PWL

Financial Planning Assumptions

Methodology and Data Update Mid-Year 2021

PWL RESEARCH

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PWL Research

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This report was written by the Research team at PWL Capital Inc. The ideas, opinions, and recommendations contained in this document are those of the authors and do not necessarily represent the views of PWL Capital Inc.

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1. Setting Expectations

Asset allocation and financial planning decisions hinge on the assumed expected return profiles of asset classes. The amount of equity risk needed to achieve a goal, the sustainable spending rate in retirement, and the amount of life insurance required are some examples of critically important calculations with results that change dramatically with small changes in expected returns. The sensitivity of these calculations stems from compounding and the long-term nature of financial decisions. While their importance cannot be overstated, predicting future returns and inflation is a challenging task.

Investors often look to historical returns to calibrate their expectations for the future; historical returns can be useful, but they are easily deceptive. Relying on the returns of a single successful market, like the United States or Canada, results in a success bias which may result in overly optimistic expectations about the future. Another approach to setting expectations is to use the information in market prices. Popular metrics like the Shiller Earnings Yield – the 10-year trailing real earnings divided by the current price – offer a market-based expectation for real stock returns. These metrics can be useful, but their predictive power is far from perfect.

In this paper we devise an evidence-based approach for setting expectations for stocks, bonds, bills, inflation, and housing for use in asset allocation and financial planning decisions. This paper marks an evolution in PWL Capital's methodology which has been in use for more than half a decade. Our previous methodology used a combination of historical and market-based estimates for expected returns with an equal weight attributed to each estimate; we refer to these components as Equilibrium Cost of Capital (ECOC) and Market Based Expected Return (MBER) respectively.

Assigning a 50% weight to MBER implies that it explains 50% of the variation in future realized returns. This implication is at odds with the evidence, which varies by asset class. For example, market-based measures are highly effective at predicting bond returns, but far less effective at predicting equity returns. Market-based inflation estimates from the breakeven rate between real and nominal bonds have no relationship to realized inflation. Our model must reflect these differences; we believe the relative weight of our market-based estimates should reflect their observed explanatory power.

Additionally, we are using long run returns data from the Dimson, Marsh, Staunton (DMS) data series with an adjustment for valuation changes to estimate historical real returns as the ECOC. The DMS data include failed and unsuccessful markets which helps to correct for the upward bias in estimates related to survivorship and success bias. Removing the portion of returns attributed to increasing price multiples removes any bias that may be created by a declining cost of capital as equity markets become less risky and easier to diversify compared to the earlier parts of the sample which starts in 1900.

[1] See Bortolotti, Kerzérho, Great Expectations: How to Estimate Future Stock and Bond Returns when creating a Financial Plan, PWL Capital, 2019.

2. Historical Returns

Predicting stock and bond returns is a difficult task. The historical record is the laboratory of financial economics. While it has clear limitations, historical data allow theories to be tested. For determining estimates of expected returns, historical realized returns, when examined properly, offer a reasonable starting point for what to expect in the future. The figure derived from long run historical data is referred to in this paper as the equilibrium cost of capital (ECOC).

(Very) Long Run Returns

The volatility of risky asset returns makes drawing insight from seemingly long periods, say 20 or 30 years, unreliable. Asness (2021) points out that while the US stock market returns beat International Developed markets by an annualized 2.1% from 1980 through 2020, nearly all that difference is explained by rising US valuations. That is, US stocks got more expensive per dollar of earnings over the period driving their returns up. Does that make the US market a better prospective investment? That seems unlikely. If anything, paying more for each dollar of future earnings is less attractive. Even with very long time periods, it is crucial to examine more than a single country's return series. Looking at 121 years of returns for the US stock market alone may be misleading for setting future expectations due to the survivorship and success bias and rising valuations in the ex-post most successful market with 121 years of continuous history. Fortunately, there are long run series of data for stocks, bonds, and inflation available for 23 countries in the DMS database. These data include Austria and Portugal, cases of "unsuccessful" markets where equities performed very poorly, and Russia and China, two markets that failed to survive for the full 121 sample period. These data span technological transformations, wars, asset price bubbles, and financial crises providing a full picture of what a hypothetical US investor owning global stocks from 1900 through 2020 would have earned in real terms. The data are available in Table 1. Note that Canadian and US inflation over this period were both 3%.

Table 1 - Real USD Geometric Mean Returns for World and Select Country / Region Stocks and Bonds 1900 - 2020

	Real Stock Return (USD)	Real Long Bond Return (USD)
Australia	6.6%	1.8%
Canada	5.5%	2.1%
Europe	4.3%	1.4%
United States	6.5%	2.1%
World	5.2%	2.1%

Source: PWL Capital; Data Source: Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021

A nominal return of 8.2% (real return of 5.2% plus 3% inflation) for global stocks over a 121-year period is nothing to complain about, but it is a problem if you were expecting to earn a higher return. Many people today look at the historical returns of the US stock market and expect the future to look similar. Over this period US stocks delivered a nominal geometric mean return of 9.5%. This illustrates the trap of success bias. Using 9.5% (or higher based on more recent history) returns in financial planning is a bet on luck repeating itself. Readers may be interested to know that in USD terms, Australia is the best performing stock market from 1900 through 2020, beating the US stock market by an annualized 0.10%. Is it reasonable to expect Australia to be the best performing stock market in the world going forward simply because it was for the past 121 years? We do not believe so.

Decomposing Historical Returns

In the short run, stock performance is dominated by capital appreciation and depreciation. We evaluate portfolios each year to see how they have performed relative to a benchmark; almost all this variation is driven by price multiple expansion or contraction. It may be surprising, then, that the capital return has historically played a relatively small role in long run stock returns as shown in Table 2. For setting expectations, it may not be reasonable to assume that the portion of returns explained by multiple expansion will repeat itself. Over the very long run, rising prices may be explained by a decreasing risk premium required by investors as markets become increasingly liquid, accessible, and diversifiable. To isolate this component of returns, the equity risk premium can be decomposed into several components. Dimson, Marsh, and Staunton (2007) demonstrate the equity risk premium decomposition from 1900 through 2005 for global stocks, as shown in Table 2.

Table 2 - World Equity Premium Decomposition 1900 - 2005

	Real Dividend Growth Rate	plus Expansion of the P/D Ratio	plus Geometric Mean Dividend Yield	minus US Real Interest Rate	equals Equity Premium for US investors
World Equities	0.77	0.68	4.23	0.96	4.72

Source: Elroy Dimson, Paul Marsh and Mike Staunton, The Worldwide Equity Premium: A Smaller Puzzle (April 7, 2006). Chapter 11 of R Mehra (Ed), Handbook of the Equity Risk Premium. Elsevier, 2008, pages 467–514, AFA 2008 New Orleans Meetings Paper; EFA 2006 Zurich Meetings Paper

The dividend yield has historically been the biggest driver of long run returns, while multiple expansion has played a relatively small role. We have updated the multiple expansion figure for the global market index for the period ending December 2020 and found that it has increased slightly, from 0.68% to 0.70%. Removing the 0.70% multiple expansion from the 5.2% real historical geometric mean global stock return, we arrive at an adjusted historical real return of 4.50% for the world equity index. This historical figure for the world index is the foundation on which we will build expectations for each individual country. The alternative of using an individual country's historical return as the foundation of its expected return results in the potential for success or unsuccess biases clouding the estimate.

Bond returns similarly have a capital return and an income return. Over the very long run period under examination, interest rates have done a round trip rise and fall. We do not have a precise breakdown of the contribution from capital and income return for bonds globally similar to the one seen for stocks in Dimson, Marsh, and Staunton (2007), but based on the round trip of interest rates starting low, rising, and falling globally over the full period we estimate that the capital return is negligible in estimating future returns. Based on this, our ECOC for fixed income is simply the long-run 121-year return for long-dated government bonds. This is imperfect as we are estimating expected returns for portfolios of bonds closer to an intermediate maturity on average and including corporate bonds. By using the long government bond return we are implicitly assuming that the term premium is making up for the lack of a credit premium in our estimate; we can live with that assumption.

3. Economic Variables and Predictability

With the ECOC starting point, the next question that we must ask is whether expected returns are constant, or time varying? If they are constant, we should simply use ECOC as our estimate for future returns; if they are time-varying, we should look for economic variables that predict differences in expected returns. It is abundantly clear from the literature and from economic logic that expected returns do change through time. Investors demand a higher premium for owning risky assets when the market is riskier or when investors are more risk averse. It is, however, less clear that economic variables reliably predict these differences in a way that can be used in making financial decisions.

Risk or Behavior?

There are two possible theoretical cases for predictable stock returns. In the behavioral case, initiated by De Bondt and Thaler (1985), investors overreact to news, causing prices to rise above or below their "fair value" to which they must inevitably return. The herding behavior of investors can push this effect further creating a feedback loop. This is the case for asset "bubbles" which must eventually pop. In the risk-based case, investors respond rationally to economic circumstances by adjusting their required return for holding risky assets. If predictability is behavior-based, and returns are predictable, there is alpha (excess risk-adjusted returns) to be earned by savvy investors. On the other hand, if predictability is risk-based, investors may expect to earn higher returns when risk premiums are elevated, but they are doing so by taking more risk. It is not possible to definitively determine which case is true.

Predictability in the Literature

The literature on predictability is mixed. Campbell and Thompson (2008) find that there is evidence of return predictability. Goyal and Welch (2008) find that predictability models would not have helped an investor with access only to available information to profitably time the market. This point is further driven home by Asness et al. (2017) with the simple explanation that observed predictability using a full data series has an inherent hindsight bias; real-time investors do not know what future valuations will be, so any notion of a low or high valuation in the historical data may not tell us much about whether current valuations are low or high relative to future valuations. Dimson et al. (2013) similarly find that observations of predictability can create something like the "Gambler's Fallacy": the belief that deviations from expected behavior are likely to be followed by deviations in the opposite direction. Within the confines of an ex-post observed trendline in stock returns, the mean reversion seems blatantly obvious; what is not obvious is that the trend line will continue. The authors find empirically in the global data from 1900 through 2012 that "for investors who do not have perfect foresight and who do not know the parameters of the model for the long-distant future, there is no consistent relationship between forecasts and outcomes.

Moreover, for cases where there is a marginally significant relationship, roughly as many countries are significantly negative as are significantly positive." Cochrane (2007) explains that the out of sample test used by Goyal and Welch (and repeated by Dimson et al.) is an interesting diagnostic, but it is not a test. The low out of sample explanatory power findings are an important caution about using return forecasts in forming aggressive market-timing portfolios given currently available data, but they are not a statistical test of predictability. Present value logic implies that if both returns and dividend growth are unforecastable, the price/dividend ratio is a constant.

Empirically, this is clearly not the case as the price/dividend ratio is highly volatile. The question that Cochrane asks is "how much of dividend growth or returns is forecastable?" Historically high prices (low dividend yields) have been resolved by low subsequent returns, not by higher dividend growth which implies that returns are forecastable while cash flows are not.

Compounding the issues within this debate is the fact that predictable returns do not lead to stocks being safe investments in the long run. Even if there is mean reversion in stock returns Pástor and Stambaugh (2012) explain that an investor today does not know the long term mean to which returns will revert; investors do not know what the equity risk premium is today; and investors do not know the values of the parameters of the return-generating process. It is safe to say that returns are not predictable in a way that can be used to profitably time the market, but it is difficult to reject the null hypothesis that expected returns vary through time.

2 See, for example, Business Conditions and Expected Returns on Stocks and Bonds by Fama and French (1989)

4. Combining Historical and Predictive Expected Return Estimates

Given the evidence, we are hesitant to completely adopt or completely ignore the possible effects of predictability on expected returns in developing a point estimate. We are acutely aware of the financial planning implications of varying expected return assumptions as the market changes. Financial planning decisions involving saving, spending, and long-term asset allocation may be affected by the expected return assumption being used. If the CAPE in a country is high (implying lower expected returns), an investor may save more, spend less, or implement a more aggressive asset allocation to meet their expected return requirement. If CAPE is sufficiently predictive these changes are sensible. Davis (2015) finds using bootstrap simulations with varying degrees of pre-defined predictability that at an R^2 of 0.30 the investor varying their asset allocation each year based on the 10-year CAPE forecast would beat the buy-and-hold investor in only 18% of simulations, even under the fixed and known return forecasting parameters in the model; live return forecasting parameters are unlikely to be fixed and they are unknown. It seems clear that while there is evidence of long-term return predictability, it is not strong enough to facilitate successful market timing.

As a middle ground we give some weight to market based expected returns without relying on them completely. Our approach to assigning weights to historical and predictive expected return estimates starts with the historical predictive power of the selected variables. By assigning a weight to the predictive expected return estimate, we are similarly defining the predictive power of that variable in our return-generating process.

Predictive Power of Predictive Metrics

We use linear regression between our market-based measure of expected return and the actual realized return during the following ten years using US data from Robert Shiller's data series for bonds and stocks. We use US data due to its availability over long horizons. Using global data will provide different results as pointed out by Dimson, Marsh, and Staunton (2013), however our objective is not to build a model perfectly rooted in history; it is to build a model that is reasonable and rooted in evidence.

The regression results provide a coefficient of determination, R^2, measuring the amount of the variation in the returns that is explained by the predictive variable, and a regression coefficient, beta, measuring the sensitivity of returns to the predictive variable. For example, if a 1% change in 1/CAPE predicts a 1% change in returns in the following decade, the beta of the regression is exactly 1. We use both overlapping and non-overlapping samples.

Overlapping samples, often used in financial analysis, overstate t-statistics while only providing marginal benefit as described in Boudoukh et al. (2019). Non-overlapping samples limit us to 7 20-year samples in the historical data. Using both lenses together is helpful.

Table 3 - Predictive Regression Results

	R^2	Beta	t-statistic
Bonds (overlapping)	0.85	0.94	41.81
Bonds (non-overlapping)	0.77	1.04	5.28
Stocks (overlapping)	0.39	0.62	16.05
Stocks (non-overlapping)	0.32	0.42	2.51

Source: PWL Capital; Data Source: Robert Shiller

To incorporate these findings into our expected returns model we take the product of the R^2 and the beta as the weight of the predictive forecast in the model. For stocks, we find a statistically significant relationship with an R^2 above 0.30 and a beta between 0.40 and 0.60 for overlapping and non-overlapping samples for CAPE and 20-year forward real US stock returns. The product of the R^2 and beta results in a weight of between 14% and 24% for MBER in our model. For bonds, we find an R^2 close to 0.80 and a beta above 0.90 for both methods using current yield on 20-year forward intermediate bond returns.

The product of the R^2 and beta results in a weight of about 75% in our model. Recognizing that this is not an exact science, we are assigning a weight of 25% to the MBER component for equity returns and a weight of 75% to the MBER component for cash and fixed income returns with the remainder in both cases coming from the 121-year survivorship-adjusted historical average.

5. Expected Inflation

Expected inflation is impounded into asset prices, but is expected inflation a good predictor of realized inflation? To measure expected inflation, we observe the breakeven rate between real return and nominal government bonds. The breakeven rate contains some noise including the risk premium that nominal bond holders endure for taking on inflation risk, but it nonetheless offers an estimate of the market's inflation expectations. To gauge the predictive power of expected inflation we run regressions between breakeven inflation and the subsequent annualized rate of inflation for the countries with sufficient available data: Canada, the U.S., the U.K, and Germany. In most cases the R^2 were low, and the coefficients of the regressions were modestly negative.

Table 4 - Breakeven inflation vs. realized inflation regression results

Issuer	Breakeven maturity	Independent variable	Period	R-square	Beta	t-stat
Canada	30-year	3-year return	1992-2018	0.09	-0.17	-5.37
Canada	30-year	5-year return	1992-2016	0.15	-0.18	-6.73
Canada	30-year	10-year return	1992-2011	0.06	-0.06	-2.97
U.S.	5-year	5-year return	1997-2016	0.00	0.05	0.60
U.K.	5-year	5-year return	1996-2016	0.01	-0.11	-1.28
Germany	5-year	5-year return	2008-2016	0.29	-0.22	-4.90

Source: PWL Capital; Data Source: Bloomberg

Two possible explanations for the weak statistical relationship are that there is no relationship between breakeven rates and realized inflation, or there is a relationship between breakeven rates and expected inflation, but the relationship is overwhelmed by the variations in observed inflation (statistical noise).

Breakeven inflation is theoretically included in the prices of the assets for which we are estimating expected returns, so ignoring it completely does not seem sensible. Given the weak predictive power of the metric we combine it in equal weights with two other metrics to attenuate its impact on our estimates. Historical inflation for the period 1900 to 2020 was 3% in both Canada and the US; this is included as part of our estimate. Developed countries including Canada, New Zealand, and the United Kingdom have been implementing inflation targeting monetary policy since the early 1990s. Since that time, realized inflation has been closely aligned with inflation targets. We do not believe that this evidence is sufficient to conclude that inflation targeting works under any conditions, but it does earn a position in our inflation estimate.

As a result, our estimate for long-run Canadian inflation is the average of 30-year Government of Canada bond breakeven inflation, historical Canadian inflation 1900 – 2020, and the Bank of Canada's inflation target.

At the time of writing these figures are 1.8%, 3.0%, and 2.0% respectively for an inflation expectation of 2.3%.

Table 5 - Expected inflation composition

	0.33 x (Breakeven Inflation) Plus	0.33 x (Historical Inflation) Plus	0.33 x (Target Inflation)	Equals Expected Inflation
Inflation	1.8%	3.0%	2.0%	2.3%

Source: PWL Capital; Data Sources: Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021, Bank of Canada

6. Primary Residence

Distinct from stocks and bonds, the primary residence is often one of the largest assets owned by a household. Understanding the expected returns for housing is important in financial planning. The primary residence is not always an asset that will be sold to fund consumption (though it is always a possibility) but the total costs of housing are related to the asset's expected return. Just as a renter pays rent, an owner similarly has unrecoverable housing costs consisting of property taxes, maintenance costs, and the cost of capital. When real estate expected returns are lower than stock market expected returns, any home equity comes with an opportunity cost as the home equity could alternatively be invested in stocks.

The concept of the User Cost of housing described by Himmelberg et al. (2005) includes the opportunity cost of capital, property taxes, maintenance costs, and a risk premium for the additional risk of owning rather than renting. Theoretically, this total cost should equate to the cost of renting a place to live, though that will often not be true practically. In some markets renting may be more attractive than owning, and in other markets the opposite will be true. To understand the User Cost of housing, we need to understand the opportunity cost and therefore the expected capital appreciation from real estate.

Based on global data dating as far back as 1628, Shiller (2006) estimates long-term historical real home price appreciation at between 0.2% and 0.4% per annum. Jorda et al. (2017) estimate the real annual historical increase of home prices in 16 countries from 1870 to 2015 at 1.1%. Importantly, this is a global figure while no homeowner does own global real estate. Many of the countries in the sample had lower appreciation while others were higher. The wide dispersion in returns stemming from concentration in a single country, city, and asset is one of the risks of owning real estate. In many cities in Canada, this risk has paid off handsomely in recent years.

The Teranet-National Bank Canadian Home Price Index increased by an annualized rate of 4.8% in the last 20 years. This index does not account for maintenance costs. Additionally, over this time period, the decline of five-year government bond yields from 4.6% to 1.0% in Canada likely buoyed price appreciation which is an effect that should not be expected to repeat.

We estimate maintenance costs at 1% annually. Jorda et al. (2017) find maintenance costs between 1% and 2% historically; their estimate includes depreciation and all other housing-related expenses excluding interest, taxes and utilities. Statistics Canada uses 1.5% of the value of the home as a depreciation expense in the CPI basket; this figure is in line with multiple academic studies and the statistical agencies of other countries. 1.5% is for the building only, so it must be multiplied by the ratio of the building over the land value to arrive at the depreciation cost for the total value of the home.

We estimate the expected real capital return for personal residences at 1% annually. The carrying costs of real estate including maintenance and insurance costs and property taxes must also be captured. We estimate a 1% annual cost for maintenance and insurance. As property taxes vary greatly, we do not attempt to prescribe a figure here, but users should be sure to include them based on their circumstances. A 1% real return less maintenance and property taxes (not to mention the opportunity cost of home equity) may make housing look like a poor investment, but it is important to remember that the owner is receiving imputed rent as a benefit.

The User Cost of housing would suggest that the total costs of an owner and renter should be similar. Home ownership is consumption rather than investment, though the Canadian experience of rising real estate makes this easy to forget. Due to the heterogeneity of real estate markets, we do not attempt a predictive approach to determining expected real estate appreciation. It should be noted that Himmelberg et al. (2005) and Case and Shiller (2004) suggest that a housing bubble occurs when homebuyers are willing to pay inflated prices for houses today because they expect unrealistically high housing appreciation in the future. If the User Cost of owning housing in a market exceeds renting, prices may be too high and expected returns may be lower than average.

In financial planning we typically capture the real estate appreciation on the real estate asset and model maintenance and other carrying costs as cash flow requirements while the home is owned.

7. Asset Class Expected Returns

This section of the paper applies the information described up until to this point to estimating the returns of cash, fixed income, and stocks. These estimates are the building blocks of our portfolio expected returns.

Market-Based Expected Returns

The MBER for cash and fixed income derived from current yield to maturity is a nominal figure, while the MBER for equity derived from 1/CAPE is a real figure. We add our inflation estimate to the equity MBER to arrive at a nominal MBER.

Table 6 - Market-Based Expected Returns (MBER)

Asset Class	Benchmark Index	Measure of Expected Return	Real MBER	Nominal MBER
Cash	3-Month Canadian T-Bills	Yield-to-maturity	N/A	0.14%
Short Term Fixed Income	ICE BoA 1-5 Year Canada Broad Market	Yield-to-maturity	N/A	0.86%
Fixed Income	ICE BoA Canada Broad Market	Yield-to-maturity	N/A	1.62%
Canadian Equity	S&P/TSX Composite	1/CAPE	3.60%	5.90%
U.S. Equity	Russell 3000	1/CAPE	2.30%	4.60%
International Equity	MSCI EAFE	1/CAPE	4.50%	6.80%
Emerging Market Equity	MSCI Emerging Markets	1/CAPE	5.90%	8.20%

Source: PWL Capital; Data Source: Bloomberg, Morningstar, Robert Shiller

Equilibrium Cost of Capital

ECOC for all regional equity markets is based on the DMS real return data for world equity (5.2%), with a downward adjustment for the historical expansion of the price-to-dividend ratio (-0.7%), which is not expected to repeat in the future.

Table 7 - Equilibrium Cost of Capital (ECOC)

Asset Class	Benchmark Index	Real ECOC	Nominal ECOC
Cash	DMS U.S. T-Bills 1900-2020	0.80%	3.10%
Short Term Fixed Income	Interpolation Cash/Fixed Income	1.45%	3.75%
Fixed Income	DMS World Bonds 1900-2020	2.10%	4.40%
Canadian Equity	DMS World Equity 1900-2020	4.50%	6.80%
U.S. Equity	DMS World Equity 1900-2020	4.50%	6.80%
International Equity	DMS World Equity 1900-2020	4.50%	6.80%
Emerging Market Equity	DMS World Equity 1900-2020	4.50%	6.80%

Source; PWL Capital; Data Source: Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021

Expected Returns

In our calculation for the expected return of each asset class, we attribute a weight “W1” to the market-based estimate and the balance of the attribution to the ECOC.

Nominal expected stock returns are calculated as:

$$E(R)= (W1 * \text{Nominal MBER}) + (W2 * \text{Nominal ECOC})$$

Where:

W1 = Weight of the Market-Based Expected Return

W2 = (100% - W1) = Weight of the ECOC

MBER = Market-Based Expected Return

ECOC = Equilibrium Cost of Capital

The details for calculating asset class expected returns are provided in Table 8 below.

Table 8 - Nominal Asset Class Expected Returns

Asset Class	W1*	Nominal MBER	W2*	Nominal ECOC	Nominal Expected Return
Cash	75%	0.14%	25%	3.10%	0.88%
Short Term Fixed Income	75%	0.86%	25%	3.75%	1.58%
Fixed Income	75%	1.62%	25%	4.40%	2.32%
Canadian Equity	25%	5.90%	75%	6.80%	6.58%
U.S. Equity	25%	4.60%	75%	6.80%	6.25%
International Equity DV+EM	25%	7.27%	75%	6.80%	6.92%
GLOBAL EQUITY 33-33-33**					6.58%

*W1 + W2 = 100%

**A global equity portfolio equally weighed between Canadian, U.S. and international developed and emerging market equity

Source: PWL Capital; Data sources: Bloomberg, Morningstar, Robert Shiller, Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021

Expected Standard Deviations

Asset Class standard deviations are estimated using a simple average of the 5-year and 20-year historical standard deviations.

Table 9 - Estimated Volatility of Major Asset Classes

Asset class	Five-year standard deviation	20-year standard deviation	Estimated standard deviation
Canadian bonds (FTSE Canada Universe)	4.19%	3.91%	4.05%
Canadian equities (S&P/ TSX Capped Composite)	14.94%	14.40%	14.67%
U.S. equities (Russell 3000)	14.77%	13.65%	14.21%
International equities (MSCI EAFE&EM)	12.46%	13.78%	13.12%
GLOBAL EQUITY 33-33-33	12.82%	12.60%	12.71%

Source: PWL Capital; Data Source: Morningstar

Expected Correlations

Asset Class correlations are estimated using a simple average of the 5-year and 20-year historical data.

Table 10 - 5-year Historical Correlations

Asset class	Canadian Bonds	Canadian equity	U.S. equity	International equity	Global equity 33-33-33
Canadian Bonds	1.00	0.30	0.28	0.28	0.31
Canadian equity	0.30	1.00	0.82	0.74	0.93
U.S. equity	0.28	0.82	1.00	0.78	0.94
International equity	0.28	0.74	0.78	1.00	0.90
Global equity 33-33-33	0.31	0.93	0.94	0.90	1.00

Source: PWL Capital; Data Source: Morningstar

Table 11 - 20-year Historical Correlations

Asset class	Canadian Bonds	Canadian equity	U.S. equity	International equity	Global equity 33-33-33
Canadian Bonds	1.00	0.03	0.05	0.12	0.07
Canadian equity	0.03	1.00	0.62	0.70	0.87
U.S. equity	0.05	0.62	1.00	0.79	0.89
International equity	0.12	0.70	0.79	1.00	0.92
Global equity 33-33-33	0.07	0.87	0.89	0.92	1.00

Source: PWL Capital; Data Source: Morningstar

Table 12 - Correlation Estimates

Asset class	Canadian Bonds	Canadian equity	U.S. equity	International equity	Global equity 33-33-33
Canadian Bonds	1.00	0.16	0.17	0.20	0.19
Canadian equity	0.16	1.00	0.72	0.72	0.90
U.S. equity	0.17	0.72	1.00	0.78	0.91
International equity	0.20	0.72	0.78	1.00	0.91
Global equity 33-33-33	0.19	0.90	0.91	0.91	1.00

Source: PWL Capital; Data Source: Morningstar

Composition of Asset Class Returns

The composition of returns, primarily consisting of the mix between capital appreciation and dividends, is important for financial planning. The tax liability in taxable and non-taxable (due to foreign withholding tax) accounts will hinge on the portion of returns assumed to be coming from dividends.

For fixed income we assume that the expected return is composed of 100% interest income. In the current market environment, fixed income funds' distribution yields are often higher than their expected returns. Rather than assuming a capital loss, which will complicate our analysis, we assume an all-income return.

To determine the composition of equity asset classes, we proceed as follows:

- Establish two mutual funds or ETFs that represent the passive benchmark for each of Canadian and U.S. equities. For international equities, we use three ETFs and mutual funds to ensure an appropriate representation of developed and emerging markets.
- For Canadian equity, the average distribution yield is assumed to be 100% Canadian dividends.
- For U.S. and International equity, the average distribution yield is assumed to be 100% foreign dividends.
- The balance of expected returns (net of dividend yields) is treated as capital gains.
- We assume a 50%/50% split between realized and deferred capital gains.

Current funds in use to estimate the composition of asset class returns:

1 Fixed income: 100% Vanguard Aggregate Bond ETF (VAB)

2 Canadian equity: 50% iShares S&P/TSX Composite ETF (XIC), 50% DFA Canadian Core Equity fund (DFA256)

3 U.S. Equity: 50% Vanguard U.S. Total Market ETF (VUN), 50% DFA U.S. Core Equity fund (DFA293)

4 International Equity: 35% Vanguard FTSE Developed All Cap Ex North America (VIU), 15% Vanguard FTSE Emerging Markets All Cap Index (VEE), 50% DFA International Core Equity fund (DFA227)

Our estimates for the composition of expected returns are illustrated at Table 13.

Table 13 - Composition of Expected Asset Class Returns

Asset class	Expected Return	Interest & Foreign Dividends	Canadian Dividends	Realized Capital Gains	Unrealized Capital Gains
Fixed Income	2.32%	2.32%	0.00%	0.00%	0.00%
Canadian Equity	6.58%	0.00%	2.39%	2.09%	2.09%
U.S. Equity	6.25%	1.07%	0.00%	2.59%	2.59%
International Equity DV & EM	6.92%	2.09%	0.00%	2.41%	2.41%
Foreign Equity (50/50)	6.58%	1.58%	0.00%	2.50%	2.50%

Source: PWL Capital; Data Sources: Bloomberg, Morningstar, Robert Shiller, Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021

8. Portfolio Expected Returns

To simplify the practical application of the information presented in this paper, we present portfolios consisting of various mixes between stocks and bonds.

Table 14 - Composition of Expected Asset Class Returns

ESTIMATED RETURN COMPOSITION						
Asset Mix (Equity/Bond)	**Expected Return**	**Expected Standard Deviation**	**Interest & Foreign Dividends**	**Canadian Dividends**	**Realized Capital Gains**	**Unrealized Capital Gains**
0/100	2.32%	4.05%	2.32%	0.00%	0.00%	0.00%
5/95	2.50%	4.02%	2.25%	0.04%	0.11%	0.11%
10/90	2.79%	4.10%	2.19%	0.08%	0.26%	0.26%
15/85	2.95%	4.24%	2.13%	0.12%	0.35%	0.35%
20/80	3.15%	4.45%	2.06%	0.16%	0.47%	0.47%
25/75	3.39%	4.81%	2.00%	0.20%	0.60%	0.60%
30/70	3.60%	5.16%	1.94%	0.24%	0.71%	0.71%
35/65	3.82%	5.60%	1.87%	0.28%	0.83%	0.83%
40/60	4.03%	6.04%	1.81%	0.32%	0.95%	0.95%
45/55	4.22%	6.47%	1.75%	0.36%	1.06%	1.06%
50/50	4.44%	7.00%	1.68%	0.40%	1.18%	1.18%
55/45	4.66%	7.53%	1.62%	0.44%	1.30%	1.30%
60/40	4.86%	8.06%	1.56%	0.48%	1.41%	1.41%
65/35	5.10%	8.67%	1.49%	0.52%	1.54%	1.54%
70/30	5.30%	9.20%	1.43%	0.56%	1.66%	1.66%
75/25	5.53%	9.81%	1.37%	0.60%	1.78%	1.78%
80/20	5.72%	10.34%	1.31%	0.64%	1.89%	1.89%
85/15	5.95%	10.95%	1.24%	0.68%	2.01%	2.01%
90/10	6.14%	11.48%	1.18%	0.72%	2.12%	2.12%
95/5	6.36%	12.10%	1.12%	0.76%	2.24%	2.24%
100/0	6.58%	12.71%	1.05%	0.80%	2.36%	2.36%

Source: PWL Capital; Data Sources: Bloomberg, Morningstar, Robert Shiller, Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of Optimists: 101 Years of Global Investment Returns, Princeton University Press, 2002; Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Returns Yearbook and Sourcebook, 2018, Zurich: Credit Suisse Research Institute, 2021

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10. Glossary

Beta: In a regression analysis, beta is the sensitivity of the independent variable to fluctuations of the explanatory variable.

DMS: A family of market indexes that was designed by Elroy Dimson, Paul Marsh and Mike Staunton from the London Business School.

ECOC: Equilibrium Cost of Capital is the historical of the asset class over more than a hundred years, adjusted, when possible, for non-recurring items.

MBER: Market-Based Expected Return is a measure of expected returns based on a variable that reflect the current market conditions.

Regression analysis: A set of statistical processes for estimating the relationships between a dependent variable and one or more independent variables (‘predictive variable’).

R-Square: The explanatory power of a regression analysis. The R-Square is located between 0 and 1. A R-Square of one means the explanatory variable(s) of the regression explain 100% of the variation of the dependent variable.

T-stat: Within a regression analysis, the t-statistic measures whether the coefficients of a regression — for example, the beta of a simple linear regression, is statistically significant. The rule of thumb is that a t-statistic of over 2 is considered significant.

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