible to achieve this asset allocation immediately and may take multiple years depending on the implementation of the private assets. Private assets generally take multiple years to be fully invested. It is also not advisable to attempt to make major asset allocation shifts in one step, as there is a market timing risk that can be mitigated by taking a more incremental approach.

We show below the implications of an immediate full implementation (Line 1) versus an incremental implementation with 4 Steps (Line 2). The numbers below each step show the real return that is expected with that asset allocation. This is an important practical consideration, as the spending policy rate is connected to the expected real return of the portfolio. If a phased approach is utilized, which we recommend, then the spending rate increase (from the 2.1% real return expected from the current allocation to the 3% real return that supports the proposed target rate) will need to be implemented gradually (Line 2).

The graphic below shows a 4 Step progression. Later tables illustrate the allocations used in each Step. Portfolio Option 2 with 50% ILS is the long-term target allocation. A four step approach is taken to transition the portfolio to the new, approved long-term target. The intermediate steps leg into the long-term target allocations, without taking any outsized bets in any one asset class. The exact timing of transitioning the portfolio is partially dependent on the timing of to transition and also partially relies on implementation decisions.

The below implementation grid shows two illustrative options moving from the current allocation to the long term target.

- 1 Three Step Path: pro rata transition across asset classes
- 2 Achieve target risk posture first, then implement illiquid assets



**Takeaway**

- The justifiable spend amounts increase by ~ 0.1% for every 4% increase in private market exposure implemented and ~ 0.3% for every 10% increase in equity exposure implemented.

The steps include three main actions:

- Stepping into private markets over time
- Increasing public equity over time
- Reducing and diversifying the fixed income portfolio

	<u>Current</u>	Step 1	Step 2	Step 3	<u>Step 4</u> Long-Term Target
<b>Fixed Income</b>	<b>69.0%</b>	<b>59.0%</b>	<b>49.0%</b>	<b>39.0%</b>	<b>29.0%</b>
<b>Global Government</b>	34.0%	28.0%	21.0%	15.0%	8.0%
<b>Global Credit</b>	13.0%	11.0%	9.0%	6.0%	4.0%
<b>US MBS</b>	6.0%	5.0%	4.0%	3.0%	3.0%
<b>Global High Yield</b>	8.0%	6.0%	5.0%	4.0%	3.0%
<b>Emerging Market Debt – Sovereign (Hard Currency)</b>	-	1.0%	2.0%	3.0%	3.0%
<b>Global Inflation-Linked Bonds</b>	8.0%	8.0%	8.0%	8.0%	8.0%
<b>Public Equity</b>	<b>31.0%</b>	<b>37.0%</b>	<b>43.0%</b>	<b>49.0%</b>	<b>56.0%</b>
<b>Private Assets</b>	-	<b>4.0%</b>	<b>8.0%</b>	<b>12.0%</b>	<b>15.0%</b>
<b>Private Equity</b>	-	3.0%	5.0%	7.0%	9.0%
<b>Private Real Estate</b>	-	1.0%	3.0%	5.0%	6.0%
<b>TOTAL</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

	<u>Current</u>	Step 1	Step 2	Step 3	<u>Step 4</u> Long-Term Target
<b>Geometric 20-year Return</b>	<b>5.3%</b>	<b>5.7%</b>	<b>6.0%</b>	<b>6.3%</b>	<b>6.6%</b>
<b>Risk (Return Standard Deviation)</b>	<b>10.7%</b>	<b>11.0%</b>	<b>11.5%</b>	<b>12.1%</b>	<b>12.9%</b>
<b>Sharpe Ratio</b>	<b>0.137</b>	<b>0.165</b>	<b>0.186</b>	<b>0.201</b>	<b>0.210</b>
<b>Range of Expected Return (75th to 25th Percentiles):</b>	<b>4.3% / 6.5%</b>	<b>4.6% / 6.8%</b>	<b>4.9% / 7.2%</b>	<b>5.2% / 7.5%</b>	<b>5.4% / 7.7%</b>
<b>CVaR (annual): 5th Percentile</b>	<b>-15.2%</b>	<b>-15.2%</b>	<b>-15.7%</b>	<b>-16.3%</b>	<b>-17.9%</b>
<b>Expected Real Return (%)</b>	<b>2.1%</b>	<b>2.5%</b>	<b>2.9%</b>	<b>3.2%</b>	<b>3.5%</b>

	<u>Current</u>	Step 1	Step 2	Step 3	<u>Step 4</u> Long-Term Target
<b>Expected Real Return with Year 1 market value = (8.1T pesos * real return)</b>	<b>172.5 B</b>	<b>204.1 B</b>	<b>233.3 B</b>	<b>260.8 B</b>	<b>284.3 B</b>

As the portfolio increases the risk profile and amount of the allocation to growth-oriented assets, the expected return increases over time and thus the viable spending rate. With an increase in the expected return, the expected real return (in % and pesos) increases and becomes aligned with the long-term target. If aligning the target spend with the portfolio over the transition period, the adjustment of the expected real return can be informative and guide the real spend. Currently with a 2.1% expected real return, the PRF could build in a 2.1% spend during the phase today. As the portfolio is transitioned, this real return will increase, along with the target spend.

## Section 9

# Measuring Success and Monitoring

## Introduction

This section introduces broad and specific benchmarks that can be utilized by the PRF moving forward to measure success of the program.

Benchmarks are intended to help investors determine if value has been created/lost relative to the simplest asset class implementation and make decisions based on that evaluation. Benchmarks are typically used for all investment asset classes, including illiquid assets. The analysis focuses on the policy benchmark at the total portfolio level and makes recommendations to several currently utilized benchmarks to remove overlapping exposures between asset classes.

Long-term measures of success should be developed to understand if the key recommendations that are made by the Finance Committee are hitting key objectives as set forth by the Ministry of Finance. We recommend a primary long-term objective of CPI + 3%.

Additionally, we recommend a shorter-term total portfolio policy benchmark (“Policy Index”), which is composed of each asset class benchmark (also discussed in this section) at its target weight, with a slight modification for the private program. The private program may not be rebalanced efficiently and it may be prudent to phase into the target exposure to ensure adequate program diversification. To address this, we recommend adjusting the over/underweight relative to target from the Global Equity allocation to account for the private equity contribution pacing being subject to the general partners’ control. i.e. If private equity actual allocation is underweight by 3%, use the actual weight and adjust the global equity target weight upwards by 3% so the policy weight continues to add to 100%. This Policy Index serves as a secondary benchmark for performance evaluation and attribution over shorter time periods, but not as a secondary objective. The objective remains to exceed CPI + 3% over the long term and the Policy Index is merely intended to provide additional information when evaluating performance.

We pair this with a shorter-term risk-tolerance measure of forward-looking CVaR 5th Percentile of -20% to ensure the portfolio is not at risk of losing more than 20% in any given year.

We then conclude this section with recommendations on when to monitor program assumptions over time.

## Benchmarking

The broad function of benchmarking is to measure performance, often through comparative indices, to inform investment allocation decisions and the quality of an institutional investor’s fund manager selection.

The CFA institute has defined key characteristics of benchmarks as follows:

1. Unambiguous
2. Relevant
3. Representative
4. Measurable
5. Specified in Advance

6. Accountable
7. Investable
8. Complete

Mercer has kept these eight characteristics in mind when evaluating which benchmarks may be most useful in measuring performance for the PRF. The following sections review benchmarks with summary recommendations for each asset class moving forward.

## Public Equities

Current benchmark: MSCI ACWI ex-Chile Index.

No recommendations to change this index moving forward, as this index is best practice for global equity exposure, with Chile exposure excluded. The standard (large and mid) cap focus allows PRF to gain exposure efficiently without any liquidity concerns from small cap. These liquidity concerns may be mitigated through active management of small cap exposure, though that would be an active implementation decision and thus should impact the relative return compared to the broad benchmark. As such, the MSCI ACWI ex-Chile index is the most suitable benchmark.

*Note for all fixed income benchmarks. Mercer has assessed the underlying exposures of each fixed income index to ensure that there would be no overlap between portfolio allocations under the new policy. The concern is that with overlap, the PRF may be overexposed to specific sectors and issues. Additionally, further specialization of the indices will allow for strategy specialists to be engaged based on skill-set appropriate for a particular sector and/or region.*

## Corporate Bonds

Current benchmark: Bloomberg Global Aggregate Corporate

No recommendations to change this index moving forward, as this index is best practice for global corporate bond exposure. The index starts from the broad Global Aggregate parent-index but restricts inclusion to investment-grade corporate issuers only, ensuring no overlap with the modeled high yield or government exposures.

## High Yield Fixed Income

Current benchmark: Bloomberg Global High Yield

**The recommended benchmark is the Bloomberg Global High Yield Corporate.** The current high yield benchmark includes global corporate high yield as well as global government and government related high yield. This overlaps with government and government related exposures in other components of the Asset Allocation. Mercer recommends adjusting the benchmark to focus on corporate issues given the addition of a dedicated emerging market debt allocation.

## Emerging Market Debt – Sovereign (USD)

Current benchmark: None (new asset class being recommended)

**The recommended benchmark is the JP Morgan EMBI Global Diversified Index.** This index is widely used for this asset class exposure. The Emerging Market Bond Index (EMBI) Global Diversified represents **sovereign and government-related** bonds issued by emerging market countries

denominated in US Dollars. It is diversified by limiting the exposure to any one issuing country to 10% of the index weight.

## US MBS

Current benchmark: Bloomberg US MBS Index (unhedged)

No recommendations to change this index moving forward, as this index provides exposure to the majority of the global securitized market

## Inflation Linked Fixed Income

Current benchmark: Bloomberg Global Inflation-Linked

No recommendations to change this index moving forward, as this index is best practice for global inflation linked securities.

## Global Government

Current benchmark: Bloomberg Global Aggregate Government-Related *and* Bloomberg Global Aggregate Treasury Bond

**The recommended benchmark is the Bloomberg Global Treasury Index Developed Market.** The current benchmark includes developed market and emerging market government and government-related issues. This overlaps with related exposures in other components of the portfolio. Mercer recommends adjusting the benchmark to focus on developed market issues given the emerging market debt mandate and potential overlap. By including the emerging market exposure, the current index is taking on elevated default risk and additional credit risk relative to the sovereign bond exposure it is attempting to capture. By moving to a developed-market only index, the benchmark can be more representative of the desired exposure.

## Private Equity

Current benchmark: None (new asset class being recommended)

For public equities, consistently updated indices with return statistics for securities are readily available. For private equity, no such ideal performance standard measure exists. Private equity index options 1) are not reflective of fund characteristics, 2) lack of transparency in underlying investments, 3) are published in a timely manner - delayed publication, 4) are not investable, and 5) are not holistic in measuring the universe - there is survivorship bias.

There are four methodologies that Mercer considers when identifying an appropriate benchmark for private equity, knowing that there is not one perfect solution:

**Public Market Comparisons:** Compares performance against an index of publicly traded securities and is used to assess whether:

- The manager is generating value through active management
- Private investments overall are delivering the value expected given the higher fees, liquidity constraints, additional required resources, etc.

**Public Market Equivalent (PME+):** Compares performance against a common public benchmark return that has been recalculated to adjust for manager cash flow decisions. It is used to assess whether:

- The manager is generating value through active management against public market indices
- Private investments overall are delivering the value expected given the higher fees, liquidity constraints, additional required resources, etc.

**Private Market Peer Comparisons:** Compares performance against other private funds often reported by a benchmark provider and is used to:

- Compare managers within a specific strategy
- Evaluate the investment selection decisions in the program

**Actual performance of the portfolio:** This uses the portfolio's actual private investment performance as the benchmark. This approach eliminates tracking error from the Total Fund benchmark.

### Private Equity Benchmarks in Policy Index

Method	Pros	Cons
<b>Public Market Index (MSCI ACWI, S&amp;P 500, Russell 2000)</b>	Broad, investable indices Easily understood methodology Timely reporting	Combines alpha and illiquidity premium Potential for significant tracking error
<b>Public Market Index + Premium (PME+)</b>	Includes cost of illiquidity Timely reporting Incorporates cash flows	Not investable Arbitrary premium Potential for significant tracking error
<b>Peer Universe Benchmark (Burgiss, Cambridge, Preqin)</b>	Extensive database Quality, consistent information Flexible reporting	Performance data is lagged Lack of transparency Potential diversification mismatch Potential for significant tracking error
<b>Actual PE Performance of the Portfolio</b>	Eliminates Tracking Error in Total Fund Benchmark	Neutralizes any alpha from appearing in Total Fund Benchmark analysis

In determining which of the above methodologies are appropriate for the PRF moving forward, one additional key consideration is timing that may be needed to build the private equity program and see it mature. In the early stages of constructing a private equity program, comparisons will be less relevant and informative, given 1) flows will primarily be outflows as fund commitments are made, with minimal inflows (J-Curve), and 2) most peer comparisons are of mature, long-established portfolios. Given the PRF will be constructing this portfolio from a non-allocation, the comparisons will not be similar and, thus, not relevant.

**Mercer recommends using actual private fund performance for years 1-4 as the program is constructed, then moving to a peer comparison index with Burgiss for years 5 onwards.**

- Years one through four. Initial J-curve commitments are made, and fund commitments are being drawn down. Recommendation is to use actual performance during these years to avoid unwanted tracking error caused during the onset of the private market program. Public market equivalent or other private benchmarks will introduce tracking error not reflective of the program success/failure.

- Years five onwards.** The program begins being out of the J-curve, and becomes more established. The PRF may begin to see distributions from early commitments. Recommendation is to use Burgiss private market total benchmarks from this point on. Burgiss benchmarks are the best representation of how private market industry has performed, and relative performance will indicate success/failure against broad private market strategies. Public market equivalents may introduce unnecessary tracking error at the total portfolio level when markets swing materially.

*Note on Burgiss; This index provider has the largest sample size of private equity funds with added customization for sub geographies and strategies. This provides the most direct comparison to other private market investors. Other commonly utilized private market index providers include Cambridge and Preqin. These were also evaluated (see below) and Burgiss is recommended.*

	<b>Preqin</b>	<b>Cambridge</b>	<b>Burgiss</b>
<b>Description</b>	New York and London-based data provider that focuses on alternative assets.	Boston-based investment advisor that focuses on foundations and endowments.	Burgiss provides a peer universe of private equity funds sourced directly from LPs (over 1,000 firms in 32 countries use the data services provided by Burgiss).
<b>Stats</b>	Performance on over 4,700 Private Equity funds	Database dates back through 1981  Over 5,400 Private Equity funds	Database dates back through 1978  Over 6,800 Private Equity Funds
<b>Usage</b>	Internal Rate of Returns  Quartile rankings  Fund league tables	Internal Rate of Returns  TVPIs, DPIs  Provide both Quartile and Pooled returns	Internal Rate of Returns  TVPIs, DPIs  Provide both Quartile and Pooled returns
<b>Advantages</b>	Transparency: can view individual fund names and performance  Customizable  Less survivorship bias because does not rely on GP self-reporting	Large sample in Venture Capital  Customizable	Returns based on actual investor cash flows  Customizable  Preset publication dates  Sourced directly from LPs rather than voluntary GP submissions, internet data extraction or FOIA requests  Less survivorship bias because it is not reliant on GP reporting

<b>Limitations</b>	Heavily reliant on publicly reported LP information	Sourced from both GPs and LPs, which can lead to survivorship bias if GPs stop reporting	Benchmark based on Burgiss clients, which can lead to selection bias
	Selection bias since largely relies on public information and may not include funds with no public investors	Benchmark includes Cambridge's clients that includes large number of Endowments & Foundations, which can create selection bias	Lack of transparency
		No visibility to underlying funds	

	<b>Benchmark</b>	<b>Investable</b>	<b>Measurable</b>	<b>Complete</b>	<b>Transparent (Unambiguous)</b>	<b>Appropriate</b>
<b>Preqin</b>		No	Yes	Over 4,700 funds	Funds are disclosed	Fund data is heavily reliant on public information
<b>Cambridge</b>		No	Yes	Over 5,400 PE funds	Constituents are not disclosed	Represents mostly E&F holdings
<b>Burgiss</b>		No	Yes	Over 6,800 PE funds	Constituents are not disclosed	Represents broad, global exposure of institutional investors

*Although no benchmark meets all of the CFA Institute's criteria, Burgiss provides the most robust and appropriate benchmark for Private Equity portfolios.*

## Private Real Estate

Current benchmark: None (new asset class being recommended)

**The recommended benchmark is the MSCI Global Property Fund Index.** The MSCI Global Property Fund Index is a robust data set of more than 110+ core real estate funds covering the 25 most mature real estate markets globally. This benchmark also aligns with the expectation that the PRF will invest at the more conservative end of the risk spectrum within this asset class, which we believe is appropriate.

## Long-Term Measures of Success

### Primary Objective:

Mercer recommends a primary objective that is in-line with the portfolios ability to maintain purchasing power, after spending. With the prior recommendation of CPI being the primary deflator measure, this would imply that **a primary objective should be CPI + 3%**. This is Mercer's recommendation as it is a direct long-term assessment of success for the PRF. CPI (and CPI + 3%) is not investable and thus any portfolio would exhibit significant tracking error relative to this objective. This makes taking a longer-term view more important to allow shorter-term noise to cancel out. We suggest evaluating performance vs the CPI + 3% objective over rolling periods of at least 5 years. For shorter time frames, the Policy Index can be used for evaluation.

### Secondary Objective

A secondary objective is warranted that focuses short-term risk tolerances, to ensure the MoF is able to weather realized experience and maintain the long-term strategy. If we assume a sustainable target of 6.0%, what period and threshold of underperformance would be tolerated before reconsidering the long-term positioning? We would caution against abandoning the long-term strategic targets due to short- or intermediate-term underperformance but understand that a certain level of underperformance can result in pressure to change course. To the extent that threshold is known or able to be estimated, we would suggest using it as a risk constraint.

In the absence of a hard constraint, we can use the shorter-term drawdown scenarios to analyze this timeframe risk. **Mercer recommends utilizing a CVaR metric for the portfolio here: CVaR 5<sup>th</sup> Percentile of -20%**. This should be measured annually with forward-looking expectations to ensure the portfolio is not at risk of losing more than 20% in any given year.

### Measuring Success.

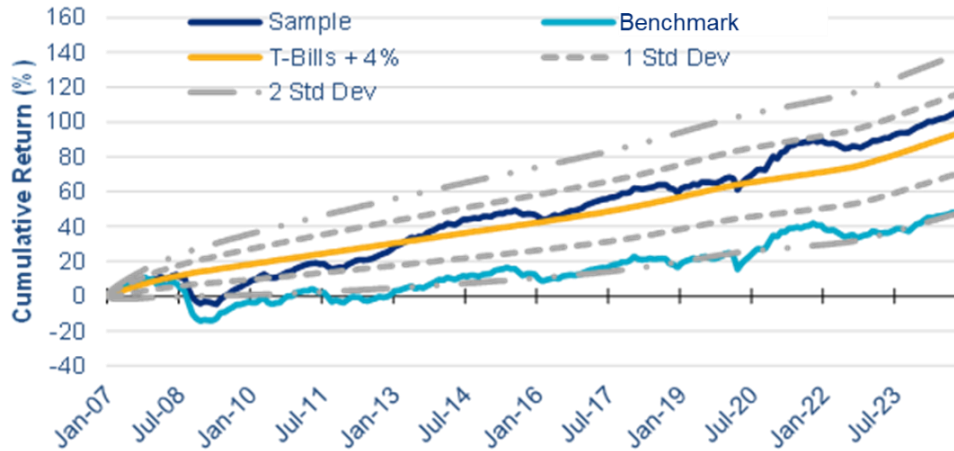
There are a variety of ways that success can be measured and analytics that can be run. Mercer recommends that a funnel chart be used with the Finance Committee to detail the program's performance "path" vs. expectations and distribution of expected growth.

A variety of metrics can be measured with this chart:

- Actual vs. Expected Market Value
- Actual vs. Expected Cumulative Spending
- Actual vs. Expected Cumulative Return

After producing this on a regular basis, action and further analysis should be undertaken if actual experience should fall below 2 standard deviations of expectations for over one year. Mercer would recommend considering a study to assess and realign portfolio with needs based on this temporary deviation.

Illustrative example of a funnel chart:



“Sample” represent the experienced results.

Tbills+4% is the expected long term path.

Dashed gray lines represent the range of expected outcomes around the expected path.

## Monitoring Program Assumptions over Time

In addition to measuring success of a program against pre-set goals and objectives, Mercer also recommends evaluating the assumptions over time. Below are the typical cadence we recommend, barring any material changes to the objectives, directives from governing bodies, or material cash flows (in or out).

- Spending Policy – Evaluate every 3-5 years to ensure in-line with expectations and needs
- Spending Rate – Evaluate every 3-5 years to ensure purchasing power continues to be maintained with the amount being withdrawn from the portfolio. Take into considerations any other expected PRF cash flows to assess if the rate should be adjusted.
- Asset allocation and expected return – Model total portfolio expectations and drawdown risks with updated capital market assumptions annually, to ensure any market dynamics and return expectation changes have not deteriorated the probability of success
- Private Program Commitment Pacing – Model annually to ensure the program is not over/under committing relative to needs and asset allocation target

## Conclusions

Total Policy Benchmarking: A total portfolio policy benchmark can be created utilizing the benchmarks below multiplied by the policy weight\*.

Asset Classes	Benchmark
Global Equity	MSCI ACWI Ex Chile Index
Private Equity*	Actual (years 1-4); Burgiss Global Private Equity – Total (years 5+)
Private Real Estate	MSCI Global Property Funds Index

Asset Classes	Benchmark
<b>Growth Fixed Income</b> <i>(High Yield and EMD)</i>	50% Bloomberg Global High Yield Corporate 50% JP Morgan EMBI Global Diversified Index
<b>Global Corporate Debt</b>	Bloomberg Global Aggregate Corporate
<b>US MBS</b>	Bloomberg US MBS Index
<b>Global Government</b>	Bloomberg Global Treasury Index Developed Market
<b>Inflation Linked Fixed Income</b>	Bloomberg Global Inflation-Linked

\*At the total portfolio level, Mercer recommends using actual weight of the private program and adjusting the over/underweight relative to target from the Global Equity allocation to account for the private equity contribution pacing being subject to the general partners' control. i.e. If private equity actual allocation is underweight by 3%, use the actual weight and adjust the global equity target weight upwards by 3% so the policy weight continues to add to 100%.

\*\*We recommend benchmarking the total private equity program to itself during the initial J-curve period (years 1-4) and versus a robust Burgiss peer group thereafter.

Primary Long-Term Objective Measure: Mercer recommends a primary objective of CPI + 3% over rolling periods of at least 5 years.

Secondary Objective Measure: Mercer recommends utilizing a CVaR metric for the portfolio here: CVaR 5<sup>th</sup> Percentile of -20%.

## Section 10

# Summary Recommendations

### Spending Policy

Mercer recommends the following methodology and rate is used for the PRF moving forward:

Hybrid Spending Methodology: 80% Prior Year Spending Adjusted for CPI plus 20% Spending Rate \* Market Value

Spending Rate: 3%

### Deflator

Mercer recommends to use CPI as the key deflator for the spending policy and to assess long-term success at maintaining purchasing power.

### Asset Allocation

The below table outlines the recommendation for the asset allocation moving forward, and includes policy ranges. The policy ranges can be modified given implementation decisions and expectations and are conservative and prudent for the PRF moving forward.

Asset Classes	Allocation	Policy Range
Global Equity	56%	51 – 61%
Private Equity	9%	0 – 19%
Private Real Estate	6%	0 – 16%
Growth Fixed Income (High Yield and EMD)	6%	0 – 11%
Global Corporate Debt	4%	0 – 9%
US MBS	3%	0 – 8%
Global Government	8%	3 – 13%
Inflation Linked Fixed Income	8%	3 – 13%

### Treatment of Loans

Any assets loaned from the PRF investible asset pool should be treated as a separate asset of the PRF, outside of the investment asset allocation and not included in the spending formula calculations.

### Implementation Considerations

We recommend an incremental implementation plan, adjusting the spending rate over time from an initial level of 2% to the long term target level of 3%.

## Benchmarking

The below table outlines benchmarking for the total portfolio.

Asset Classes	Benchmark
Global Equity	MSCI ACWI Ex Chile Index
Private Equity	Actual (years 1-4); Burgiss Global Private Equity – Total (years 5+)
Private Real Estate	MSCI Global Property Funds Index
Growth Fixed Income (High Yield and EMD)	50% Bloomberg Global High Yield Corporate 50% JP Morgan EMBI Global Diversified Index
Global Corporate Debt	Bloomberg Global Aggregate Corporate
US MBS	Bloomberg US MBS Index
Global Government	Bloomberg Global Treasury Index Developed Market
Inflation Linked Fixed Income	Bloomberg Global Inflation-Linked

## Measures of Success

Primary Long-Term Objective Measure: CPI + 3% over rolling periods of at least 5 years. Policy Index also utilized to facilitate performance evaluation and attribution.

Secondary Objective Measure: Forward-looking metric for the portfolio to ensure acceptable downside risk with the latest capital market assumptions: CVaR 5<sup>th</sup> Percentile of -20%.

Mercer recommends measuring results vs. expectations on a regular basis and further evaluate if results are >2 standard deviations below for over one year. If realized results are outside of expectations for over one year, Mercer would recommend doing a study to evaluate ways to shift the portfolio or spending to move in-line with expectations.

## Appendix A

# Assorted Mercer White Papers

### **MercerInsight Community**

The MercerInsight Community (MIC) is our strategic research web platform that facilitates the publication and sharing of Mercer's latest intellectual capital and research with clients and internal investment and consulting teams. In addition, MIC allows the broader investment management community to post their own research, which gives clients and Mercer a central location to stay on top of the latest industry thinking. Clients may sign up for this service free of charge using the website below:

<https://insightcommunity.mercer.com/signup>

The platform hosts a large collection of white papers, and we wanted to highlight a handful below.

### **Developing a Spending Policy to Help Portfolios Remain Resilient**

A well-considered spending rule is one of the most important policy components for not-for-profit institutions. Asset allocation rightly demands a significant level of attention because of its involvement in capital creation, but allocation decisions are most heavily influenced by understanding how much an institution needs to spend to serve its community and achieve its mission. For investment committees, the prudent stewardship of assets includes developing a spending policy that instills discipline not only under normal economic conditions, but also in times of market stress.

An effective policy optimizes what economist James Tobin coined "intergenerational equity," the idea that "the trustees of endowed institutions are the guardians of the future against the claims of the present." Spend too little and reduce the endowment's impact today; spend too much and potentially reduce its impact tomorrow. If there was predictability around future performance the calculus would be infinitely less difficult, but because institutions don't enjoy this luxury they must manage these competing priorities accordingly.

We hope that this paper can assist clients in developing a process and structure around the spending policy decision. Because changes to the spending policy should occur infrequently, it's important to consider all the relevant factors before deciding on the policy that best matches an institution's objectives, ensuring that it is well-positioned financially to help achieve its mission going forward.

Link: [https://insightcommunity.mercer.com/research/653215771b773c001ba3fd56/Mercer\\_Weathering\\_any\\_Storm\\_Spending\\_Policy](https://insightcommunity.mercer.com/research/653215771b773c001ba3fd56/Mercer_Weathering_any_Storm_Spending_Policy)

### **The Art & Science of CMAs and their role in portfolio construction**

In this paper, we define Capital Market Assumptions (or CMAs) and describe how to correctly interpret them. We begin this paper by briefly outlining how Mercer produces its CMAs using our proprietary regime-switching stochastic model that is based on fundamental economic and financial building blocks and calibrated towards current market conditions. While we find that our historical forecasts have been reasonably close to actual market performance over the long run for broader asset class aggregates, we caution users not to focus on precise "expected return" point estimates, but instead consider the entire distribution, incorporating potential tail events and the scenarios involved. These will ultimately determine whether the investor can sit out the journey.

When it comes to using CMAs for portfolio construction, we move from the economic and statistical formulae that underpin our stochastic financial modelling towards the art of portfolio construction. We caution against using mean-variance optimization for anything but creating an initial strawman portfolio, otherwise this leads to an error maximization exercise by focusing on point estimates rather than return distributions. The right approach is to analyze the entire stochastic distribution of expected portfolio return paths for different strategic asset allocations and enhance this analysis with deterministic scenarios to test for robustness. From here, qualitative considerations such as liquidity needs, taxes and investment beliefs should be considered. The consultant, portfolio manager or strategist can aim to add the most value here by driving the discussion with the asset owners to ultimately build a portfolio that is most suitable for their individual needs.

We believe CMAs are extremely useful to scope out this journey and help us understand the role and impact of different asset classes on the total portfolio. While very important, they are not the only tool of a robust portfolio construction process and should be seen as complements rather than a substitute for qualitative investment views and investor-specific considerations.

Link:

[https://insightcommunity.mercer.com/research/664c15fe634356f361d3573e/Mercer\\_Making\\_the\\_right\\_choices\\_The\\_Art\\_and\\_Science\\_of\\_Capital\\_Market\\_Assumptions\\_and](https://insightcommunity.mercer.com/research/664c15fe634356f361d3573e/Mercer_Making_the_right_choices_The_Art_and_Science_of_Capital_Market_Assumptions_and)

### **Private Investigations: A building block approach to Private Market Assumptions**

In this paper, we review three approaches to setting private market capital market assumptions, using private equity as an example. The first approach sets out Mercer's general strategy for modelling private equity, which has traditionally been based on a risk factor model. The second approach is based on an analysis of the excess returns historically achieved by private equity and venture capital. As a third approach, we create a bottom-up model of a representative private equity portfolio company that takes into consideration factors such as implied operational improvement, leverage and valuation changes.

We conclude that each approach leads to similar results. Historical excess returns and bottom-up modelling validate the private equity return assumptions that the risk factor model used in our capital market assumptions produces for traditional private equity strategies.

Link:

[https://insightcommunity.mercer.com/research/66e2272c0347c08b68251998/Mercer\\_Private\\_Investigations\\_A\\_building\\_block\\_approach\\_to\\_Private\\_Market\\_Assumptions](https://insightcommunity.mercer.com/research/66e2272c0347c08b68251998/Mercer_Private_Investigations_A_building_block_approach_to_Private_Market_Assumptions)

### **Real assets, real returns: Modelling real estate and infrastructure**

In this paper, we review three complementary approaches to setting real estate and infrastructure capital market assumptions. Mercer's strategy for modelling unlisted real assets is traditionally based on a risk factor model that considers the unlisted asset class's sensitivity to the performance of public market return factors such as equity and credit risk premia, as well as macro factors such as interest rates, GDP growth (as demographics influence supply and demand) and inflation. Net of fees average alpha is added for value-add and opportunistic assets.

This is validated empirically through the returns historically achieved by real estate and infrastructure based on an analysis of Burgiss and listed market data. In addition, we apply forward-looking, fundamental bottom-up models for both real estate and infrastructure, as we want to be informed but not guided by the past.

These three approaches give us consistent results. Historical risk factor betas derived through regression analysis already incorporate an empirical element, which we validate further by looking at the historical returns of the asset classes across different annualized time periods to understand different regimes and trends that may have been driving forces.

Link:

[https://insightcommunity.mercer.com/research/675310b1c8849fa268575fd7/Mercer\\_Real\\_assets\\_real\\_returns\\_Modelling\\_real\\_estate\\_and\\_infrastructure](https://insightcommunity.mercer.com/research/675310b1c8849fa268575fd7/Mercer_Real_assets_real_returns_Modelling_real_estate_and_infrastructure)

## Appendix B

# 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.

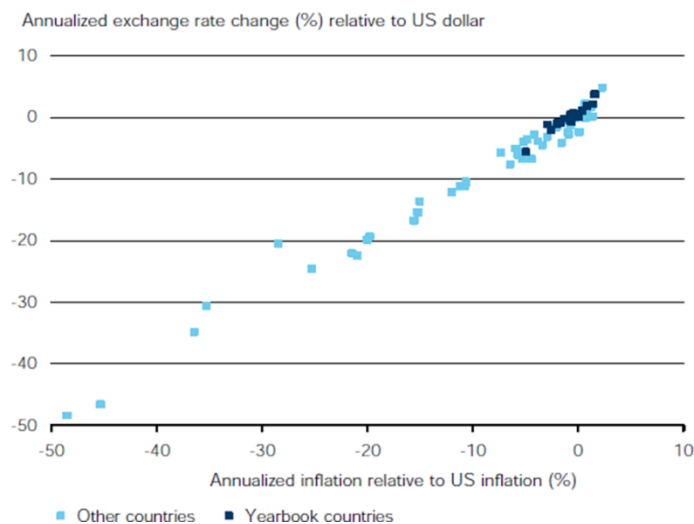
In the "relative" version, the difference in the rate of change in prices at home and abroad – the difference in the inflation rates – is equal to the percentage depreciation or appreciation of the exchange rate.

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 study<sup>3</sup> 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.

**Exchange rates and inflation: 83 countries, 1970–2011**

Source: Elroy Dimson, Paul Marsh, and Mike Staunton; Global Financial Data and IMF



<sup>3</sup> Elroy Dimson, Paul Marsh and Mike Staunton (all of the London Business School), Currency Matters, Credit Suisse Global Investment Returns Yearbook 2012

Our approach for currencies of referring 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. At the time of this analysis, CLP had an initial PPP deviation of -54% relative to the USD. We cap the assumed PPP valuation deviation impact at 50% and also incorporate the Current Account Balance in determining the amount of PPP reversion that will be incorporated. Due to the elevated negative Current Account Balance and 50% deviation cap, this resulted in a 15% reversion in CLP over 20 years, which increase CLP FX returns by 0.2% per year.

CLP inflation of 3% minus USD Inflation of 2.2% generates a baseline appreciation of USD relative to CLP of 0.8% per year. Reversion of starting PPP mis-valuation reduces USD appreciation by 0.2%. The final modeled return for USD in CLP is +0.6% on average.

# Appendix C

## Mercer Stochastic Simulation Model

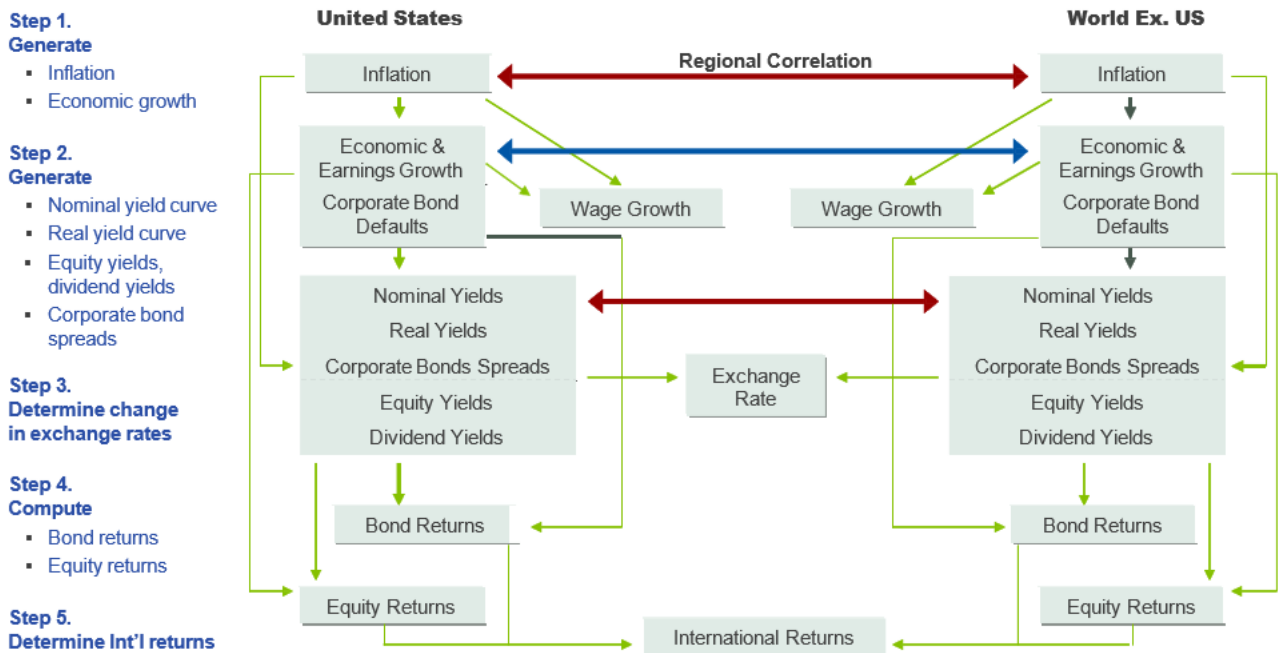
The Capital Market Simulator is a stochastic economic and capital market simulation system. It produces a data set of many trials of future economic and capital markets scenarios. It uses a fundamental approach to simulating economic and asset returns. It starts with the most basic independent economic 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 is 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 could capture 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:**

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

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:**

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

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 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 can 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.

Asset Class	Short Name	Geometric Return	Std. Deviation	Return/Risk
CPI - Chilean Inflation	Inflation - Chile	3.01%	2.52%	1.195

## Appendix D

# Back Testing Supplemental Information

We relied on the following representative index return streams for each asset class.

Asset Class	Representative Index
Global Gov	JP Morgan GBI Global
Global ILS	Bloomberg Global Inflation Linked
Global Credit	Bloomberg Global Aggregate Corporate
US MBS	Bloomberg US Mortgage Backed Securities
Global High Yield	ICE BofA Global High Yield
Emerging Market Debt – Sovereign (Hard Currency)	JP Morgan EMBI Global Diversified
Global Equity	MSCI AC World
Private Equity	Burgiss Global Private Equity Index
Private Real Estate	MSCI Global Property Fund Index since 2008. S&P Global Property Index prior to 2008, since MSCI Global Property Fund Index returns were only published annually prior to 2008

### Asset Class Quarterly Return Streams (in CLP)

Representative Index	JP Morgan GBI Global	Bloomberg Global Inflation Linked	Bloomberg Global Aggregate Corporate	Bloomberg US Mortgage Backed Securities	ICE BofA Global High Yield	JP Morgan EMBI Global Diversified	MSCI AC World	Burgiss Global Private Equity Index	MSCI Global Property Fund Index / S&P Global Property Index
Sep-2024	7.95%	6.61%	6.95%	6.17%	6.53%	6.80%	7.37%	1.90%	0.88%
Jun-2024	-0.48%	0.63%	1.32%	1.56%	2.73%	1.79%	4.55%	4.62%	0.70%
Mar-2024	-1.70%	-0.81%	0.24%	-0.05%	2.48%	3.06%	9.41%	0.46%	-0.60%
Dec-2023	10.79%	11.59%	11.86%	10.47%	10.62%	12.20%	14.24%	4.44%	-1.14%
Sep-2023	4.88%	4.00%	6.57%	5.12%	9.64%	7.12%	5.95%	11.49%	7.79%
Jun-2023	0.37%	0.83%	2.71%	1.98%	4.31%	4.88%	9.16%	3.27%	0.57%
Mar-2023	3.13%	4.41%	3.40%	2.46%	3.53%	1.80%	7.38%	-2.19%	-2.31%
Dec-2022	-11.22%	-10.91%	-9.80%	-12.58%	-8.44%	-7.47%	-5.96%	-18.96%	-18.62%
Sep-2022	-3.63%	-6.54%	-2.92%	-1.76%	1.08%	-0.95%	-3.17%	2.35%	3.78%
Jun-2022	-2.99%	-8.88%	-3.30%	1.70%	-6.13%	-6.17%	-10.51%	11.76%	10.15%
Mar-2022	1.18%	3.13%	-0.12%	2.54%	1.41%	-2.91%	2.23%	14.34%	14.23%
Dec-2021	-2.19%	1.35%	-1.78%	-1.70%	-2.06%	-1.76%	5.35%	10.87%	5.39%

<b>Sep-2021</b>	4.86%	6.65%	5.20%	6.11%	5.64%	5.26%	4.99%	17.64%	11.36%
<b>Jun-2021</b>	8.33%	10.28%	10.03%	7.54%	9.93%	11.53%	15.25%	25.61%	11.23%
<b>Mar-2021</b>	-8.92%	-6.76%	-7.56%	-4.52%	-3.54%	-7.84%	1.06%	7.15%	-1.53%
<b>Dec-2020</b>	-2.67%	-0.18%	-0.76%	-4.59%	2.34%	0.70%	9.26%	4.69%	-3.21%
<b>Sep-2020</b>	3.95%	4.99%	4.52%	1.49%	6.36%	3.73%	9.74%	-6.47%	1.96%
<b>Jun-2020</b>	-7.43%	-2.71%	-0.96%	-8.16%	1.73%	2.42%	8.93%	-3.38%	-10.53%
<b>Mar-2020</b>	7.92%	1.83%	-0.99%	7.63%	-10.08%	-9.33%	-17.57%	6.46%	4.94%
<b>Dec-2019</b>	6.86%	7.42%	9.34%	8.18%	11.08%	9.37%	17.16%	12.58%	9.11%
<b>Sep-2019</b>	7.33%	7.96%	7.40%	7.57%	6.56%	7.72%	6.22%	11.55%	7.41%
<b>Jun-2019</b>	6.67%	5.36%	7.13%	5.10%	6.02%	7.28%	7.00%	2.87%	4.21%
<b>Mar-2019</b>	4.08%	6.21%	6.47%	4.44%	8.86%	9.33%	14.82%	6.58%	3.55%
<b>Dec-2018</b>	-2.35%	-5.04%	-5.05%	-2.28%	-7.90%	-5.47%	-16.38%	0.16%	-2.63%
<b>Sep-2018</b>	6.76%	6.83%	9.05%	8.48%	10.79%	11.11%	13.38%	12.22%	10.74%
<b>Jun-2018</b>	2.15%	1.89%	2.86%	5.60%	3.99%	1.62%	6.10%	10.89%	7.48%
<b>Mar-2018</b>	2.05%	1.48%	-0.95%	-1.31%	-0.34%	-1.86%	-0.96%	4.21%	1.96%
<b>Dec-2017</b>	-1.39%	0.43%	-0.95%	-2.21%	-1.60%	-1.22%	3.34%	2.18%	0.10%
<b>Sep-2017</b>	-3.36%	-2.82%	-2.79%	-4.01%	-2.22%	-2.42%	0.12%	-1.43%	-2.99%
<b>Jun-2017</b>	0.53%	-0.02%	1.45%	-1.16%	1.07%	0.19%	2.35%	0.13%	-0.15%
<b>Mar-2017</b>	4.40%	4.25%	4.56%	3.40%	6.08%	6.90%	10.17%	6.97%	4.86%
<b>Dec-2016</b>	-8.74%	-5.80%	-4.64%	-2.44%	-0.03%	-4.48%	0.82%	1.28%	1.74%
<b>Sep-2016</b>	0.49%	3.48%	2.19%	0.92%	5.59%	4.37%	5.77%	-0.12%	1.97%
<b>Jun-2016</b>	4.13%	2.18%	2.68%	1.63%	4.99%	5.56%	1.71%	3.17%	2.26%
<b>Mar-2016</b>	-3.38%	-5.22%	-5.34%	-7.69%	-5.93%	-4.92%	-9.13%	-9.99%	-7.79%
<b>Dec-2015</b>	2.37%	1.07%	2.72%	3.46%	2.27%	4.86%	8.90%	9.41%	6.84%
<b>Sep-2015</b>	4.52%	1.14%	2.39%	3.77%	-2.32%	0.69%	-7.12%	4.39%	5.69%
<b>Jun-2015</b>	8.57%	10.59%	8.70%	9.60%	11.99%	10.04%	10.99%	14.64%	14.14%
<b>Mar-2015</b>	-5.56%	-5.31%	-4.98%	-2.82%	-3.51%	-1.90%	-1.50%	-3.80%	-1.19%
<b>Dec-2014</b>	8.80%	9.66%	9.87%	11.76%	7.20%	9.20%	10.38%	15.11%	13.25%
<b>Sep-2014</b>	-2.48%	-1.95%	-1.32%	1.02%	-2.52%	0.24%	-1.38%	4.15%	3.84%
<b>Jun-2014</b>	4.11%	5.45%	4.50%	4.23%	4.74%	6.63%	7.11%	9.64%	4.77%
<b>Mar-2014</b>	5.27%	5.36%	5.17%	4.12%	5.44%	6.33%	3.74%	8.52%	4.99%
<b>Dec-2013</b>	6.43%	7.68%	9.16%	7.34%	11.90%	9.43%	15.79%	10.98%	10.88%
<b>Sep-2013</b>	1.46%	2.58%	1.59%	-0.17%	2.20%	-0.01%	6.74%	1.46%	1.64%
<b>Jun-2013</b>	5.75%	2.83%	6.37%	6.97%	7.66%	2.96%	8.86%	12.97%	12.24%
<b>Mar-2013</b>	-2.77%	-0.91%	-1.10%	-0.01%	1.93%	-2.23%	6.66%	3.26%	2.09%
<b>Dec-2012</b>	-3.51%	0.95%	0.15%	-1.91%	2.83%	1.04%	1.25%	-2.00%	-0.06%
<b>Sep-2012</b>	2.14%	2.56%	4.12%	0.49%	5.10%	5.98%	6.30%	4.97%	1.22%
<b>Jun-2012</b>	1.05%	-0.52%	0.02%	0.82%	0.13%	2.48%	-5.62%	2.32%	1.55%
<b>Mar-2012</b>	-2.16%	1.33%	2.57%	-0.70%	6.06%	2.94%	10.61%	-6.29%	0.90%
<b>Dec-2011</b>	2.26%	4.65%	3.07%	3.01%	7.55%	6.86%	9.57%	7.40%	4.49%
<b>Sep-2011</b>	8.44%	5.05%	3.51%	7.71%	-3.44%	3.03%	-13.01%	10.95%	7.93%
<b>Jun-2011</b>	3.99%	4.66%	3.28%	2.93%	1.89%	4.52%	1.08%	9.24%	3.86%
<b>Mar-2011</b>	-4.77%	-1.88%	-3.03%	-4.73%	-0.67%	-4.46%	-0.99%	0.59%	-2.45%
<b>Dec-2010</b>	-3.96%	-3.27%	-3.86%	-1.98%	-0.16%	-3.93%	6.42%	-1.50%	1.27%

<b>Sep-2010</b>	3.27%	3.31%	3.69%	-3.73%	4.22%	3.54%	9.50%	-2.37%	-0.69%
<b>Jun-2010</b>	1.84%	-1.46%	-0.76%	3.25%	-1.70%	1.62%	-11.63%	6.65%	3.71%
<b>Mar-2010</b>	-2.11%	-2.78%	-0.62%	0.48%	3.45%	3.17%	2.15%	5.13%	0.56%
<b>Dec-2009</b>	-3.79%	-1.08%	-1.18%	-1.36%	3.64%	-0.33%	2.72%	2.99%	-2.57%
<b>Sep-2009</b>	5.47%	4.62%	8.82%	1.85%	16.07%	9.92%	17.45%	-4.98%	-4.64%
<b>Jun-2009</b>	-5.81%	-1.79%	2.95%	-7.87%	14.77%	1.94%	12.11%	-23.55%	-15.27%
<b>Mar-2009</b>	-8.75%	-4.37%	-7.87%	-2.09%	0.41%	-0.52%	-14.33%	-12.67%	-14.70%
<b>Dec-2008</b>	-0.13%	-14.65%	-9.09%	-5.04%	-25.75%	-15.44%	-29.24%	-10.11%	-18.92%
<b>Sep-2008</b>	28.86%	21.89%	19.47%	34.73%	17.88%	25.62%	10.43%	31.32%	29.63%
<b>Jun-2008</b>	6.54%	11.12%	10.10%	10.87%	13.35%	10.40%	9.90%	16.73%	11.11%
<b>Mar-2008</b>	7.82%	5.39%	0.84%	0.81%	-4.04%	-0.99%	-10.62%	1.49%	-1.33%
<b>Dec-2007</b>	-1.75%	-1.46%	-3.62%	-2.61%	-6.42%	-2.85%	-7.11%	3.34%	-14.70%
<b>Sep-2007</b>	0.63%	-0.03%	-2.65%	-3.61%	-5.39%	-3.87%	-2.75%	-1.32%	-2.66%
<b>Jun-2007</b>	0.41%	1.92%	1.70%	1.65%	2.75%	0.59%	9.74%	15.58%	-2.42%
<b>Mar-2007</b>	-1.56%	-1.85%	-1.36%	-1.21%	-0.10%	-0.35%	-0.21%	0.70%	3.65%
<b>Dec-2006</b>	5.24%	5.25%	6.01%	5.20%	8.35%	7.49%	13.03%	10.19%	18.67%
<b>Sep-2006</b>	-1.53%	-0.01%	-0.28%	0.43%	0.66%	3.12%	1.38%	2.24%	6.20%
<b>Jun-2006</b>	8.08%	8.53%	7.15%	4.94%	6.12%	2.59%	4.28%	12.21%	3.85%
<b>Mar-2006</b>	-7.11%	-7.74%	-7.03%	-6.79%	-3.70%	-5.11%	-0.12%	-0.73%	6.10%
<b>Dec-2005</b>	-4.97%	-3.69%	-4.06%	-2.54%	-2.83%	-1.63%	0.20%	2.41%	1.27%
<b>Sep-2005</b>	-4.95%	-2.92%	-4.48%	-3.93%	-2.71%	-0.37%	3.65%	-3.76%	2.32%
<b>Jun-2005</b>	-4.13%	-2.88%	-2.88%	-0.82%	-1.30%	2.78%	-2.24%	8.76%	5.72%
<b>Mar-2005</b>	-2.40%	-1.76%	-2.02%	-0.08%	-1.68%	-1.03%	-0.81%	4.08%	-5.09%

## Portfolio Quarterly Return Streams in CLP

	Portfolio Option 1	Portfolio Option 2	Portfolio Option 3	Portfolio Option 1 with 50% ILS	Portfolio Option 2 with 50% ILS	Portfolio Option 3 with 50% ILS
<b>Sep-2024</b>	6.47%	6.48%	6.51%	6.32%	6.38%	6.44%
<b>Jun-2024</b>	2.72%	3.16%	3.66%	2.84%	3.25%	3.72%
<b>Mar-2024</b>	4.08%	5.18%	6.43%	4.17%	5.25%	6.47%
<b>Dec-2023</b>	11.13%	11.50%	11.94%	11.22%	11.57%	11.98%
<b>Sep-2023</b>	6.58%	6.53%	6.45%	6.49%	6.46%	6.41%
<b>Jun-2023</b>	5.13%	5.96%	6.89%	5.18%	5.99%	6.92%
<b>Mar-2023</b>	4.14%	4.66%	5.29%	4.27%	4.77%	5.36%
<b>Dec-2022</b>	-9.69%	-9.20%	-8.66%	-9.65%	-9.18%	-8.64%
<b>Sep-2022</b>	-1.96%	-2.08%	-2.27%	-2.26%	-2.32%	-2.41%
<b>Jun-2022</b>	-4.33%	-5.15%	-6.05%	-4.95%	-5.62%	-6.35%
<b>Mar-2022</b>	3.39%	3.61%	3.87%	3.60%	3.76%	3.97%
<b>Dec-2021</b>	2.83%	3.71%	4.74%	3.20%	3.99%	4.92%
<b>Sep-2021</b>	6.59%	6.56%	6.53%	6.78%	6.71%	6.62%

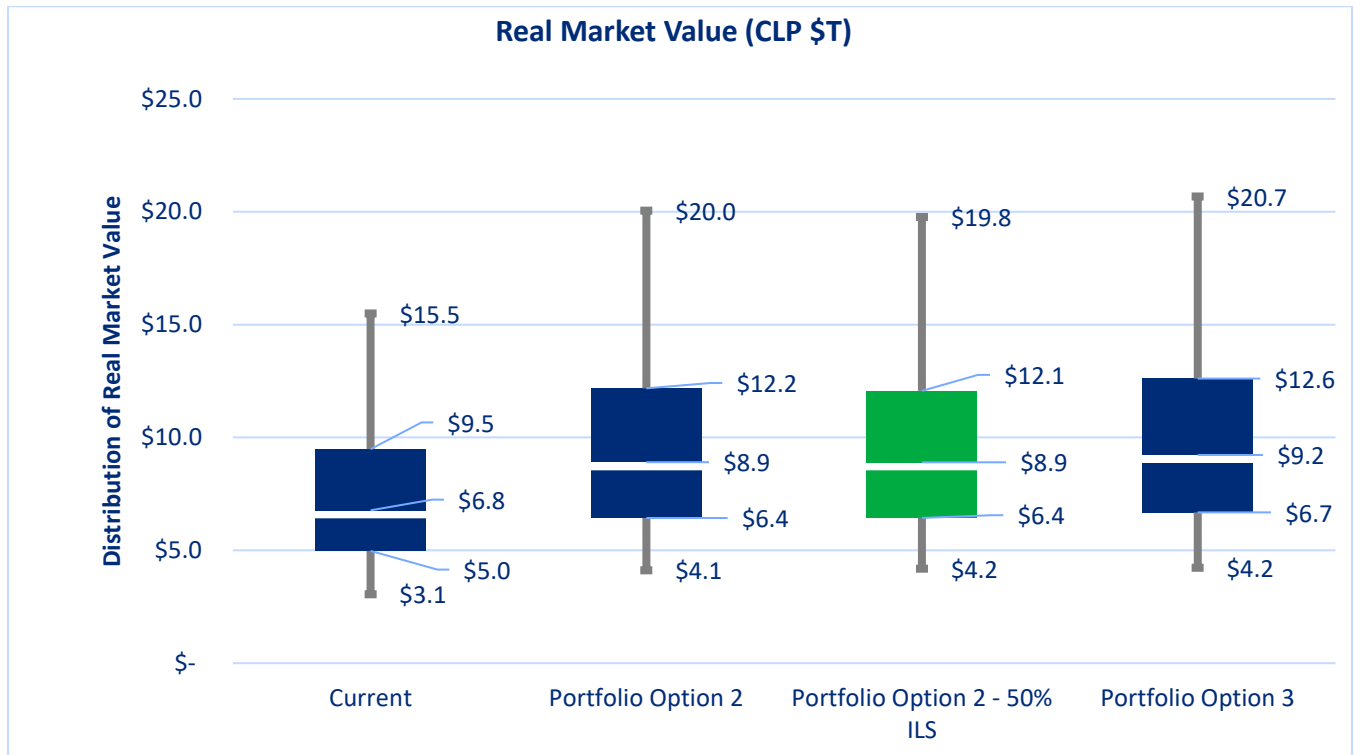
<b>Jun-2021</b>	13.41%	14.12%	14.93%	13.62%	14.28%	15.03%
<b>Mar-2021</b>	-2.06%	-1.06%	0.09%	-1.83%	-0.89%	0.19%
<b>Dec-2020</b>	3.66%	4.91%	6.33%	3.93%	5.11%	6.45%
<b>Sep-2020</b>	5.49%	6.15%	6.92%	5.60%	6.24%	6.97%
<b>Jun-2020</b>	1.26%	2.72%	4.38%	1.75%	3.09%	4.62%
<b>Mar-2020</b>	-5.91%	-8.09%	-10.51%	-6.55%	-8.57%	-10.81%
<b>Dec-2019</b>	12.58%	13.62%	14.82%	12.64%	13.66%	14.85%
<b>Sep-2019</b>	7.22%	7.09%	6.95%	7.29%	7.14%	6.98%
<b>Jun-2019</b>	6.29%	6.33%	6.39%	6.15%	6.23%	6.32%
<b>Mar-2019</b>	9.66%	10.70%	11.87%	9.88%	10.87%	11.98%
<b>Dec-2018</b>	-8.91%	-10.37%	-12.04%	-9.19%	-10.58%	-12.18%
<b>Sep-2018</b>	11.03%	11.59%	12.23%	11.04%	11.60%	12.23%
<b>Jun-2018</b>	5.24%	5.64%	6.11%	5.22%	5.62%	6.10%
<b>Mar-2018</b>	0.29%	0.15%	-0.02%	0.23%	0.10%	-0.05%
<b>Dec-2017</b>	1.10%	1.66%	2.33%	1.29%	1.81%	2.42%
<b>Sep-2017</b>	-1.52%	-1.15%	-0.72%	-1.46%	-1.11%	-0.70%
<b>Jun-2017</b>	1.25%	1.47%	1.72%	1.20%	1.42%	1.70%
<b>Mar-2017</b>	7.38%	7.99%	8.68%	7.36%	7.98%	8.68%
<b>Dec-2016</b>	-1.86%	-1.11%	-0.27%	-1.55%	-0.88%	-0.12%
<b>Sep-2016</b>	3.41%	3.83%	4.28%	3.73%	4.07%	4.43%
<b>Jun-2016</b>	2.80%	2.52%	2.15%	2.59%	2.36%	2.05%
<b>Mar-2016</b>	-7.26%	-7.79%	-8.41%	-7.46%	-7.94%	-8.50%
<b>Dec-2015</b>	6.33%	7.05%	7.87%	6.19%	6.94%	7.81%
<b>Sep-2015</b>	-1.24%	-2.37%	-3.65%	-1.59%	-2.64%	-3.82%
<b>Jun-2015</b>	10.81%	10.99%	11.17%	11.02%	11.15%	11.27%
<b>Mar-2015</b>	-2.92%	-2.59%	-2.22%	-2.90%	-2.57%	-2.21%
<b>Dec-2014</b>	10.45%	10.61%	10.83%	10.54%	10.68%	10.87%
<b>Sep-2014</b>	-0.68%	-0.66%	-0.63%	-0.62%	-0.62%	-0.61%
<b>Jun-2014</b>	6.16%	6.44%	6.76%	6.30%	6.55%	6.83%
<b>Mar-2014</b>	4.88%	4.69%	4.45%	4.89%	4.69%	4.45%
<b>Dec-2013</b>	11.85%	12.74%	13.76%	11.98%	12.84%	13.82%
<b>Sep-2013</b>	3.70%	4.36%	5.14%	3.82%	4.45%	5.20%
<b>Jun-2013</b>	8.20%	8.56%	9.01%	7.89%	8.33%	8.86%
<b>Mar-2013</b>	2.69%	3.65%	4.77%	2.88%	3.80%	4.87%
<b>Dec-2012</b>	-0.25%	0.02%	0.30%	0.22%	0.37%	0.53%
<b>Sep-2012</b>	4.56%	4.90%	5.28%	4.61%	4.94%	5.30%
<b>Jun-2012</b>	-1.78%	-2.57%	-3.51%	-1.95%	-2.70%	-3.59%
<b>Mar-2012</b>	4.28%	5.43%	6.76%	4.64%	5.71%	6.93%
<b>Dec-2011</b>	6.64%	7.30%	8.01%	6.89%	7.49%	8.13%
<b>Sep-2011</b>	-1.99%	-4.11%	-6.54%	-2.35%	-4.38%	-6.71%
<b>Jun-2011</b>	3.01%	2.72%	2.38%	3.08%	2.77%	2.41%
<b>Mar-2011</b>	-2.16%	-1.83%	-1.45%	-1.85%	-1.60%	-1.30%
<b>Dec-2010</b>	1.42%	2.56%	3.88%	1.49%	2.62%	3.92%
<b>Sep-2010</b>	5.07%	5.86%	6.76%	5.08%	5.86%	6.76%

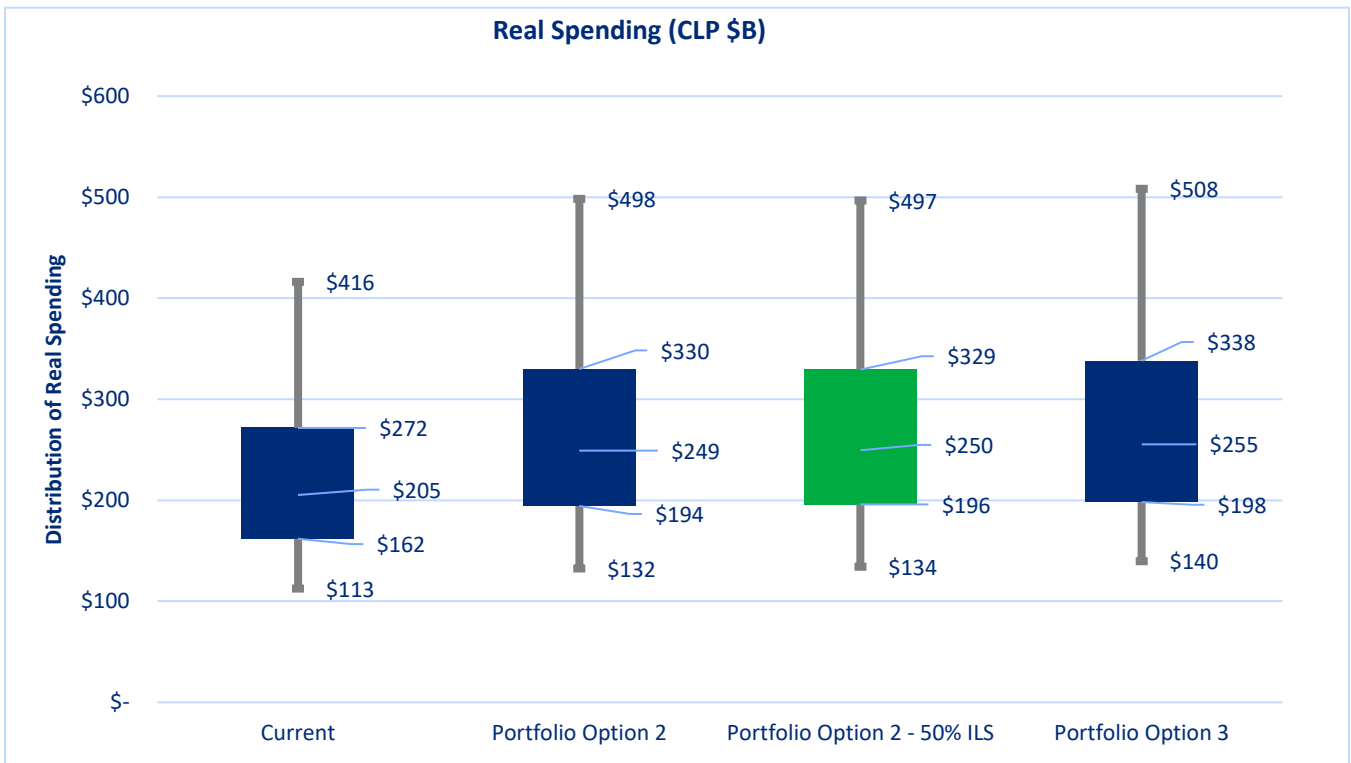
<b>Jun-2010</b>	-3.83%	-5.33%	-7.10%	-4.18%	-5.60%	-7.26%
<b>Mar-2010</b>	1.31%	1.55%	1.78%	1.24%	1.50%	1.75%
<b>Dec-2009</b>	0.56%	1.05%	1.58%	0.84%	1.26%	1.71%
<b>Sep-2009</b>	10.00%	11.11%	12.34%	9.91%	11.04%	12.30%
<b>Jun-2009</b>	1.77%	3.20%	4.79%	2.19%	3.52%	4.99%
<b>Mar-2009</b>	-10.72%	-11.83%	-13.20%	-10.26%	-11.47%	-12.98%
<b>Dec-2008</b>	-17.75%	-20.19%	-22.90%	-19.27%	-21.35%	-23.63%
<b>Sep-2008</b>	19.98%	18.18%	16.06%	19.25%	17.62%	15.71%
<b>Jun-2008</b>	10.13%	10.21%	10.28%	10.61%	10.57%	10.51%
<b>Mar-2008</b>	-3.14%	-4.73%	-6.56%	-3.40%	-4.93%	-6.68%
<b>Dec-2007</b>	-4.86%	-5.34%	-5.89%	-4.83%	-5.32%	-5.88%
<b>Sep-2007</b>	-2.12%	-2.21%	-2.29%	-2.19%	-2.26%	-2.33%
<b>Jun-2007</b>	5.96%	6.99%	8.20%	6.12%	7.12%	8.27%
<b>Mar-2007</b>	-0.29%	-0.19%	-0.08%	-0.32%	-0.21%	-0.10%
<b>Dec-2006</b>	10.23%	11.05%	11.97%	10.23%	11.05%	11.97%
<b>Sep-2006</b>	1.05%	1.22%	1.39%	1.21%	1.34%	1.47%
<b>Jun-2006</b>	5.98%	5.72%	5.45%	6.02%	5.75%	5.47%
<b>Mar-2006</b>	-2.38%	-1.65%	-0.84%	-2.45%	-1.71%	-0.87%
<b>Dec-2005</b>	-1.23%	-0.76%	-0.24%	-1.10%	-0.66%	-0.17%
<b>Sep-2005</b>	-0.21%	0.66%	1.65%	0.00%	0.83%	1.75%
<b>Jun-2005</b>	-0.85%	-0.88%	-0.95%	-0.72%	-0.78%	-0.89%
<b>Mar-2005</b>	-1.06%	-0.94%	-0.81%	-0.99%	-0.89%	-0.78%

## Appendix E

# Range of Expectations for Portfolios Under Consideration

The below charts highlight the range of real market value and real spending from the portfolio after 20 years. The recommended Portfolio Option 2 (with 50% ILS) is highlighted here in green.





## Appendix F

# Currency Hedging

### Introduction

One important consideration for investors is their base currency frame of reference. Most investors will define wealth maximization in their home currency. However, sovereign wealth funds often face the situation that they invest in foreign currency denominated assets. In practice, many adopt one of three reference points for evaluating the purchasing power of their assets:

- 1) Domestic. Preserving domestic purchasing power, as the portfolio will spend in domestic currency for domestic benefit.
- 2) US. As the world's dominant traded currency and common reserve currency, many investors seek to preserve purchasing power in US dollars. Notably, many key commodities are priced in US dollars.
- 3) Global. A third option is to use a basket approach, relying on a calculation of purchasing power in a collection of foreign currencies. The basket may be trade-weighted, consumption-weighted, or an alternative weighting approach.

The alternative frames of reference can be evaluated by measuring their fit relative to the objectives of the investor. For the PRF, the objective is to provide pension and social welfare benefits to Chile's citizens. From this standpoint, the spend, and thus the measure of purchasing power, are in Chilean pesos and a domestic frame of reference is appropriate.

Investments denominated in foreign currencies will rise in value when the Chilean Peso (CLP) loses value (depreciates) relative to the foreign currencies of the assets. Conversely, foreign investments will have a higher value in CLP when the Peso depreciates. This creates an additional risk factor for PRF spending that is denominated in CLP. A substantial rise in the value of the Peso will result in a decline in the Peso value of the foreign assets, leading to spending a larger proportion of the assets in such a year. The opposite effect occurs with a CLP depreciation. Hedging the investments' foreign currency exposure, by entering into agreements to eliminate currency risk, can mitigate this uncertainty.

### Is Hedging Necessary?

Most of the assets in the proposed PRF portfolio are denominated in foreign currencies. This suggests that hedging some of the currency exposure to Chilean Pesos may be appropriate as that is the base currency for spending. One of the key drivers of Chilean Peso valuations is commodity prices. When the CLP strengthens relative to other currencies because of higher commodity prices, especially copper, the Chilean economy is likely also stronger. This results in increased PRF contributions and presents a natural hedge, reducing the need for explicit currency hedging.

### Hedging Program Constraints

A hedging program must be able to:

- Identify the specific currency exposures that need to be hedged, which may change with market conditions
- Source liquidity in hedging instruments, such as forward contracts, options, and swaps to lock in exchange rates

- Specify risk tolerances for imperfect hedges and determine hedging costs

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 strengthen.<sup>4</sup>

Additionally, the ability to source liquidity for sufficient hedging instruments is a true constraint given the size of the CLP currency market.

## Hedging Output

The tables below indicate the impact of hedging on returns, in CLP on some of the major asset classes being considered:

	In Local Currency		
	Annual/Arithmetic Return	Compound Return	Standard Deviation
Cash – Chile	3.79%	3.77%	2.15%
Cash – USA	2.71%	2.69%	2.02%
Fixed Income – Global Government	3.18%	3.05%	5.47%
Equity – EAFE	7.13%	5.83%	16.28%
Equity – USA	7.89%	6.28%	18.28%

	In CLP – Unhedged			
	Annual/Arithmetic Return	Compound Return	Standard Deviation	Inflation Differential
Cash – Chile	3.79%	3.77%	2.15%	n/a
Cash – USA	3.48%	2.67%	12.69%	0.88%
Fixed Income – Global Government	4.57%	3.95%	11.43%	1.14%
Equity – EAFE	8.45%	7.06%	17.26%	0.99%
Equity – USA	7.69%	6.17%	18.05%	0.88%

**Unhedged asset returns are affected by a) FX currency return, which is driven by inflation differentials, and b) volatility increases vs. local currency, which lowers multi-year compound returns**

<sup>4</sup> This tendency for currencies of less developed countries 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.

	In CLP – Hedged			
	Annual/ Arithmetic Return	Compound Return	Standard Deviation	Inflation Differential
Cash – Chile	3.79%	3.77%	2.15%	n/a
Cash – USA	3.34%	3.32%	2.28%	1.06%
Fixed Income – Global Government	4.63%	4.49%	5.68%	1.66%
Equity – EAFE	8.01%	6.70%	16.45%	1.23%
Equity – USA	8.53%	6.92%	18.62%	1.06%

*Hedged asset returns are affected by a) hedging return, driven by cash interest rate differential, and b) minimum volatility impact vs. local currency returns.*

The below table outlines the key expectations of Portfolio Option 2, when the assets are unhedged, partially hedged (investment grade fixed income only) and fully hedged.

	Unhedged	Partially Hedged *	Fully Hedged
Geometric 20-year Return	6.6%	6.7%	7.3%
Risk (Return Standard Deviation)	12.9%	11.7%	11.2%
Sharpe Ratio	0.209	0.244	0.310
Range of Expected Return (75 <sup>th</sup> to 25 <sup>th</sup> Percentiles):	5.4% - 7.9%	5.7% - 7.8%	6.2% - 8.5%
CVaR (annual): 5 <sup>th</sup> Percentile	-17.5%	-15.5%	-15.7%

*\*Investment grade fixed income only*

## Conclusions

In general, hedging adds to the expected return and lowers the risk – increasing the Sharpe Ratio meaningfully. Hedging also adds to the overall portfolio complexity and requires strict oversight, governance controls, and collateral management

Collateral management is easiest for less volatile asset classes, such as government (which may serve as its own collateral) and investment grade fixed income.

As volatility increases, such as with emerging market debt and growth assets, high quality assets would need to be earmarked to serve as a buffer. This implementation consideration may erode the benefit from fully hedging.

As such, absent implementation constraints, Mercer recommends hedging the global government and global investment grade credit allocations to achieve some hedging benefit while avoiding the collateral crunch risk associated with a fully hedged portfolio.

However, the CLP FX market may not have sufficient liquidity to implement even an investment grade-only hedge.

## Appendix G

# Additional Spending Model Output

The below Utilizing Nominal GDP as the Deflator (instead of CPI)'

Shading represents if the spending or market value maintains purchasing power after the twenty years. Red indicates that purchasing power is not maintained; green indicates that purchasing power is maintained Note: Spending values in billions; Market Value in trillions

3% Spending Rate Year 1 Spending: 243B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	377	452	453	463
Spending – Year 20 (MM Real)	140	168	168	172
Market Value – Year 20 (B Nominal)	12.3	15.9	15.9	16.5
Market Value – Year 20 (B Real)	4.6	6.0	6.0	6.3

4% Spending Rate Year 1 Spending: 324B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	421	508	510	519
Spending – Year 20 (MM Real)	156	188	189	193
Market Value – Year 20 (B Nominal)	9.6	12.6	12.6	13.1
Market Value – Year 20 (B Real)	3.6	4.8	4.8	5.0

5% Spending Rate Year 1 Spending: 405B	Current	Portfolio Option 2	Portfolio Option 2- 50% ILS	Portfolio Option 3
Spending – Year 20 (MM Nominal)	436	527	529	539
Spending – Year 20 (MM Real)	162	195	195	200
Market Value – Year 20 (B Nominal)	7.3	9.7	9.7	10.1
Market Value – Year 20 (B Real)	2.7	3.7	3.7	3.8

Note: Average outcome across simulations shown in table

## Appendix H

# External Sources

Sources for Sovereign Wealth Fund Peer Review Information	
<b>Chile</b>	<a href="https://rmicfatf.com/">https://rmicfatf.com/</a> <a href="https://www.state.gov/wp-content/uploads/2024/07/24-501-Marshall-Islands-Regional-Issues-Trust-Fund.pdf">https://www.state.gov/wp-content/uploads/2024/07/24-501-Marshall-Islands-Regional-Issues-Trust-Fund.pdf</a>
<b>Marshall Islands</b>	<a href="https://apfc.org/fund-structure/#era">https://apfc.org/fund-structure/#era</a>
<b>State of Alaska</b>	<a href="https://www.mof.gov.sg/policies/reserves/what-are-the-reserves-used-for#:~:text=The%20reserves%20enable%20MAS%20to,exchange%20rate%2Dcentred%20financial%20system.">https://www.mof.gov.sg/policies/reserves/what-are-the-reserves-used-for#:~:text=The%20reserves%20enable%20MAS%20to,exchange%20rate%2Dcentred%20financial%20system.</a>
<b>Singapore</b>	<a href="https://documents1.worldbank.org/curated/en/099325004052224957/pdf/P17363103caa4a0800a40401f9a3ef7b3f8.pdf">https://documents1.worldbank.org/curated/en/099325004052224957/pdf/P17363103caa4a0800a40401f9a3ef7b3f8.pdf</a>
<b>Mongolia</b>	<a href="https://www.regjeringen.no/en/topics/the-economy/economic-policy/economic-policy/id418083/">https://www.regjeringen.no/en/topics/the-economy/economic-policy/economic-policy/id418083/</a> <a href="https://www.nbim.no/en/the-fund/about-the-fund/">https://www.nbim.no/en/the-fund/about-the-fund/</a>
<b>Norway</b>	<a href="https://www.finance.gov.au/government/australian-government-investment-funds/future-fund">https://www.finance.gov.au/government/australian-government-investment-funds/future-fund</a>
<b>Australia</b>	<a href="https://www.ntma.ie/business-areas/future-ireland-funds">https://www.ntma.ie/business-areas/future-ireland-funds</a>

Asset Classes	Benchmark	Sources for Benchmark Information
<b>Global Equity</b>	MSCI ACWI Ex Chile Index	<a href="https://www.msci.com/indexes/documents/methodology/0_MSCI_Index_Calculation_Methodology_20240812.pdf">https://www.msci.com/indexes/documents/methodology/0_MSCI_Index_Calculation_Methodology_20240812.pdf</a>
<b>Private Equity</b>	Burgiss Global Private Equity – Total	<a href="https://www.msci.com/documents/1296102/42712789/MSCI%27s+Burgiss+Private+Capital+Indexes_2024_01_18.pdf/58db2cce-2343-0073-05fb-09d5748cafe7?t=1705614522939">https://www.msci.com/documents/1296102/42712789/MSCI%27s+Burgiss+Private+Capital+Indexes_2024_01_18.pdf/58db2cce-2343-0073-05fb-09d5748cafe7?t=1705614522939</a>
<b>Private Real Estate</b>	MSCI Global Property Funds Index	<a href="https://www.msci.com/documents/1296102/19899620/MSCI+Global+Quarterly+Property+Fund+Index+%28Unfrozen%29+Methodology.pdf/135203c1-2995-d155-26e3-8efb04851e01">https://www.msci.com/documents/1296102/19899620/MSCI+Global+Quarterly+Property+Fund+Index+%28Unfrozen%29+Methodology.pdf/135203c1-2995-d155-26e3-8efb04851e01</a>
<b>Growth Fixed Income (High Yield and EMD)</b>	50% Bloomberg Global High Yield Corporate 50% JP Morgan EMBI Global Diversified Index	<a href="https://assets.bbhub.io/professional/sites/10/23059.pdf">https://assets.bbhub.io/professional/sites/10/23059.pdf</a> <a href="https://www.jpmorgan.com/content/dam/jpm/cib/complex/content/markets/composition-docs/pdf-27.pdf">https://www.jpmorgan.com/content/dam/jpm/cib/complex/content/markets/composition-docs/pdf-27.pdf</a>
<b>Global Corporate Debt</b>	Bloomberg Global Aggregate Corporate	<a href="https://assets.bbhub.io/professional/sites/27/Global-Aggregate-Corporate-Index.pdf">https://assets.bbhub.io/professional/sites/27/Global-Aggregate-Corporate-Index.pdf</a>
<b>US MBS</b>	Bloomberg US MBS Index	<a href="https://assets.bbhub.io/professional/sites/27/US-MBS-Index.pdf">https://assets.bbhub.io/professional/sites/27/US-MBS-Index.pdf</a>
<b>Global Government</b>	Bloomberg Global Treasury Index Developed Market	<a href="https://assets.bbhub.io/professional/sites/27/Global-Treasury-Index.pdf">https://assets.bbhub.io/professional/sites/27/Global-Treasury-Index.pdf</a>
<b>Inflation Linked Fixed Income</b>	Bloomberg Global Inflation-Linked	<a href="https://assets.bbhub.io/professional/sites/27/Global-Inflation-Linked-Index-Series-L.pdf">https://assets.bbhub.io/professional/sites/27/Global-Inflation-Linked-Index-Series-L.pdf</a>

## Appendix I

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