

**Total Return and Statutory Return
Projections for the Alaska Permanent Fund**

Methodology Description and Key
Assumptions



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Introduction

This report will summarize the process and inputs used to generate projected 10-year returns for the Alaska Permanent Fund (APFC) portfolio. The first section will detail the methodology and assumptions that Callan used to generate 10-year annualized geometric return and standard deviation projection projections for the APFC Total Fund portfolio. The second section will explain the methodology and key assumptions used to generate the projected statutory net income (realized return) assumptions over the same period. An appendix provides background on Callan's capital market projections.

10-year geometric return projection

The 10-year projected annualized geometric return for the APFC portfolio is **6.95%**. The projected annual standard deviation is **12.38%**. In order to generate expected return and standard deviation projections for the APFC portfolio, Callan employed mean-variance optimization software and our standard 10-year capital market projections for each of the underlying asset classes. Callan generates these projections on an annual basis and uses them in all of the strategic planning work done on behalf of our clients. We believe them to be reasonable and consistent with projections used across the industry for long-term strategic planning purposes. The table below summarizes the return and standard

Asset Category	Projected Arithmetic Return	Projected 10-Year Geometric Return	Annualized Standard Deviation
Global Equities	9.20%	7.60%	19.35%
Cash Equivalents	2.25%	2.27%	0.90%
US TIPS	3.10%	3.00%	5.30%
US Fixed Income	3.05%	3.00%	4.05%
Investment Grade Credit	3.80%	3.71%	5.40%
Global Fixed Income	2.15%	1.70%	9.70%
Emerging Markets Debt	4.80%	4.49%	8.90%
High Yield Fixed Income	5.90%	5.41%	11.10%
Global REITS	8.85%	6.85%	21.20%
Global Listed Infrastructure	6.80%	5.58%	16.60%
Private Equity	10.95%	8.60%	22.85%
Real Estate	6.80%	5.99%	14.00%
Private Infrastructure	6.45%	5.69%	13.50%
Absolute Return	5.55%	5.23%	9.30%

deviation assumptions used in developing the projected return for the APFC portfolio.

The projection process also requires a set of correlation assumptions between the various asset classes employed in the portfolio. The table below summarizes the correlation assumptions used in developing the return projections for the APFC portfolio.

Asset Category	Global Equities	Cash	US TIPS	Fixed Income	Credit	Global Fixed	EMD	High Yield	Global REITS	Listed Infra	Private Equity	Real Estate	Private Infra	Absolute Return
Global Equities	1.000	-0.042	-0.053	-0.120	0.298	0.014	0.330	0.320	0.702	0.670	0.699	0.551	0.235	0.801
Cash Equivalents	-0.042	1.000	0.070	0.100	0.000	-0.090	-0.070	0.050	0.000	0.000	0.000	-0.060	0.000	-0.070
US TIPS	-0.053	0.070	1.000	0.580	0.021	0.340	0.590	0.580	0.060	0.050	-0.100	0.005	0.018	0.055
US Fixed Income	-0.120	0.100	0.580	1.000	0.035	0.510	0.610	0.625	0.030	-0.100	-0.130	-0.020	-0.035	0.080
Investment Grade Credit	0.298	0.000	0.021	0.035	1.000	0.000	0.250	0.178	0.700	0.350	0.270	0.245	0.035	0.089
Global Fixed Income	0.014	-0.090	0.340	0.510	0.000	1.000	0.640	0.570	0.000	0.100	-0.060	-0.040	0.035	-0.080
Emerging Markets Debt	0.330	-0.070	0.590	0.610	0.250	0.640	1.000	0.780	0.400	0.370	0.200	0.250	0.158	0.320
High Yield Fixed Income	0.320	0.050	0.580	0.625	0.178	0.570	0.780	1.000	0.350	0.340	0.200	0.190	0.150	0.390
Global REITS	0.702	0.000	0.060	0.030	0.700	0.000	0.400	0.350	1.000	0.760	0.720	0.660	0.350	0.596
Global Listed Infrastructure	0.670	0.000	0.050	-0.100	0.350	0.100	0.370	0.340	0.760	1.000	0.600	0.630	0.700	0.604
Private Equity	0.699	0.000	-0.100	-0.130	0.270	-0.060	0.200	0.200	0.720	0.600	1.000	0.460	0.210	0.540
Real Estate	0.551	-0.060	0.005	-0.020	0.245	-0.040	0.250	0.190	0.660	0.630	0.460	1.000	0.243	0.490
Private Infrastructure	0.235	0.000	0.018	-0.035	0.035	0.035	0.158	0.150	0.350	0.700	0.210	0.243	1.000	0.211
Absolute Return	0.801	-0.070	0.055	0.080	0.089	-0.080	0.320	0.390	0.596	0.604	0.540	0.490	0.211	1.000

In order to generate projections for a multi-asset class portfolio, mean-variance methodology requires an assumed asset allocation for the portfolio. The assumed asset allocation used in the projection process is the 2017 target asset allocation for the APFC portfolio which is summarized in the table below.

Asset Category	Target
Global Equities	41.7%
Cash Equivalents	3.2%
US TIPS	1.1%
US Fixed Income	5.7%
Investment Grade Credit	5.7%
Global Fixed Income	2.3%
Emerging Markets Debt	1.1%
High Yield Fixed Income	4.4%
Global REITS	2.3%
Global Listed Infrastructure	1.1%
Private Equity	11.5%
Real Estate	11.5%
Private Infrastructure	3.1%
Absolute Return	5.2%

The table below summarizes the results of the total return projection for the APFC Total Fund portfolio:

Asset Category	Projected Arithmetic Return	Projected 10-Year Geometric Return	Annualized Standard Deviation
APFC Portfolio	7.50%	6.95%	12.38%
Inflation	2.25%	2.25%	1.50%

It is important to reinforce the fact that this projection represents a wide range of potential outcomes. The mid-point of the range (6.95%) should not be interpreted as the most likely outcome. It is simply the point where there is a 50% chance of a higher return and a 50% chance of a lower return. In any given year during the 10-year period the return for the fund will likely vary significantly from the mid-point of the projected range.

10-year Statutory Net Income (realized return) projection

The 10-year projected statutory return for the APFC portfolio is **6.24%**. The 2017 fiscal year statutory return projection from the model is **5.43%**. In projecting the range of 10-year Statutory Net Income (SNI) for the Permanent Fund each year, Callan employs a Monte Carlo simulation model that we have maintained on APFC's behalf for over twenty years. Describing the model in detail is beyond the scope of this summary report. Instead we will discuss the key inputs into the model which impact the SNI projection.

The SNI for the Fund in any given year is equal to the income return for the Fund in that year (dividends, coupons, leasing income, etc.) plus the realized portion of total return for the year. Thus, in order to project the SNI for the Fund, you need a model that is capable of disaggregating the Fund's total return into three components; income return, realized return, and unrealized return.

The first step in doing this requires generating income return projections for each of the asset classes used in the model. The table below summarizes Callan's total return projections and income projections for each of the asset classes used in the model:

Asset Category	Projected Arithmetic Return	Projected 10-Year Geometric Return	Projected Annualized Income Return
Global Equities	9.20%	7.60%	2.40%
Cash Equivalents	2.25%	2.27%	2.25%
US TIPS	3.10%	3.00%	3.30%
US Fixed Income	3.05%	3.00%	3.50%
Investment Grade Credit	3.80%	3.71%	4.30%
Global Fixed Income	2.15%	1.70%	2.40%
Emerging Markets Debt	4.80%	4.49%	6.00%
High Yield Fixed Income	5.90%	5.41%	7.50%
Global REITS	8.85%	6.85%	4.00%
Global Listed Infrastructure	6.80%	5.58%	4.50%
Private Equity	10.95%	8.60%	0.00%
Real Estate	6.80%	5.99%	5.00%
Private Infrastructure	6.45%	5.69%	5.50%
Absolute Return	5.55%	5.23%	0.00%

Income returns are significantly less volatile than total returns (particularly for the equity asset classes). A reasonable approximation for the projected income return for a portfolio can be derived using the asset class weights and the income return projections to calculate a weighted average. Applying the asset class weights used in the previous section for the APFC portfolio to the projected income returns shown in the table above, results in a projected income return of approximately 2.9% for the APFC total portfolio.

The second step in the return disaggregation requires the model to project realized returns for each of the asset classes. Unfortunately this step is significantly more complicated than the income step. Realized returns are impacted by a number of different variables discussed below.

Appreciation Return is essentially the difference between total return and income return. For equity asset classes the expected 10-year appreciation return is a relatively large percentage of total return (for Global Equity, $7.60\% - 2.40\% = 5.20\%$). For fixed income asset classes it is relatively small and even negative if the baseline assumption underlying the projection is for rising rates. It is important to note that in any given year, the appreciation return can be very large or significantly negative relative to the income return depending on market volatility.

Beginning Unrealized Capital Gains (or Losses) is the difference between the market value of the portfolio and the cost basis of the portfolio. In strong or sustained bull markets this value can be significantly positive. After steep market declines it can be negative. The reason this number is important is that turnover in the portfolio (the selling of securities to fund distributions, facilitate rebalancing, or meet general portfolio management objectives), will result in the realization of these unrealized gains or losses. To the extent that there is a big difference between cost and market value going into a given year, the same level of turnover will result in larger realization of gains. As of June 30, 2015, for example, the APFC portfolio had an approximate cost basis of \$45.4 billion, and an approximate market value of \$52.8 billion, representing a total of roughly 7.4 billion in unrealized capital gains.

Asset Class Turnover (capital gains realization) in the context of Callan's model is the latent day-to-day turnover or capital gains realization observed within each of the asset class portfolios. It is the result of the actions of the investment managers within those portfolios, and not the result of a rebalancing or distribution funding event executed by the APFC. To the extent that there are no rebalancing or distribution events, you could generate a simplified projected realized return for each asset class by multiplying the projected turnover for the asset class by the projected difference between cost and market value for the asset class, and then dividing that dollar amount by the market value of the asset class. The table below summarizes the asset class turnover assumptions used in Callan's projection model.

Asset Category	Annualized Turnover
Global Equities	15%
Cash Equivalents	100%
US TIPS	25%
US Fixed Income	15%
Investment Grade Credit	15%
Global Fixed Income	15%
Emerging Markets Debt	15%
High Yield Fixed Income	15%
Global REITS	15%
Global Listed Infrastructure	15%
Private Equity	10%
Real Estate	10%
Private Infrastructure	10%
Absolute Return	25%

Rebalancing Turnover, in the context of Callan's model, is the turnover created by rebalancing events within the portfolio. Rebalancing events are triggered when an asset class moves outside of its targeted range. This is caused by relative under or out-performance versus the other asset classes. In a deterministic model, rebalancing events are relatively rare and small in terms of their impact. In a Monte Carlo simulation model, which introduces uncorrelated volatility into the behavior of each asset class, rebalancing events are common occurrences. To the extent target ranges are wider rebalancing events are less frequent. Narrow rebalancing ranges result in more frequent rebalancing. For the purposes of the projection it was assumed that the portfolio was rebalanced back to target quarterly. In practice the APFC employs a more efficient rebalancing strategy which will likely result in less rebalancing-related turnover than is projected by the simple assumptions used in this model. On balance this will tend to reduce gains realization which will in turn reduce the statutory return relative to the projection from the model.

Distribution Event Turnover is the last significant driver of realized return. This is simply the sales required to fund the annual distribution from the Fund. The model assumes that the distribution is funded by selling securities held in the bond portfolio. To the extent that this pulls the bond portfolio below its targeted range it will result in a rebalancing event to bring the bond portfolio back to target.

All of these various factors interact with each other differently depending on the behavior of the capital markets. Monte Carlo simulation allows us to explore these interactions across a broad range of potential capital market outcomes each of which takes into account prospective volatility. This results in a range of outcomes for SNI. A deterministic model will not capture the impact of volatility, and therefore would likely understate turnover if the same assumptions were employed.

Appendix –Capital Market Projections

Overview

Callan Associates develops long-term capital market projections at the start of each year, detailing our expectations for return, volatility, and correlation for all the broad asset classes. These projections represent our best thinking regarding a longer-term outlook and are critical for strategic planning as our investor clients set investment expectations over five-year, ten-year, and longer time horizons. Since our forecasts are long term in nature they are informed by current market conditions, but not directly built from them. Long term equilibrium relationships between markets and long term trends in global growth are the key drivers. This results in a set of assumptions that change slowly (or not at all) from year to year. Importantly the process is designed to insure that the forecasts behave reasonably and predictably when used as a set in an optimization or simulation environment. Our forecasting process begins with estimates of major global macroeconomic variables which are integrated into our equity, fixed income and alternative investment models which generate initial estimates. A qualitative overlay is applied to create a reasonable and consistent set of projections.

Economic Outlook

We look at a wide variety of economic variables which ultimately lead to forecasts for growth in real gross domestic product (GDP) and consumer price inflation for the regions for which we forecast equity, bond and alternative investment returns. These forecasts are intertwined in that higher (lower) GDP growth tends to correspond with higher (lower) inflation. Both variables play important roles in our capital market forecasts.

For the ten-year projection period used in this analysis, we are forecasting average real GDP growth to be between 2% and 2.5% for the US, 1.5% to 2% for developed non-US markets and 4% to 5% for emerging markets.

The real GDP expectation for the US represents a higher value than the average growth observed since the global financial crisis but a lower value than that experience over the last 50 years. US growth could be supported by a strong labor market, the policies of the incoming administration (lower taxes, increased infrastructure spending and reduced regulation), and the potential for increased exports to foreign countries whose economies are also expected to improve. US growth could be constrained by increases in interest rates, limits to fiscal stimulus imposed by the federal deficit and a strong dollar, as well as restrictive trade policies that could limit the attractiveness of US exports.

Real GDP growth for non-US developed markets faces headwinds primarily from political uncertainty and the health of the banking systems. These economies have the potential to grow faster due to continued stimulative monetary policies, reductions in government budget deficits (especially if this reduces the perceived need for austerity), improvements in bank capitalization and reduced unemployment.

Just by virtue of their sizes, emerging economies are unlikely to grow at the same rates as they have historically but their growth rates will still substantially exceed those of developed markets. Low commodity prices, expanding internal demand and improving export markets could all promote growth. Government policies and foreign trade restrictions could limit growth.

For the ten-year projection period we are forecasting consumer price inflation to be between 2.0% and 2.5% for the US, 1.75% to 2.25% for developed non-US markets and 2.5% to 3.5% for emerging markets.

The US inflation rate could be on the high end of expectations if energy prices rebound, currency strength drives up import prices, there are significant levels of fiscal stimulus, monetary stimulus or both, or labor markets become tight. Inflation could be constrained if overseas economies improve to the point where the dollar becomes weaker, the Fed imposes monetary constraints to offset fiscal stimulus or a larger, more competitive labor market keeps wages in check.

Inflation in developed non-US economies is more likely to be at the lower end of the range due to limits on further fiscal and monetary stimulus as well as constraints on population and productivity growth. More liberal, growth-oriented policies could drive the values to the higher end of the range.

The rate of emerging markets inflation is subject to considerable uncertainty due a wide variety of possible outcomes for government policies, currencies, trade, internal supply and demand, and commodity prices.

Equity Forecasts

All equity forecasts are developed by building off the fundamental relationship:

Equity return = Income return + Capital appreciation

While the short-term relationship is weak, over a long-term strategic horizon earnings tend to follow economic growth. In the absence of this linkage profits would become an extraordinarily large or small part of the economy. The connection is more robust in developed economies than in emerging markets where profit growth can substantially lag economic growth.

Forecast earnings growth is the key to projected equity price appreciation with investors obviously willing to pay more for stocks if they have a higher profit potential. Income return is also a function of earnings by way of the payout ratio. We are also cognizant of market valuations, but valuation averages can vary substantially across market cycles. For example average P/E ratios for the S&P 500 were substantially different over the market cycle that included the tech bubble then they have been over the market cycle that included the global financial crisis. Consequently, adjustments to capital appreciation forecasts are only made at extreme market valuations.

Inflation also plays a role in equity forecasts in as much as the variables described above are forecast in real terms with inflation added to generate nominal returns.

Global Equity (ACWI IMI Index) Return = 7.60%, Risk = 19.35%

In the US, earnings growth is expected to be modestly above GDP growth given expected economic conditions and government policies. P/E ratios are within historical norms and therefore we have not incorporated a negative P/E repricing term into our long horizon forecast. Payout ratios are close to historical norms and dividend yields have been remarkable stable for the last two decades even in the face of substantial changes in earnings and interest rates so dividend yields are expected to remain approximately unchanged. Over the long run, we forecast any additional income derived from share buybacks will be offset by dilution though new share issuance.

We expect earnings growth in overseas markets to be moderate driven by poor but improving economic growth in developed markets and slowing but still substantial economic growth in emerging markets. Uncertain political and economic conditions will cause earnings growth to lag economic growth across markets with the problem being more acute in emerging markets. International developed equity has historically had a significantly higher dividend yield than in the US and we expect that income return will be a greater driver of overall return in these markets. Dividends will be somewhat lower in emerging markets but still above those in the US. The current P/E valuations, while cheaper than the US, are in line with longer term averages so we expect no P/E repricing adjustments in either developed or emerging markets. Lower inflation than in the US is a drag on developed markets nominal return. Conversely, higher inflation boosts emerging markets.

Fixed Income Forecasts

Our fixed income forecasts are created by decomposing fixed income returns into subcomponents and incorporating a forecast for the evolution of the term structure over time. Fixed income return can be decomposed into the following terms:

$$\text{Fixed Income Return} = \text{Yield} + \text{Capital Gains} + \text{Roll Return}$$

Broad US Fixed Income (Bloomberg Barclays Aggregate Index) Return = 3.00%, Risk = 4.05%

We forecast a modest increase in interest rates over the next ten years with most of the increase front loaded to the first 3 years. The shorter end of the yield curve will rise more than the longer end resulting in a flatter yield curve. The annualized yield for the Aggregate is forecasted to increase significantly over the next 10 years. Capital gains on the Aggregate will be negative given the projected rise in rates. Note that in a rising rate environment, the yield term increases but is directionally offset by negative capital gains, muting the impact of rate increases on changes on expected returns. The Barclays Aggregate has only a moderate interest rate sensitivity (duration of roughly 5) so the capital losses are not substantial. Credit spreads are forecast to migrate to their longer term averages. This does not have a substantial impact on the forecast. As we forecast an upward sloping yield curve over the forecast horizon, we expect a positive roll effect as bond issues gradually move toward maturity. The roll return is expected to decline in the future as the yield curve flattens.

Alternatives Forecasts

Alternative investments differ substantially from each other so different models are used for each.

Hedge Funds (HFRI Index) Return = 5.25%, Risk = 9.30%

Hedge funds can be evaluated in a multi-factor context using the following relationship:

$$\text{Expected Return} = \text{Cash} + \text{Equity Beta} * (\text{Equity-Cash}) + \text{Exotic Beta} + \text{Alpha} - \text{Fees}$$

Callan's 10 year cash forecast is 2.25%, consistent with our expectation for the average return of cash over the next decade. The HFRI index has historically exhibited equity beta relative to the S&P 500 on the order of 0.4, which when combined with our equity risk premium forecast results in an excess return from equity beta of approximately 2%. Return from hedge fund exotic beta/ illiquidity premia is forecasted to be 1%, to arrive at an overall expected return of 5.25%. Implicit in this forecast is the assumption that hedge fund alpha in aggregate after subtracting out fees is zero. In practice,

hedge funds display significant divergence in returns and the ability to select skillful managers could result in returns greater or less than we project.

Real Estate (Callan Real Estate Database), Return = 6.00%, Risk = 14.00%

Cap rates continued their trend of declining in 2016 (cap rates have declined every year from 2010 to present) and are currently at record lows. The NCREIF rolling 4 quarter average cap rate declined 25bp from 3Q 2015 to 3Q 2016.

In addition, the spread between cap rates and bonds has recently compressed, making real estate a potentially less attractive income source. We forecast the expected real estate return to be 75% of the excess return (versus cash) of the US equity market which, when combined with the forecast cash return results in a forecast of 6.00%.

Private Equity (Cambridge Private Equity Index), Return = 8.60%, Risk = 22.85%

Private equity in aggregate is driven by many of the same economic factors as public equity markets. Accordingly, we explicitly link private equity returns to our public equity returns in our forecasting model. When our forecast for the public equity risk premium changes, we adjust our private equity forecast proportionately. Consistent with the notion that higher risk asset classes should confer higher expected returns, private equity has the greatest expected return of any asset class. Given our public equity risk premium is contracting, the spread between private and public equity should contract by a similar amount for consistency. Adding a private equity spread to our US equity forecast results in an annualized return forecast of 8.60%. There is tremendous disparity between the best returning and worst returning private equity managers. The ability to select skillful managers could result in realized returns significantly greater than we project.