

Wealthsimple

Our Approach to Building Portfolios

Wealthsimple Investment Team

October 2019

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Executive Summary

The most important thing we can do for our clients is provide diversified, low cost, passive portfolios that they can invest in for the long term. Our investment principles are as follows:

Risk drives returns.

The returns you get from investing are roughly proportional to the risk you take.

Diversification increases risk-adjusted returns.

The more risk you allocate to diversifying assets, the higher your return-to-risk ratio will be.

Outperforming a diversified, low-cost, passive portfolio is extremely hard.

Investors who try to time the market systematically lose money, and most managers who try to beat the market underperform. Investors are therefore better off with low-fee passive ETFs vs. higher-fee active funds.

We designed our portfolios to increase diversification compared to more conventional portfolios. Here is what we did differently and why.

Bonds: We increased risk to government bonds, added inflation-linked bonds, and reduced credit risk.

- Increasing bond risk improves diversification across asset classes — i.e. between equities and bonds.
- Inflation-linked bonds can provide a valuable hedge that nominal bonds and equities don't offer.
- Unlike government bonds, corporate credit is correlated to equities and therefore less diversifying, so we reduced credit risk to further improve portfolio balance.

Equities: We reduced equity risk by adding lower-volatility equities and improved geographic diversification.

- We reduced equity risk to make room for more bond risk in the portfolio, although equities still dominate.
- We also made the equity allocations more efficient. "Minimum-volatility" equities are more diversified than market-cap-weighted indices, since they weight stocks based on their volatility and how they relate to each other, not just based on their size.
- We increased exposure to international and emerging markets to reduce concentration risk in the event the U.S. economy materially underperforms.

We expect our portfolios to offer superior risk-adjusted returns over the long term compared to more conventional portfolios.

- We built “consensus” portfolios that reflect investor expectations and what we see in the marketplace.
- Our portfolios behave similarly to these consensus portfolios, doing well when equities do well and poorly in market downturns and inflationary environments.
- Our portfolios would have materially outperformed the consensus portfolios historically, with 30%+ higher risk-adjusted returns for the balanced and growth portfolios.
- Although they may outperform or underperform in any given year, over time we expect our portfolios to outperform the consensus allocations because they are better diversified.

To implement the portfolios, we selected securities that minimize total costs (including taxes).

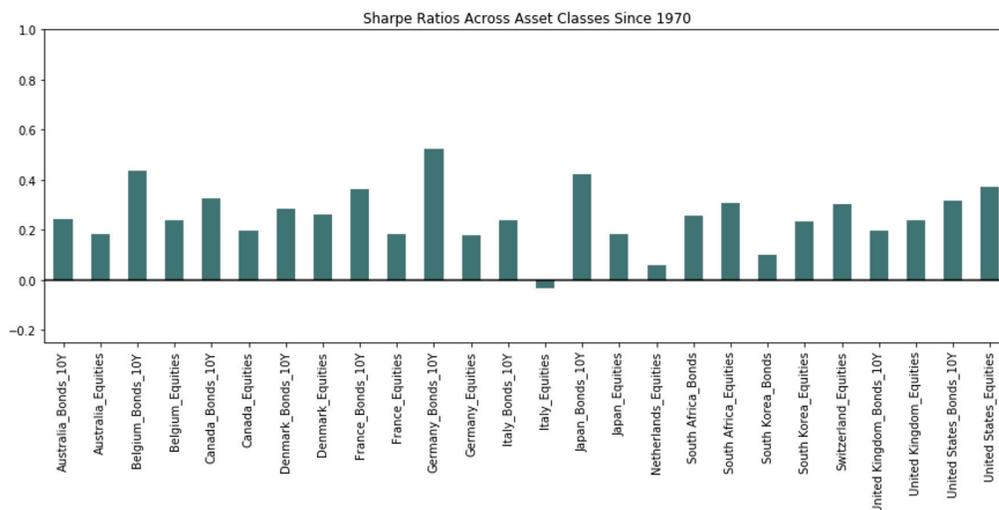
- We tailor our security selection to account types (e.g. 401K/IRA vs. taxable) based on tax considerations.
- The resulting portfolios have slightly lower all-in costs after accounting for ETF expense ratios, expected transactions costs (including commissions and bid/ask spreads), and taxes.

Investment Principles

Three core investment beliefs drive our approach to building portfolios:

1) Risk drives returns.

In general, **investment returns are compensation for taking on risk**—specifically, the risk that your investments lose value. Issuers of debt and equity pay this compensation to incentivize investors to lend to them or purchase an equity stake. Bonds make money over time because they're riskier than cash, and stocks make more money because they're riskier than bonds. This type of passive market risk is commonly referred to as "beta." Over the long term, with beta, **the returns you get are roughly proportional to the risks you take**. Indeed, as the table below illustrates, return-to-risk ratios across asset classes have been by and large similar, averaging around 0.25 over the period shown (since 1970).



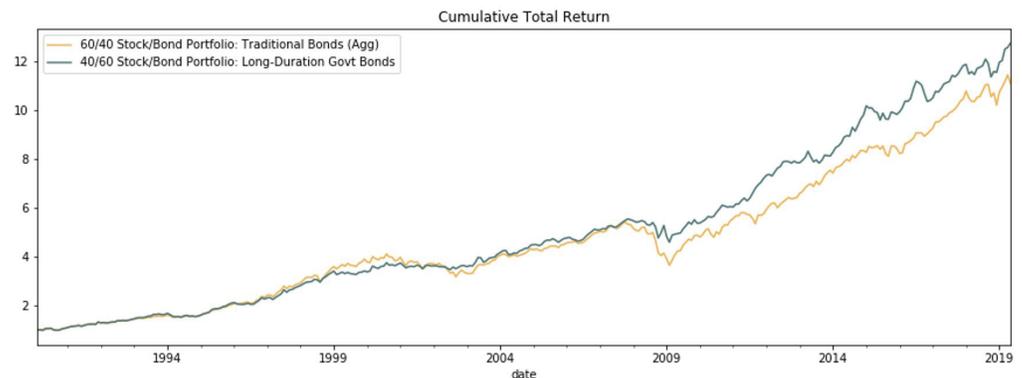
Global Financial Data, Wealthsimple analysis. Note: Sharpe ratios calculated as the compound annualized monthly total return less the compound annualized local cash rate, divided by the annualized standard deviation of monthly total returns. Past performance of markets is not necessarily indicative of future results.

2) Diversification increases risk-adjusted returns.

A diversified portfolio combines assets to minimize exposure to uncompensated risks. Here, we offer three practical "rules" of diversification. First, **invest in a broad basket of assets** (e.g. many stocks vs. a handful) because doing so narrows the range of outcomes, reducing risk without reducing expected returns. Second, **invest in assets that behave**

differently from each other, including different asset classes (e.g. stocks vs. bonds) and different markets within an asset class (e.g. U.S. stocks vs. Chinese stocks). Critically, “different” is not about an asset’s *structure*; it’s about its *behaviour* — how correlated or uncorrelated it is to other assets. The more truly diversifying sources of return you can add to your portfolio, the higher its return-to-risk. Third, and perhaps most important, **allocate risk, not capital**, to maximize diversification. A dollar in stocks is very different from a dollar in bonds. If investors want to maximize their risk-adjusted returns, the most important thing they can do is allocate similar amounts of risk to asset classes that diversify each other. The capital allocation should fall out of this risk allocation, not the other way around.

The chart and table below compare the historical performance of two stock/bond portfolios to highlight the importance of balancing risk vs. capital. The first portfolio splits capital 60/40 between U.S. stocks and bonds, resulting in a portfolio driven by equity risk. The second is a more risk-balanced mix, with 40% of capital allocated to stocks and 60% to longer-duration (riskier) government bonds. As you can see, the more risk-balanced portfolio would have delivered substantially higher risk-adjusted returns over the past two decades, handily outperforming the traditional mix with less risk. As growth was a major driver of asset returns during this period, having similar risk in stocks (which do well when growth is rising) and bonds (which do well when it is falling) made the portfolio particularly well diversified.



	60/40 Stock/Bond Portfolio: Traditional Bonds (Agg)	40/60 Stock/Bond Portfolio: Long-Duration Govt Bonds
Ann. Total Return	8.55%	9.07%
Ann. Excess Return	5.82%	6.33%
Ann. Std. Dev.	8.80%	7.64%
Sharpe Ratio	0.66	0.83

Bloomberg data, Wealthsimple analysis. Chart shows the simulated historical gross-of-fees performance of two hypothetical portfolios rebalanced monthly before transactions costs. Portfolios are constructed with the benefit of hindsight for illustrative purposes only. Past performance is not necessarily indicative of future results.

3) Outperforming a diversified, low-cost, passive portfolio is extremely hard.

Returns from active bets on markets are commonly referred to as “alpha.” **Alpha is difficult.** First, **timing the market is very hard.** Even the most sophisticated players are unable to do it consistently, and individual investors tend to lose money doing it — chasing

positive performance, selling based on emotion, and often missing out on subsequent returns they could not have predicted.¹ It follows that the most important thing investors can do is stay invested regardless of what markets have been doing. Second, **beating the market is very hard**. Few investors — including professional asset managers — are able to do it consistently, especially after fees. Although some have claimed that fixed-income managers may do better, studies have shown that this is often because they systematically overweight risky credit; not because they truly add value.² And even conceding that a handful of managers can beat the market, it is very hard to identify those managers ex ante. Most investors rely on a manager's recent performance, but research has shown that **recent performance has little to no predictive value**.³ Meanwhile, the few managers who have the skill to outperform are often out of reach for individual investors.

To be sure, some active managers can provide a valuable source of diversification and downside protection, in particular through strategies that manage risk systematically or offer returns that are reliably uncorrelated to the rest of the investors' portfolios. For example, research has shown that systematic exposure to high-quality stocks (e.g. stocks with strong balance sheets and profitability) can reduce risk relative to a broader index. Investors considering active management should carefully evaluate why a specific manager or strategy would be expected to add value to their portfolios and, in most cases, should seek the help of an expert advisor.

¹ See, e.g., http://crr.bc.edu/wp-content/uploads/2017/01/IB_17-2.pdf, <https://www.spindices.com/documents/spiva/spiva-us-year-end-2018.pdf>, <https://www.qidllc.com/wp-content/uploads/2016/02/2016-Dalbar-QAIB-Report.pdf>, https://www.researchaffiliates.com/en_us/publications/articles/429_calling_the_turns_why_market_timing_is_so_hard.html, <https://advisor.mp.morningstar.com/resourceDownload?type=publicForms&id=3f9dff3c-f085-47a1-98ba-0bc008df9f25>, <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1047&context=cbafacpub>, <https://faculty.haas.berkeley.edu/odean/papers%20current%20versions/behavior%20of%20individual%20investors.pdf>

² <https://images.aqr.com/-/media/AQR/Documents/Alternative-Thinking/Alternative-Thinking-4Q18-Illusion-of-Active-Fixed-Income-Alpha.pdf>

³ http://www.hec.unil.ch/agoyal/docs/Persistence_JoF.pdf, <https://jpm.ijournals.com/content/43/4/33>

Wealthsimple's Approach to Building Portfolios

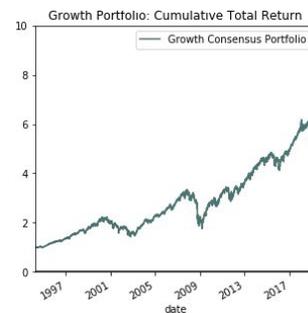
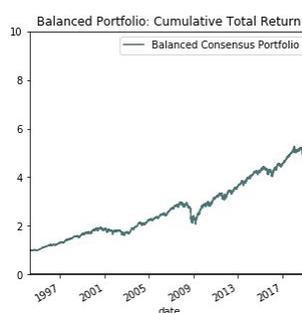
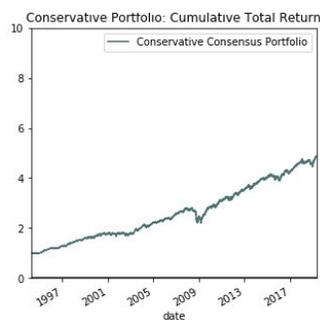
These investment principles guide our approach to building portfolios. To construct the portfolios, we first ask, "What is the best asset allocation we can give our investors that will help them achieve their goals?" We start with our investors' expectations, because expectations drive behaviour and behaviour drives outcomes: If our portfolios don't look, feel and perform the way our investors expect, our investors may not stay invested, which will hurt their long-term results. From there, our goal is to maximize diversification and minimize costs. Our portfolio-construction process thus has three basic steps:

1. Build "consensus" stock/bond portfolios that reflect investor expectations
2. Improve diversification to increase risk-adjusted returns
3. Choose securities for each account that minimize tracking error, costs, and taxes

Step 1: Build "Consensus" Stock/Bond Portfolios that Reflect Investor Expectations

Our starting point is investor expectations. Again, this is because the most important thing for long-term investors is to stay invested and, to do that, investors need to understand and believe in the portfolios they're invested in. This is much easier to do when the performance of one's portfolio reflects local and regional equity markets. Although every investor is different, we represent expectations using a broad mix of assets with a tilt towards U.S. assets, allocating money between stocks and bonds to reach different target risk levels (stocks for returns, bonds for risk reduction). We believe that these portfolios will track perceptions of what's happening in the markets.

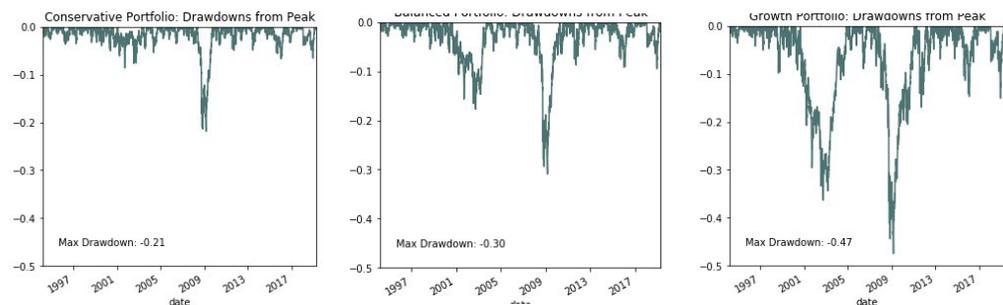
As long as investors do not pay high fees for them, these consensus portfolios should provide attractive returns over time. And as the charts below illustrate, they would have consistently outperformed cash over longer time horizons.



	Conservative Consensus Portfolio	Balanced Consensus Portfolio	Growth Consensus Portfolio
Ann. Total Return	6.30%	6.69%	7.28%
Ann. Excess Return	3.90%	4.28%	4.87%
Ann. Std. Dev.	5.32%	7.22%	11.61%
Sharpe Ratio	0.73	0.59	0.42

Source: Bloomberg data, Wealthsimple analysis. Charts show the simulated historical gross-of-fees performance of hypothetical portfolios rebalanced daily before transactions costs. For illustrative purposes only. Past performance is not necessarily indicative of future results.

That said, because these portfolios are highly concentrated in equity risk, they have a “boom/bust” profile driven by their equity exposure — rising when markets rally but suffering large losses in market downturns. The following charts illustrate these drawdowns.



Bloomberg data, Wealthsimple analysis. Charts show the simulated historical drawdowns from peak of the hypothetical portfolios described above. Portfolios are constructed with the benefit of hindsight for illustrative purposes only. Past performance is not necessarily indicative of future results.

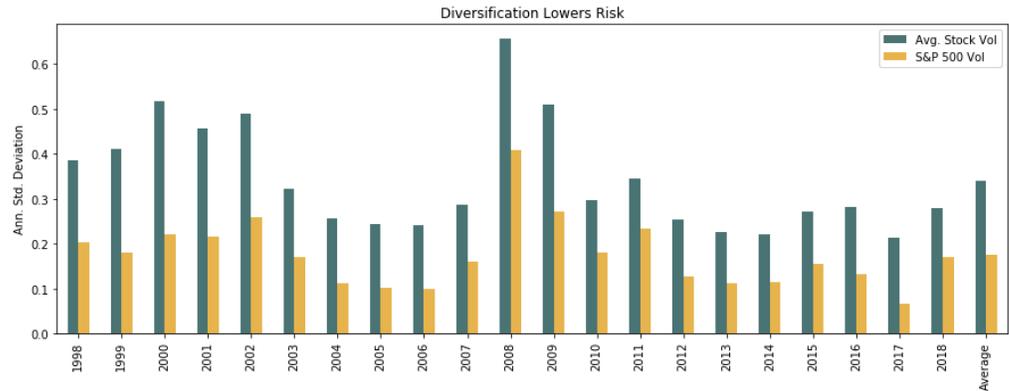
It is worth emphasizing that this kind of volatility degrades returns even for investors with long time horizons. A 47% drawdown (the largest over this timeframe for the growth portfolio) requires an ~89% return just to break even, since it compounds on a smaller asset base ($53\% \text{ of starting assets} * 1.89 = 100\%$). And there is no guarantee that recovery will be achieved quickly. Improving diversification can help mitigate these severe drawdowns and improve long-term risk-adjusted returns.

Step 2: Improve Diversification to Increase Risk-Adjusted Returns

Our next step is to improve diversification while continuing to deliver the core exposures investors expect.

The Consensus Portfolios

Are the consensus portfolios diversified? Yes and no. Their biggest advantage is that they provide investors with broad passive exposure to thousands of different underlying stocks and bonds at low cost. As the following chart shows, the average stock in the S&P 500 has been almost twice as volatile as the index itself — highlighting how the index helps to diversify away individual company risk. The index provides attractive returns over time at a lower level of risk overall.



Bloomberg data; Wealthsimple analysis. Past performance is not necessarily indicative of future results.

On the other hand, the consensus portfolios concentrate their risk in equities — and in local equity markets in particular. This gives up a number of diversifying sources of return, such as international bonds, inflation-linked bonds, and commodities. The portfolios also do a poor job of allocating risk to maximize portfolio efficiency. First, diversification across asset classes is sub-optimal. The balanced and growth portfolios, in particular, and even the conservative portfolio, are all highly concentrated in equity risk, underperforming significantly in economic and market downturns and inflationary environments. Exposure to corporate credit only exacerbates this problem, as the performance of corporate credit spreads is highly correlated to that of equities. Not only is risk not allocated well across asset classes; diversification within asset classes is also sub-optimal. Equity exposures in the consensus portfolios are all market-cap-weighted — i.e., the bigger the company, the bigger the position — even though bigger doesn't necessarily mean better, and they are overweight domestic assets.

In sum, the portfolios hold many assets but few truly diversifying sources of return and, given their risk allocation, are not as diversified as they could be — either within or across asset classes.

Improving Diversification

We identified a few basic adjustments to the consensus portfolios to improve diversification. Our first priority was to **improve diversification across asset classes** — specifically, between equities and bonds — to reduce portfolio sensitivity to poor economic growth. We also added inflation-linked bonds to help protect against inflation. Asset-class diversification was our first priority because it has the biggest impact on overall risk and performance. Our second priority was to **improve diversification within asset classes** — allocating risk more evenly across equities, for example. These two priorities complement each other well. More diversification means less risk. By making our equity allocation more diversified, we were able to reduce equity risk, and thus accommodate more bond risk. The adjustments we made were as follows:

- **Bonds:** We increased risk to government bonds, including inflation-linked bonds, and decreased credit risk.

- **Equities:** We reduced equity risk by shifting to lower-volatility equities and improving geographic balance.

The rest of this section explains how we modified our bond and equity allocations to improve diversification.

IMPROVING THE BOND ALLOCATION

Bonds diversify stocks very well, so our goal was to make the bond allocation as diversifying and impactful as possible. The main drawbacks to the bond allocations in the consensus portfolios are as follows:

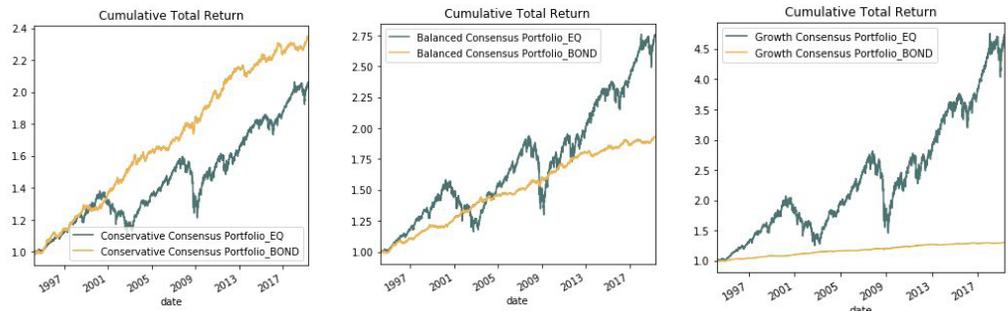
1. They are relatively low risk
2. They offer no inflation protection
3. They include credit risk, which is correlated to equities and can be similarly vulnerable in recessions

To address these drawbacks, we:

1. Increased exposure to longer-duration bonds, which increases their risk contribution to balance out equities
2. Added inflation-protected bonds to better protect against inflation
3. Reduced or eliminated exposure to corporate credit to improve performance in recessions

Equities Drive Portfolio Risk

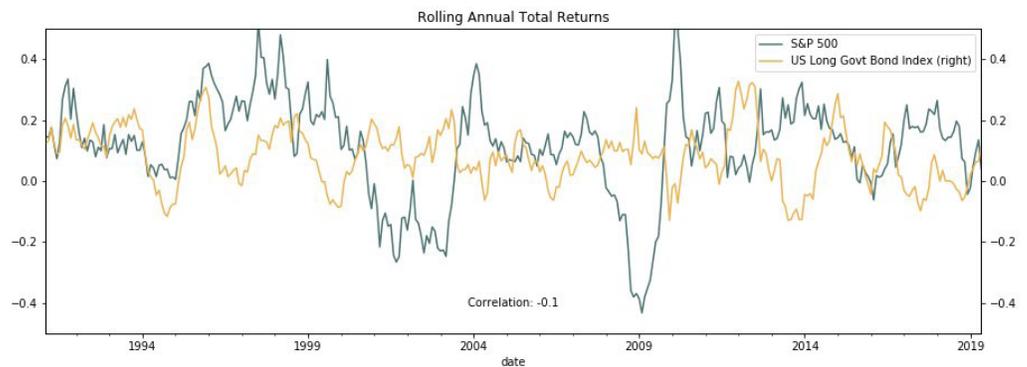
Equities drive most of the risk in even the conservative consensus portfolio. In the balanced portfolio, the diversification bonds offer is minimal and, in the growth portfolio, it is negligible. As you can see below, the equity allocations are far more volatile than the bond allocations across the board.



Bloomberg data, Wealthsimple analysis. Charts show the simulated historical gross-of-fees performance of the equity and bond allocations of hypothetical portfolios rebalanced daily before transactions costs. For illustrative purposes only. Past performance is not necessarily indicative of future results.

Bonds Diversify Equities

The equity-bond risk allocation in the portfolios is not optimal because bonds can be highly diversifying if given enough risk share in the portfolios to have an impact. Although the correlation of stocks to bonds fluctuates, it has been low on average over time — particularly in recent decades. The following chart shows the rolling annual total returns of the S&P 500 vs. longer-duration government nominal bonds. Note how the two often move in opposite directions (although not always). The correlation of these two return streams has been slightly negative over the period shown. Note also that equities remain far more volatile than even these longer-duration bonds. For further detail on how growth, inflation and central-bank policy drive the correlation between stocks and bonds, see Appendix A.



Bloomberg data, Wealthsimple analysis. For illustrative purposes only. Past performance is not necessarily indicative of future results.

We Increased Bond Risk to Balance Out Equities

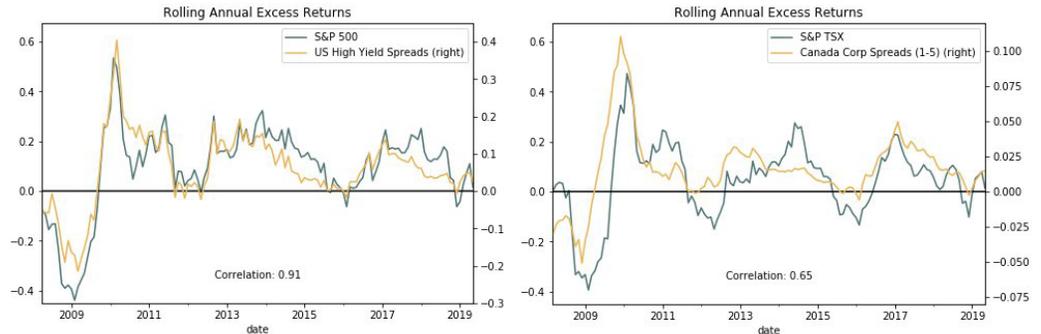
A common misconception among investors is that, although bonds diversify equities, they are too low risk to have a meaningful impact. But not all bonds have low risk. And higher-risk bonds have, in general, higher expected returns — this is the basic principle of investing discussed earlier (“risk drives returns”), and one that has been borne out historically. We can thus increase the impact of bonds on the portfolio by taking exposure to more diversifying, higher-risk, higher-return bonds.

Increase interest rate risk; reduce credit risk

Risk for bonds has two basic components: (a) credit risk and (b) interest rate risk. Credit risk is the risk of default. Companies at high risk of default have higher yields and higher expected risk and return than companies with low default risk.⁵ Credit spreads — the spread of a bond’s yield above otherwise-comparable risk-free treasury bonds — compensate investors for this risk, which corresponds to the creditworthiness of

⁵ The same is true for countries that, unable to print their own currency, have default risk (e.g. emerging-market countries that have issued debt denominated in U.S. dollars, or the so-called “PIIGS” countries in Europe, whose debt is denominated in Euros that only the European Central Bank can print).

the bonds' issuers. Because the performance of these credit spreads is highly correlated to companies' financial performance and global growth more generally, the spreads are not as diversifying to equities as government bonds. The following charts show two examples of this using data for credit spread returns in the U.S. and Canada since 2007 — as far back as data was available for both indices. As the charts show, credit and equities in both countries have generally risen and fallen together.

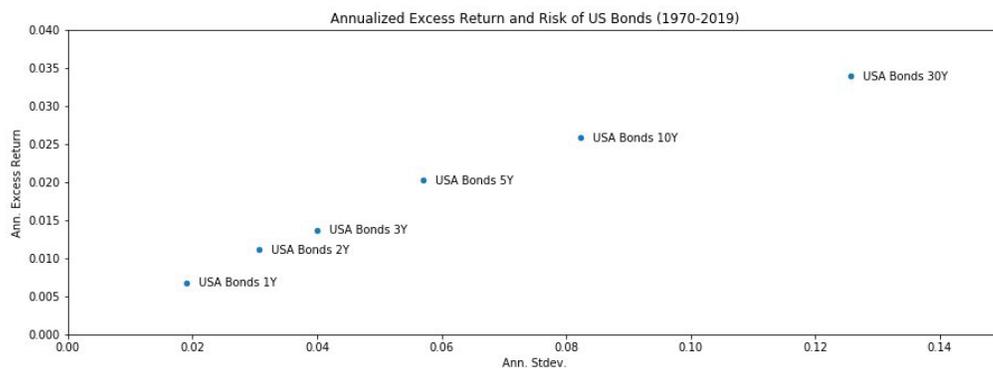


Bloomberg data, Wealthsimple analysis. U.S. returns are based on UBS' CDX High Yield Index. Canada returns are simulated excess returns of 1-5-year corporate credit above government bonds. For illustrative purposes only. Past performance is not necessarily indicative of future results.

Because credit risk is not very diversifying, we reduced exposure to it and focused instead on more lowly correlated government bonds, which have very low risk of explicit default.

The second type of bond risk is interest-rate risk. Governments (and companies) issue short-term, intermediate-term and long-term bonds — with terms ranging from 30 days to 30 years or more (Austria recently issued a 100-year bond!). In general, the longer the term, the farther out cash flows are fixed into the future, and the bigger the impact a change in interest rates will have on the present value of those cash flows (i.e. on the price of the bond). Because falling rates increase bond prices at a time when equities are often underperforming, rate risk is the kind of bond risk we wanted to increase exposure to. In general, the longer the duration of the government bonds we invest in, the higher their expected risk and return, and the greater their impact on the portfolio.

The following chart shows the historical annualized excess returns and risks of bonds at different maturities. As you can see, the higher the maturity, the higher the return and risk have been. On a risk-adjusted basis, returns over the ~50-year period shown have been roughly similar. For further discussion on what drives the higher returns of longer duration bonds, see Appendix B.



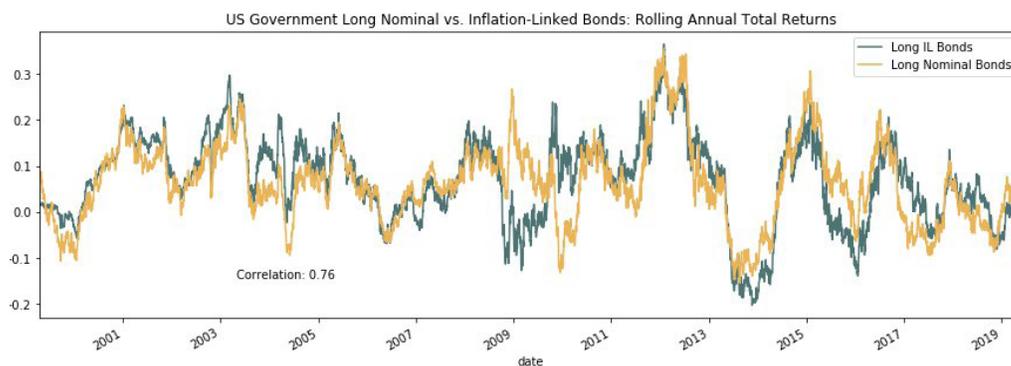
Bloomberg data, Wealthsimple analysis. For illustrative purposes only. Past performance is not necessarily indicative of future results.

In sum, we reduced exposure to shorter-duration bonds, including corporate credit, and increased exposure to longer-duration government bonds.

We Incorporated Longer-Duration Inflation-Linked Bonds to Protect Against Inflation

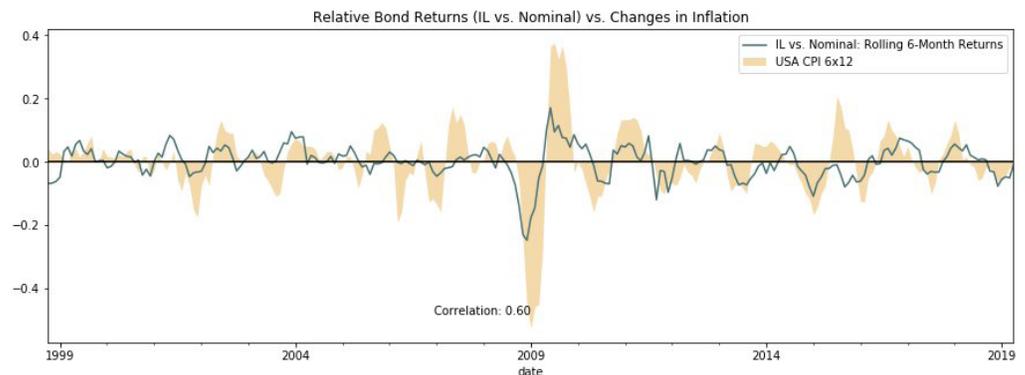
We have focused thus far on adding longer-duration nominal government bonds to the portfolio — i.e., bonds whose coupons are fixed. These bonds do well when growth and inflation fall (relative to market expectations) and poorly when they rise. But there is another kind of government bond called an inflation-linked (IL) bond. Like nominal bonds, inflation-linked bonds do well when growth disappoints and poorly when it surprises on the upside. But unlike nominal bonds, inflation-linked bonds offer protection against inflation. These bonds deliver a fixed real component but a variable inflation component, which rises and falls with the consumer price index (CPI) and accrues to the principal amount of the bond.

Because they benefit from inflation rather than being hurt by it, inflation-linked bonds provide a valuable source of asset-class diversification to the portfolio. To be sure, they can be highly correlated to nominal bonds and have been especially so over the past two decades, as swings in growth have driven both types of bonds up and down while inflation has remained flat and relatively stable. Although inflation-linked bonds are a relatively recent phenomenon in the U.S., we believe their correlation to nominal bonds would have been much lower historically in periods like the 1970s and 1980s, when changes in inflation were a major driver of asset returns.



Bloomberg data, Wealthsimple analysis. For illustrative purposes only. Past performance is not necessarily indicative of future results.

To the extent nominal and inflation-linked bonds have diverged in recent history, those divergences have mainly been driven by changes in inflation expectations. The following chart highlights this by showing the rolling 6-month returns of real vs. nominal bonds against changes in inflation (6-month inflation vs. its 12-month moving average), as a proxy for how inflation evolved relative to expectations and how expectations shifted. As the chart shows, when inflation increased compared to recent experience (the shaded area), IIs outperformed nominals (the dark green line); when inflation fell, they underperformed (correlation: 0.60). The financial crisis of 2008 was a good example of this, as the collapse in growth brought inflation down with it, contributing (among other 16 factors like liquidity) to the underperformance of IIs vs. nominals; when inflation stopped falling so quickly, in early to mid-2009, the trend reversed and IIs outperformed.

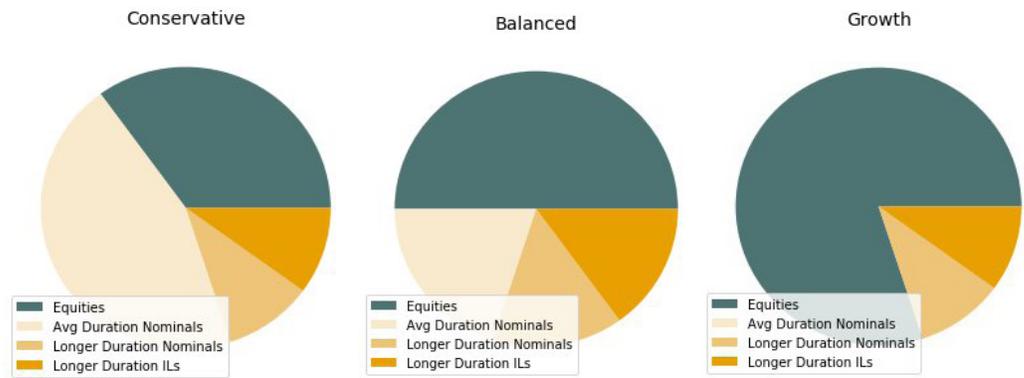


Bloomberg data, Wealthsimple analysis. For illustrative purposes only. Past performance is not necessarily indicative of future results.

When inflation is low and stable, as it generally has been, nominal bonds and inflation linked bonds will behave similarly, and there is not much incremental benefit to having IIs in the portfolio. But predicting inflation far out into the future is difficult. Many commentators have written about the alleged “death” of inflation, but we don’t know if it is dead or merely dormant, and we don’t want to bet on this one way or the other. Nor do we want to wait until inflation rises again, because markets move quickly and we do not expect to outmaneuver them. If long-term expectations for inflation rise, we know nominal bonds will sell off and IIs will probably appreciate long before we are able to “react.” For this reason, we think it is better to “react” now by diversifying our portfolio so that, whatever the outcome for inflation, we have some protection.

The Resulting Fixed Income Allocations

The following charts show our fixed-income allocations in the conservative, balanced, and growth portfolios. For the growth portfolio, because the fixed income allocation is so small to begin with (20%), we allocate most of it to longer-duration nominal bonds (for greater interest-rate risk) and the remainder to IIs. For the balanced and conservative portfolios, we allocate only a portion of the fixed-income allocations to longer-duration bonds, some to TIPS, and the balance to the standard US bond aggregate exposure.



For illustrative purposes only. Actual allocations over time may vary.

IMPROVING THE EQUITY ALLOCATION

Equities are the main engine of growth in the consensus portfolios and provide healthy returns over long periods of time. That said, equities drive a disproportionate amount of the risk in the portfolios; these allocations could be more diversified internally and more diversifying to the portfolios. In particular:

1. The portfolios are highly concentrated in equity risk
2. The equity allocations are over-concentrated in the largest companies
3. The allocations are not as geographically diversified as they could be

To add diversification and reduce risk, we:

1. Shifted part of the equities allocations to “minimum volatility” equities exposures — reducing equity risk in the portfolio (#1 above) and moderating exposure to the largest companies (#2).
2. Reduced the domestic bias to Canadian equities and increased exposure to international equities, including emerging markets (#3 above).

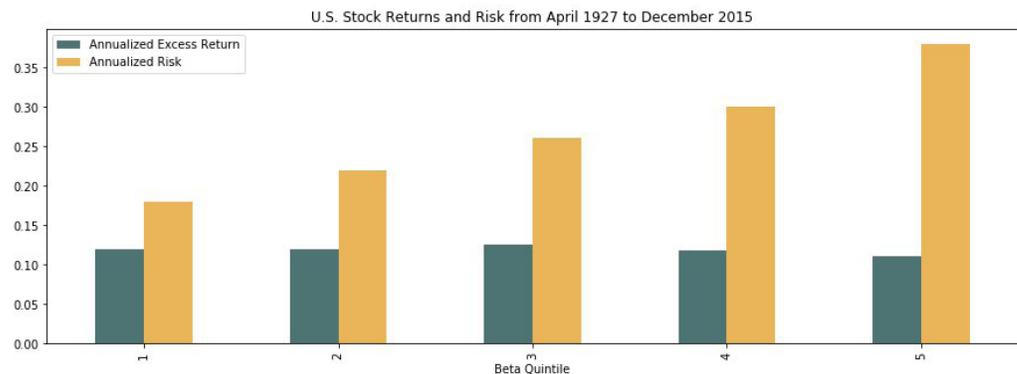
“Min Vol” Equities

Just as we shifted from lower-risk to higher-risk bonds, we shifted equities in the reverse direction — from higher-risk to lower-risk equities. In particular, we reduced equity risk by shifting some capital from tracking market-cap-weighted indices to minimumvolatility (“min-vol”) indices. Min-vol reduces volatility in two ways. First, it provides greater exposure to lower-volatility, lower-beta equities. Second, it weights those equities in a sensible way, taking into account their relative volatilities and correlations to minimize the volatility of the overall allocation. This weighting is typically done subject to certain constraints (e.g. on sector and country weights) that limit deviations from the benchmark and limit turnover.

Low-volatility vs. high-volatility equities

In theory, higher-volatility equities should provide higher returns, and lower-volatility equities, lower returns. In practice, this has not been true; in fact, low-volatility equities have provided similar or even slightly higher absolute returns than their high-volatility counterparts. This phenomenon, known as the “low-volatility anomaly,” has been confirmed and replicated by academics in studies across geographies and time horizons. Theories abound as to why low-vol has outperformed, including (1) that investors systematically over-estimate and over-price popular but volatile growth stocks or, relatedly, (2) that low-volatility simply combines less popular “value” stocks with “profitability” (or “quality”) – two other factors known to have outperformed historically, or (3) that investors and managers systematically overweight volatile stocks in order to chase higher returns or beat their benchmarks without taking leverage. Whatever the reasons, this phenomenon has been widespread and persistent.

The following analysis by AQR shows the historical performance of U.S. stocks by volatility (beta) quintile. As you can see, historically, returns have not scaled with volatility; rather, returns of the most volatile and least volatile stocks have been similar. This means that, on a risk-adjusted basis, low-volatility stocks have significantly outperformed.



Source: AQR. U.S. Equities are represented by the CRSP U.S. index until 1980, then the Russell 3000 thereafter. Chart shows arithmetic average returns. Past performance is not a guarantee of future performance. Return and risk characteristics are provided excess of the risk-free rate. At the beginning of each calendar month, stocks are ranked in ascending order on the basis of their estimated beta at the end of the previous month. The ranked stocks are assigned to one of five quintile portfolios. All stocks are equally weighted within a given portfolio. The risk free rate is represented by U.S. 3 Month T-Bills. These are not the returns of an actual portfolio that AQR manages and are for illustrative purposes only. Hypothetical performance results have inherent limitations. For the full AQR paper, see <https://images.aqr.com/-/media/AQR/Documents/DC-Solutions/DC-Solutions-Defensive-Equity-Part-1.pdf>

We do not know whether this kind of risk-adjusted outperformance will persist. The more well-documented and widely known phenomena like this become, the more liable they are to get “priced in” — i.e., if everyone knows low-vol stocks offer higher risk-adjusted returns, investors will bid up the prices of those stocks (and sell high-vol stocks) until that is no longer the case. And indeed, low-vol strategies and ETFs have become quite popular, with substantial inflows over the past few years. That said, we are aware of no evidence that this phenomenon has disappeared or that the gap between high-vol

and low-vol is closing. And though interest in low-vol strategies has grown, the amount of assets in these strategies remains a small fraction of the assets in other equities strategies, including traditional market-cap-weighted approaches. So there seems to be a lot of room for low-vol strategies to grow. To the extent the anomaly gets priced in, we would expect risk-adjusted returns to equities to normalize over time — that is, we would expect returns to be similar on a risk-adjusted basis (similar Sharpe ratios) across volatility quantiles. Unless and until that happens, a low-vol allocation will benefit from any continued outperformance.

To be clear, we are not incorporating low-volatility equities because they are “better”; we are incorporating them because they lower volatility. Reducing equity volatility lets us increase bond volatility without increasing the volatility of the overall portfolios. To the extent the low-volatility anomaly persists, however, we would welcome any outperformance as an added bonus.

Minimum volatility vs. market-cap weighting

The difference between a market-cap-weighted index and a “minimum volatility” index is not just that the latter favors lower-volatility stocks; it is also in how those stocks are weighted. Market-cap-weighted indices weight stocks in proportion to their size. This maximizes liquidity — by definition, the largest and most liquid stocks receive the largest weights — and it provides investors with a good and intuitive exposure to how “the market” and economy are doing. But as an example, the fact that Apple is ~70x larger than Domino’s Pizza does not mean that Apple’s returns will be any higher; they may actually be lower. From the standpoint of a passive investor (which is what we are), all else equal, \$1 in Apple stock is no better or worse than \$1 in Domino’s stock.

Rather than weight stocks based on size, the minimum-volatility approach is to weight them based on (a) how volatile they are and (b) their correlations to each other. Weighting the less volatile stocks more heavily in *dollar* terms ensures that all stocks have similar impact in *risk* terms. And accounting for correlations means more diversifying stocks are given higher weight. This is the same exercise we performed to allocate risk between equities and bonds, only now on a micro-scale within equities. The result is a weighting scheme that minimizes the volatility of the equity allocation without necessarily sacrificing returns.

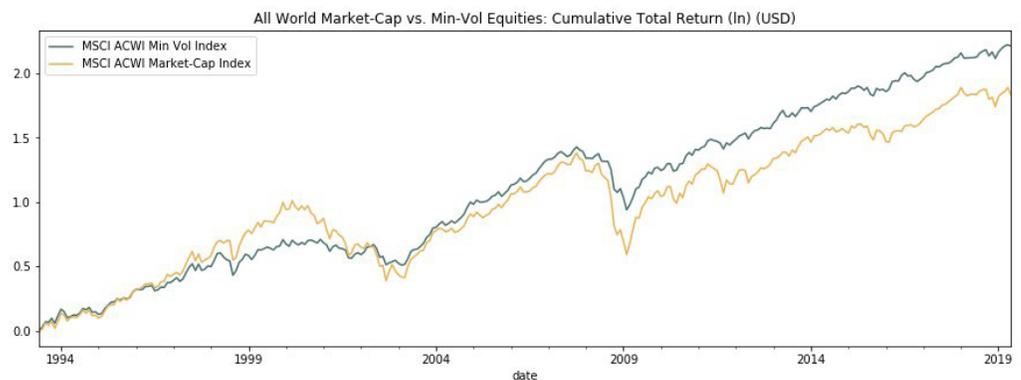
A final component of this weighting scheme is its constraints, as most such schemes are constrained to by and large resemble the sector, country, and factor exposures of their parent market-cap-weighted indices. Overall we see this as a benefit. Some indices are unconstrained and also ignore correlations. These “low-vol” (as opposed to min-vol) indices can result in very high sector concentrations that in our view are undesirable, as they expose the portfolio to idiosyncratic risks specific to those sectors. Although historically this has not been an issue, the indices are designed with the benefit of hindsight, and sector concentration might well pose a risk in the future. After all, volatility for a sector can spike rapidly and individual sectors can underperform.

A constrained index, in contrast, largely replicates the sector exposures of the parent index. To be sure, the parent index can also become concentrated, and there is no magic to its sector weightings. But it is generally more balanced across sectors than an unconstrained index could be. More importantly, these constraints limit tracking error, so the index is more likely to look like the exposure to “the market” that our investors want.

Comparative Performance

Historically, min-vol indices have been substantially less volatile than their market-capweighted peers. They have outperformed, in particular, during periods of market downturns — i.e., when such relative outperformance is needed most — and underperformed in major rallies (e.g. 2009) and in periods of market exuberance (e.g. 1999). Overall, these indices have provided higher risk-adjusted returns than market-capweighted indices, which have historically failed to compensate investors for their additional volatility.

The following chart compares the historical performance of the MSCI All Country World (ACWI) Index, which is market-cap-weighted, to that of the MSCI ACWI Minimum Volatility Index. As you can see, the min-vol index has delivered higher returns over its history with substantially less risk and shallower drawdowns. Again, we would strongly caution against extrapolating this degree of outperformance going forward, but we think this exposure is worth it for the risk-reduction benefit alone and would not be surprised if it continues to outperform over longer time horizons.



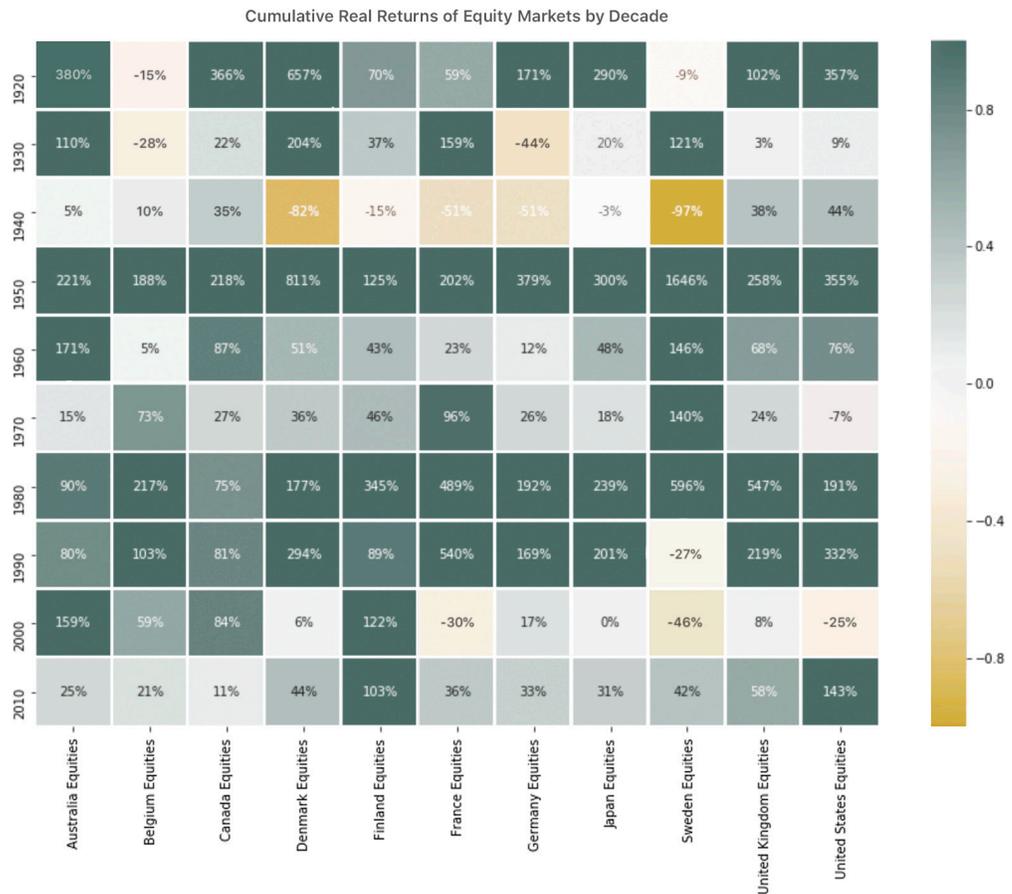
	MSCI ACWI Min Vol Index	MSCI ACWI Market-Cap Index
Ann. Total Return	8.88%	7.30%
Ann. Excess Return	6.45%	4.87%
Ann. Stdev.	10.31%	14.84%
Sharpe Ratio	0.63	0.33

Source: Bloomberg data, Wealthsimple analysis.

Geographic Diversification

Finally, we improved the geographic balance of the equities allocation. As mentioned, geographic diversification is critical because it reduces concentration risk. Most investors have a strong domestic bias, meaning they heavily overweight U.S. assets. Distributing exposure across countries and regions is critical because it mitigates the impact if one country (the U.S.) or region (North America) were to severely underperform — which, over long periods of time, is bound to happen. It happened in Germany, France, and Japan during World War II and its aftermath, the United States during the Great Depression, Japan again in the 1990s and 2000s, and in more countries and time periods over the last century than many realize. To be sure, the U.S. plays a dominant role in the world economy and capital markets and, as such, a large allocation to U.S. assets makes sense to a degree. But where portfolios are overly concentrated, the impact of underperformance can be devastating.

The following chart shows the cumulative real returns (above local inflation) of equity markets by decade, from the 1920s until today. As you can see, there has been wide dispersion between the most and least profitable markets — resulting in a potential real return difference of over 200% in a typical (median) decade.



Source: Global Financial Data, Wealthsimple analysis.

We don't know which markets will outperform and which will underperform, so we try to achieve better balance across countries to mitigate risk to any one market. This is the same thing we do with individual stocks — we take broad exposure because we don't know which stocks will outperform and which will underperform.

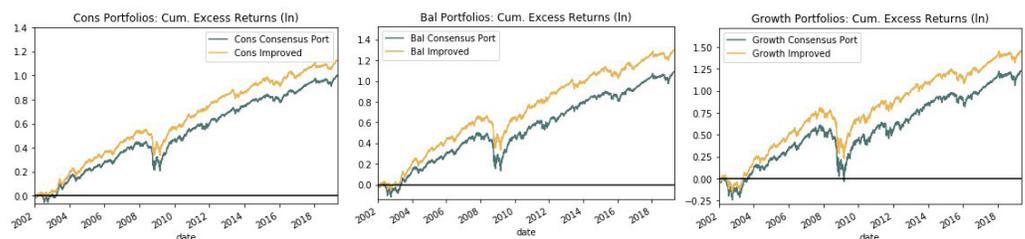
In practice, we achieve better balance in part by using min-vol indices that provide broad exposure to global equity markets, including emerging markets. In addition, we shift some capital from U.S. market-cap-weighted equities to international exposures in Europe, Asia and the Far East (mainly Japan). The result is a more diversified equity allocation with a narrower expected range of potential outcomes.

The Overall Equity Allocation

In the growth portfolios, we allocate about a third of our equity exposure to minimum volatility equities. We do not allocate more for a few reasons. First, growth investors are most comfortable with risk and have a strong expectation that their performance will track “the market.” Min-vol equities do this but tend to underperform (on a relative basis) when markets are rallying and outperform (also on a relative basis) when they are declining. Our growth investors expect to capture the full “upside” of bull markets. While it is not possible to capture all of the upside without all of the downside, a one-third allocation to min-vol equities strikes a good balance between capturing upside and providing a slight cushion on the downside (slight because min-vol equities are still equities, and when markets go down a lot, they will go down a lot, too). For the conservative and balanced portfolios, investors generally have shorter time horizons, so drawdowns matter more; min-vol equities directly support their overall objectives. Here, we split the allocation about evenly between min-vol and market-cap-weighted equities. We recognize that min-vol remains less conventional, investors will continue to expect returns comparable to those of traditional benchmarks, and we want to avoid overallocating to any one idea or approach. Our equity allocations reflect these considerations.

THE IMPROVED PORTFOLIOS AT A GLANCE

The resulting portfolios have better diversification within and across asset classes and, therefore, higher risk-adjusted returns. The charts below compare the historical performance (simulated and gross of fees for illustrative purposes only) of the consensus and improved conservative, balanced, and growth portfolios going back to 2002 — as far back as data for all portfolios were readily available.



	Cons Consensus Port	Cons Improved	Bal Consensus Port	Bal Improved	Growth Consensus Port	Growth Improved
Ann. Total Return	5.74%	6.49%	6.26%	7.50%	7.07%	8.45%
Ann. Excess Return	4.47%	5.21%	4.98%	6.23%	5.80%	7.17%
Std. Deviation	5.35%	5.23%	7.52%	6.85%	12.43%	10.44%
Sharpe Ratio	0.84	1.00	0.66	0.91	0.47	0.69
Max Drawdown	-21.9%	-20.0%	-30.9%	-28.4%	-47.5%	-44.2%
% Time >5% Below Peak	7.2%	9.2%	17.5%	15.9%	35.9%	32.3%

Source: Bloomberg data and Wealthsimple analysis. Performance is shown simulated, gross of fees and before transactions costs for illustrative purposes only. Excess return statistics shown reflect compound annualized total returns less the compound annualized return of 3-month US T-bills. Simulated performance is subject to inherent limitations, including that the portfolios were not actually traded and were developed with the benefit of hindsight. Past performance is not necessarily indicative of future results.

Four takeaways are worth highlighting.

First, by and large, the two sets of portfolios would have performed similarly to each other, rising and falling together. The improved portfolios are highly correlated to the consensus portfolios by design; despite their differences, both sets of portfolios have similar exposures and are driven by equities.

Second, even though the improved portfolios would have materially outperformed over the long term, the probability of one portfolio outperforming or underperforming in any given year is nearly 50/50. It is critical to avoid drawing any conclusions by looking at just one year, or even just one environment (which can span many years). The improved portfolios are designed to better withstand multiple different environments, which cannot be predicted in advance, and they should be evaluated in that larger context.

Third, it is important to understand what drives relative performance. The improved portfolios would have outperformed markedly during market downturns like the early 2000s and the financial crisis of 2008: although both sets of portfolios would have had substantial losses, the improved portfolios would have lost less as a result of their greater exposure to bonds and lower-volatility equities. In contrast, the improved portfolios would have slightly underperformed when interest rates rose. This happened in 2013, during the “Taper Tantrum,” after the Federal Reserve unexpectedly announced it would start scaling back its “quantitative easing” program, and in late 2016, after Trump was elected and equities rallied. To be clear, we consider this added rate risk a benefit: big picture, the consensus portfolios are 100% exposed to one risk — equity-market risk — while the improved portfolios are exposed to two risks — equity-market risk and rate risk (although the former still dominates). Because the improved portfolios spread risk across these two diversifying sources, they are more balanced overall, which leads to higher expected risk-adjusted returns for the portfolios.

Fourth, a cautionary note. Although the strong simulated performance of the portfolios is reassuring, we would strongly caution against extrapolating this degree of outperformance going forward. First, bonds did extremely well in this period. The improved portfolios outperformed in part because they have more bond risk. Second, min-vol equities outperformed market-cap-weighted equities on both an absolute and risk-adjusted basis. As mentioned, while we expect min-vol’s risk-reduction benefit to

persist, we would not be surprised if min-vol equities do not continue to beat market-cap-weighted equities outright. Lastly, risky assets in general did well in this period relative to history. In sum, we would not necessarily expect such high risk-adjusted returns to persist.

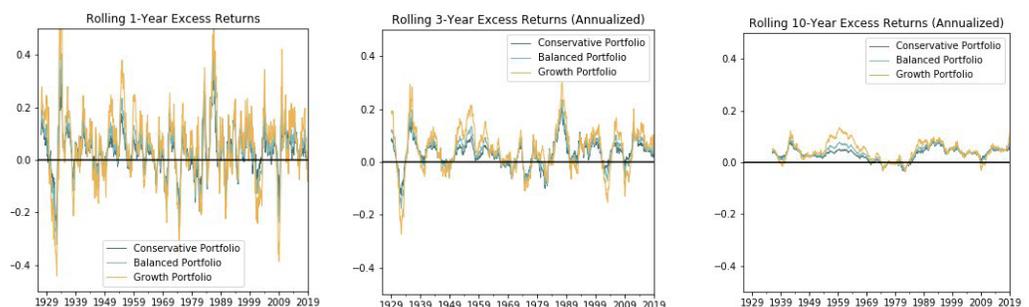
That said, we have researched and tested the ideas that underpin the improved portfolios across long timeframes and a wide range of geographies. The notion of balancing risk within and across asset classes to maximize risk-adjusted returns is both well supported and logically sound. As a result, we are confident that, because the improved portfolios are better diversified, they are better portfolios to hold on an expected basis over the long term.

FORWARD-LOOKING EXPECTATIONS: WHAT INVESTORS SHOULD EXPECT

The goal of this section is to provide our investors with general guidance as to what to expect from the portfolios.

Predicting market and portfolio returns is notoriously difficult and not the business we are in. Nevertheless, we feel it is critical to understand the range of potential outcomes in the short and medium terms in order to stay invested for the long term. This is especially true with regard to losses. In the financial crisis, the S&P 500 lost 2/3 of its value from peak to trough. Other stock markets performed similarly — some better, some worse, but all very poorly. If you had 80% of your money in equities, your portfolio would have lost more than half its value. While markets have since recovered phenomenally, particularly in the U.S., the speed and magnitude of the recovery were by no means guaranteed, and had the policy response been different, the results could have been very different, too.

We provide a long-term picture below to illustrate the kinds of outcomes that are possible. Long-term simulations of the portfolios are challenging — inflation-linked bonds did not exist, the “low-volatility anomaly” was less well-known, and min-vol indices did not exist. But we can look at the performance of simple stock-bond portfolios through different economic and market environments to get a basic picture. The following charts show the rolling 1-year, 3-year, and 10-year excess returns of sample conservative, balanced, and growth portfolios. We use long histories of world equities and US government bonds for simplicity and go back to the 1930s. As you can see, while 1-year and 3-year excess returns are quite volatile, especially for the growth portfolio, annualized returns become smoother and more consistently positive over longer horizons.



Global Financial Data; Wealthsimple analysis. Charts show the simulated long-term performance (gross of fees) of hypothetical portfolios created for illustrative purposes only. Past performance is not necessarily indicative of future results.

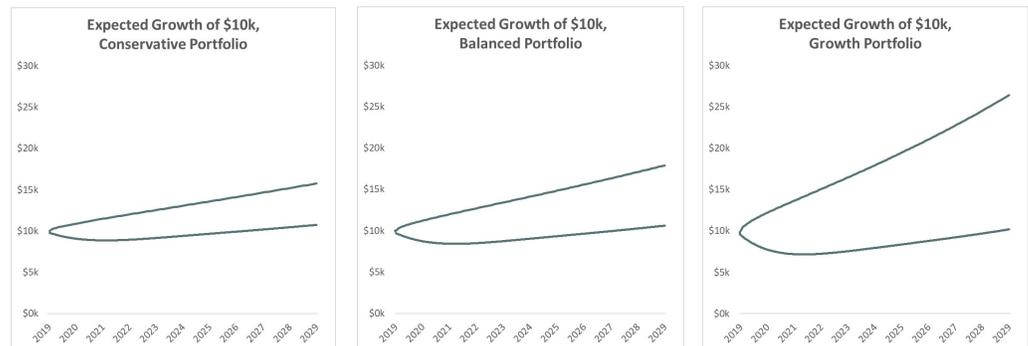
The following tables zoom in on losses over the 1-year and 3-year timeframes to show how negative excess returns can get and how often. The tables show the percentage of rolling 1-year and 3-year periods in which annualized losses exceeded the thresholds shown on the left. As you can see, it is quite normal for these portfolios to be under water — across the portfolios, excess returns were negative in ~30% of 1-year periods and ~25% of 3-year periods. Larger losses were more common for the growth portfolio than for less risky portfolios. This kind of performance pattern highlights how critical it is to resist the temptation to sell after experiencing losses, as doing so all but guarantees worse performance over the long run.

	Conservative Portfolio	Balanced Portfolio	Growth Portfolio
1-Yr Excess Returns Below:			
0%	29.5%	28.3%	30.3%
-5%	11.6%	14.4%	19.0%
-10%	4.4%	7.5%	13.0%
-20%	0.7%	1.5%	4.2%
-30%	0.0%	0.2%	1.8%

	Conservative Portfolio	Balanced Portfolio	Growth Portfolio
3-Yr Ann. Excess Returns Below:			
0%	21.70%	24.75%	27.24%
-5%	5.17%	5.91%	10.90%
-10%	0.83%	1.75%	3.51%
-20%	0.00%	0.00%	1.20%
-30%	0.00%	0.00%	0.00%

Source: Global Financial Data; Wealthsimple analysis. Past performance is not necessarily indicative of future results.

For an additional perspective, the next charts illustrate the range of expected outcomes for cumulative returns over time. ~90% of the time, returns should be within the two bands shown. The probability of having negative returns falls over time until it is very small (but not zero).



The following charts show the same ranges for each portfolio, but expressed in terms of expected annualized returns. You can see the expected range of returns narrowing over time, which is a benefit of patient, long-term investing.



For illustrative purposes only. Ranges show 90% confidence intervals and are not meant to capture the full range of potential outcomes. Expectations for actual allocations may vary, and actual performance may differ materially from expectations. Expected annualized returns not shown for periods of less than one year.

Step 3: Security Selection and Tax Optimization

Having determined our target exposures, our final step is to identify the securities we’ll use to implement them. To do this, we apply a comprehensive security-selection framework that we have developed. An in-depth discussion of this framework is beyond the scope of this paper. But as we often receive questions about why we choose particular securities over others, we describe this process here at a high level. One component of our process that we think differentiates us is how we tailor securities to different account types (e.g. tax-advantaged retirement accounts vs. regular accounts) based on tax considerations. We conclude with the final portfolios.

The Framework

Our security-selection framework assesses securities across three different criteria, each of which has several components.

The first criterion is **representativeness** — i.e., how accurately does the security represent the target exposure. We evaluate this based on the ETF’s benchmark and holdings, and with metrics like “tracking error” to the underlying benchmark, “tracking difference” (or “drag”) vs. the underlying benchmark, the length of the ETF’s track record, and the experience and reputation of the ETF provider (which informs the extent to which we can rely on the ETF to deliver the promised exposure).

The second criterion is **cost** — i.e., what is the “total cost of ownership” for a security, including (a) trading and (b) holding the security. Cost has many components and it is critical to take them all into account. These include not just (1) management expense ratios (MERs), but also (2) transactions costs (including bid/ask spreads, commissions, and market impact to the extent it can be assessed) and (3) tax impact, including foreign withholding tax and domestic tax, which vary by security and account type (e.g. 401Ks or

IRAs vs. taxable accounts), and capital gains that may be realized by switching from one security to another. In particular, the tax consequences of choosing certain securities over others can be large, so it is critical to understand the securities tax laws and their implications for which securities to choose and which to avoid. All else equal, we choose the security that minimizes all-in costs. In practice, cost is often the greatest determinant of which securities are selected and which are eliminated.

The third criterion is **risk** — i.e., what risks may be associated with trading and holding the security. These include risks relating to liquidity, counterparty exposure (not applicable here), regulatory action, and ETF closure. Note this is different from the kind of risk associated with the underlying exposure.

Getting a high-quality, comprehensive picture across these three criteria often requires going beyond the data. We have in-depth discussions with market-makers and ETF providers to understand issues like the liquidity of less liquid exposures and how best to trade them, the potential for ETF closure, and why dividend yields and tracking differences may vary from one ETF to another. In addition, to quantify and aggregate explicit and implicit costs, we account for the fact that some costs recur annually while others are one-time transaction costs to be amortized over the estimated life of the investment. We then evaluate the securities and select those that, when viewed holistically, best satisfy the above criteria.

The Final Portfolios

We took the improved portfolios, applied the security-selection framework, and arrived at the final portfolios shown below.

Exposure	Taxable Account	Tax-Advantaged	Conservative	Balanced	Growth
US Equities	VTI US Equity	VTI US Equity	10%	15%	25%
Dev Ex US Equities	IDEV US Equity	IDEV US Equity	10%	15%	25%
World Min Vol Equities	ACWV US Equity	ACWV US Equity	10%	10%	15%
EM Min Vol Equities	EEMV US Equity	EEMV US Equity	5%	10%	15%
Munis / Agg	MUB US Equity	BND US Equity	45%	20%	0%
US Long Nominals	SPTL US Equity	SPTL US Equity	10%	15%	10%
US Long ILs	LTPZ US Equity	LTPZ US Equity	10%	15%	10%

Note: Actual allocations over time may vary.

Conclusion

The best way for investors to achieve their goals is to invest and stay invested in low cost, diversified, passive portfolios of risky assets. And the most important ingredient in building those portfolios is diversification. To build our portfolios, then, we started with the “consensus” equity/bond portfolios investors expect and made them more diversified. We did this by increasing risk to bonds, adding inflation-linked bonds, decreasing equity risk, and making the equity allocation more efficient — with smarter weights internally and better geographic balance. We then selected securities to implement those portfolios in the optimal way, minimizing tracking error, costs, and taxes for each type of account. Over long time horizons, we expect the improved portfolios to deliver higher risk-adjusted returns net of fees and after taxes than their more conventional peers in the marketplace.

We will continue to monitor and improve the portfolios over time in whatever ways we can, consistent with the investment principles that we outlined above and always come back to. In the meantime, as always, please reach out if you have any questions — we are always available.

Appendix A: Economic Conditions and Policy Drive Asset Class Correlations

Asset-class returns and correlations are driven by how economic conditions and central bank policy unfold relative to expectations.

When economic growth drives asset-class performance, the correlation between stocks and bonds tends to be low and often negative. Here's why. When growth is strong, demand for capital to spend and invest increases, putting upward pressure on interest rates (as borrowers compete for capital). In addition, central banks tend to increase short-term lending rates to keep inflation in check. In such an environment, equities do well (as growth and demand are strong), and bonds do poorly (as rates rise). Conversely, when growth weakens, demand for capital falls, putting natural downward pressure on rates. And rather than being forced to "tighten" (i.e. raise rates) to curb inflation, central banks lower policy rates and may even purchase bonds outright to stimulate borrowing and spending. In this environment, bonds do well as interest rates fall and equities underperform. The two asset classes are thus natural complements to each other. This is true for both nominal and inflation-linked bonds.

In contrast, when inflation drives performance, the correlation between stocks and nominal bonds is much higher, and that between stocks and inflation-linked bonds is lower. Stocks and nominal bonds are both hurt by rising inflation (as in the 1970s) and both helped by disinflation (where inflation is declining but still positive, as in the 1980s). Specifically, when inflation rises, interest rates rise, and the discounted present value of fixed future cash flows falls; when inflation declines, rates fall, and the present value of those cash flows rises. This affects nominal bond cash flows (fixed coupon and principal payments out into the future) as well as equity cash flows (future earnings, which may rise with inflation but tend to do so with a lag). In such an environment, stocks and nominal bonds tend to rise and fall together. Inflation-linked bonds, on the other hand, are liable to move in the opposite direction, as their cash flows rise with inflation.

Finally, all asset classes are more correlated to each other when central banks sharply tighten (or ease) monetary policy — as the Federal Reserve did in 1994, for example, or in 1980-81 to "break the back of inflation." This rapid increase in interest rates causes bonds to sell off and increases borrowing costs, potentially choking off economic growth and hurting equities as well. Viewed from another angle, when short-term rates rise, holding cash becomes more attractive than risky assets like equities or bonds, and the latter have to "re-price" — i.e. sell off — until they no longer look expensive relative to cash, and investors are willing to hold them again.

The correlations of stocks, nominal bonds, and inflation-linked bonds will thus be driven

by underlying macroeconomic drivers like growth and inflation and how central banks manage their policies of promoting the former while keeping the latter in check. Overall, even when correlations are higher, stocks and bonds (both nominal and inflation-linked) remain more diversifying to each other than stocks are to other stocks. This is what makes them so valuable in the portfolio.

Appendix B: Bond Returns, Duration, and Leverage

Our goal was to increase interest-rate risk in the portfolios because more rate risk means higher returns and better diversification. The first section below explains how and why a bond's return and risk scale with its duration. The second section explains how to increase rate risk by either using leverage or increasing exposure to longer-duration bonds.

Bond returns and duration

A common misconception about bonds is that longer-term bonds don't compensate investors for their added risk. An investor might think this because the yield on long-term bonds is often not that much higher than that on shorter-term bonds. But bond returns are a function of more than just the yield. Returns can be broken down a few different ways, but for our purposes, it is helpful to distinguish between returns attributable to the yield and those attributable to capital appreciation. Longer-duration bonds have higher returns over time in part because they have higher yields and in part because of greater capital appreciation.

Here's how bond returns work at a high level. We first consider the yield. The bond market prices bond yields for months and years into the future. The yield at a point in time reflects, among other things, (a) the market's expectations for the future path of short-term interest rates and (b) compensation for risk. If you plot the yields on a chart with years to maturity as your x-axis and yield as your y-axis, and connect the dots, you will see what's known as a "yield curve." On average over time, bond yield curves are upward-sloping. Thus, whereas the yield on a 10-year bond might be 2.5%, the yield on a 30-year bond will typically be a bit higher — e.g. 3%. This is to compensate investors for the greater risk of a longer-dated bond. Part of this compensation comes in the form of extra yield.

The other part of the return comes in the form of capital appreciation. Bond prices rise when yields fall because the discounted present value of fixed future cash flows increases. Prices fall when yields rise as that value decreases. But even if the yield curve stays the same, bonds will often appreciate through what's known as the "roll-down effect." As bonds mature, their yields tend to fall as they "roll down" the curve — e.g. moving from a 10-year bond at 2.5% to a 9-year bond at 2.4% — causing them to appreciate in value. The magnitude of this appreciation is a function of the bond's "duration" — i.e. a weighted-average measure of future cash flows that reflects the bond's sensitivity to changes in rates. If the 10-year bond in the previous example has 7 years' duration, it will appreciate by $(2.50\% - 2.40\%) * 7$, or 0.70%, over the course of a year. If it has 14 years' duration, that same 0.10% yield difference will result in double the appreciation — 1.4%. So greater returns to longer duration come in part from higher yields and in part from greater capital appreciation.

Note, if the yield curve is inverted — meaning short-term rates are higher than long-term rates — that does not mean returns will be negative. It merely means the market is expecting rates to decline. If rates decline more than expected, bond investors will make money (above and beyond the yield). If they decline less, investors will lose money — just as they would if rates were expected to rise. The longer the duration, the more money bonds will make (lose) when rates fall (rise).

Increasing rate risk

The question is how to increase interest-rate risk in the portfolios to better balance out equity risk without sacrificing returns.

The first way to increase rate risk is to use leverage. Leverage simply means using borrowed funds to gain greater exposure to an asset. Modest amounts of leverage can be used to reduce portfolio risk — such as equity-concentration risk — by offering increased exposure to lower-risk assets like bonds. Because government bonds are widely considered safe assets, they are highly valued as collateral, so the cost to borrow to finance a position in these bonds is low. To increase duration risk, an investor might buy \$100 worth of bonds and use them as collateral to finance the purchase of an additional \$100 of bonds — taking \$200 of notional exposure for every \$100 in portfolio equity. This would effectively double the duration of the investor's bond allocation, thereby improving the overall risk balance at the portfolio level. Government bonds can also be accessed through futures contracts, which track the excess returns of the underlying bonds above the short-term financing rate without requiring investors to fully fund their positions up front. This accomplishes the same thing as outright borrowing — increasing exposure to bond risk to better balance a portfolio that is concentrated in equities.

Leverage is a tool. And like any tool, it can be misused — as it was in the lead-up to the financial crisis, for example. Unfortunately, largely as a result of its misuse, leverage is often greatly misunderstood. Many investors do not have access to leverage, and those who do are often averse to using it; indeed, even many institutional investors eschew the use of leverage, and regulators are wary of it. It is thus relatively uncommon for investors to use leverage despite its potential benefits for portfolio diversification.

The second way to increase rate risk is to simply purchase longer-duration bonds. This approach has a few limitations. First, investors are limited to what the bond market offers, so if the longest-duration bonds are 11 years, for example, that is all the duration an investor can get. Second, longer-dated bonds are often slightly less liquid. Third, investors are limited to only one part of the yield curve — the long end — exposing them to greater risk from changes in the shape of the curve compared to a broader exposure across the curve. Fourth, mixed evidence suggests that, on the margin, the risk-adjusted returns to these bonds may be slightly lower than those on a leveraged position of shorter-term bonds, although the possibility of arbitrage should limit this difference. Finally, in certain markets — for example, the market for long-dated U.K. inflation-linked government bonds (or “gilts”) — there is a good argument that structural demand from players like pension

funds suppresses yields, making such bonds less attractive than they might otherwise be.⁶ But these limitations, while valid, must be kept in perspective. Where leverage is not an option, the balance of considerations strongly favors the use of longer-duration bonds to diversify equity-heavy portfolios.

⁶ <https://www.schroders.com/en/sysglobalassets/schroders/sites/ukpensions/pdfs/2016-06-pension-schemes-and-index-linked-gilts.pdf>