
Optimization, Valuation, Diversification, and Risk in Constructing Global Portfolios

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Current institutional portfolios have many challenges. An investment framework of value considers diversification, the true meaning of assets in a portfolio, and risk rebalancing—not rebalancing capital each quarter but rebalancing risk. Finally, tail risk management must be managed opportunistically.

I am not going to talk about optimization; I am going to talk about the problem with current institutional portfolios and the investment framework that we at Wurts & Associates use. In addition, I want to discuss the meaning of diversification in a portfolio, rebalancing a portfolio based on risk, and tail risk management.

Problems with the Status Quo

When I was with Microsoft, we managed an \$80 billion portfolio. One of the things that we had to do—as required by Bill Gates and Steve Ballmer—was to work within a risk budget, which was not just about volatility or value at risk. It was about earnings per share, and there was a limit on how much we were allowed to lose. Those parameters meant we had to be able to see into the future or that the portfolio had to be diversified.

Portfolios are typically not diversified. They lean to one side. Equities have done well historically. For the past 20 or 30 years, global growth has been good and US growth has been good, accompanied by falling interest rates and falling inflation. There have been a few hiccups along the way, granted, but overall, it has been a good environment for equities.

Consider the different ways portfolios can be constructed. Buy and hold, similar to the Warren Buffett method, only works with a very long time horizon. At the Alaska Permanent Fund, the time horizon was multigenerational. But the board wanted to review performance every single quarter. Investment managers are usually forced into very short periods of

time to invest, even though the investment horizon could be 20, 30, or even 50 years. Investment managers who underperform their peers in the short term do not last; they will be fired.

Mean-variance optimization began in the 1970s and really caught on in the 1980s. Harry Markowitz published his seminal work on portfolio selection and the power of diversification in 1952,¹ although even today, unfortunately, most institutional portfolios are not diversified from the perspective of risk measures.

David Swenson at the Yale Investment Office paved the way for the famous endowment model. Essentially, the endowment model portfolio is more heavily invested in diversifying alternatives and private assets. Risk parity is a concept that holds that superior returns can result from a portfolio balanced by risk in different growth environments and inflation environments or by different risk factors. I am going to look more closely at that concept later.

For programmatic tail risk hedging, take a standard 60/40 portfolio and incorporate a thoughtful approach to hedging tail risk; the objective is to protect the portfolio from large drawdown risk, which destroys wealth.

Lastly, I am going to evaluate a risk allocation strategy that was not developed at the Alaska Permanent Fund. It began to develop during my time at Dow Chemical, when I was hedging certain risk exposures for the company.

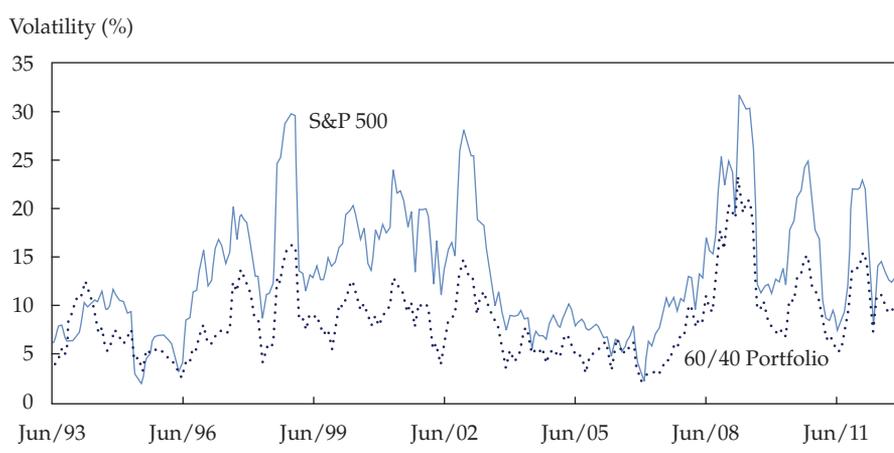
A Portfolio Approach to Volatility

Figure 1 shows the six-month rolling volatility, or the risk, of the S&P 500 versus a 60/40 portfolio. The S&P portfolio goes from about 4% or 5%

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¹Harry Markowitz, “Portfolio Selection,” *Journal of Finance*, vol. 7, no. 1 (March 1952):77–91.

Figure 1. Six-Month Rolling Volatility of S&P 500 Index vs. 60/40 Portfolio, June 1993–December 2012



volatility all the way up to 30% volatility. Clients or trustees typically dislike such quantitative notions of risk. The easiest way to dampen such volatility associated with equities is to adjust the portfolio's cash position because cash reduces the portfolio's volatility. Because cash returns are often low, average investors typically allocate roughly 40% of their portfolios to bonds to reduce the volatility from equities.

For the 60/40 portfolio in Figure 1, volatility is also going up and down during the time period. When the portfolio is run through the mean-variance optimization process—usually through a third-party consultant—the efficient frontier emerges and managers choose the desired portfolio volatility. The efficient frontier looks like this over a long period of time at, for example, 10% volatility.

The 60/40 portfolio represents dynamic risk with static asset allocation. Boards always tell me that they want 10% volatility. But a portfolio's volatility goes up and down dramatically. Can the volatility be better managed by looking at risk allocation instead of static asset allocation?

The 10-year compounded return for a portfolio with a 10% return every year is 10%. What if there was one bad year—30% down as in 2008 and 2009? If the investment horizon is long, like that of the Alaska Permanent Fund, and the portfolio needs a 7.5% return and has been going along for nine years at 10% a year, the compounded return has been cut almost in half. And after a 30% draw-down, it takes considerably more than a 30% gain to get back to the high-water mark. Most portfolios have this problem: People panic, and just like in the stock market, when the market goes down, fear takes over. This situation is what creates left-tail events.

An Investment Framework to Manage Risk

There are three key principles that every investor should consider: (1) Unless the future is known with the help of an economist and crystal ball, diversification is vital; (2) it is possible to manage risk in a portfolio, but it is almost impossible to manage to returns; and (3) fundamental valuation is very important. An investor must have a sense of whether assets are rich or cheap.

All of these principles are surrounded by the concept of humility. At Wurts & Associates, we have been working in the industry for more than 25 years and are continuously learning.

Asset Allocation Decision. Asset allocation drives risk and return. Studies suggest anything from 80% to 100% of variability of risk and returns is a function of asset allocation. The asset allocation decision drives the portfolio, but most institutions spend very little time on asset allocation. The typical institutional process is to spend little time on asset allocation and spend an excessive amount of time on the elusive search for alpha. Often at board meetings, manager after manager parades through with great marketing ideas; the boards thus probably spend about 80% of their time evaluating managers, listening to managers, and looking at past performance—and very little time on everything else.

The Alaska Permanent Fund's website indicates that the board spends the first 90 minutes of every quarterly board meeting looking at the risk dashboard.² This is similar to checking a car's dashboard: Do I have enough gas? Is the oil pressure correct?

²See www.apfc.org/home/Content/publications/reportArchive.cfm.

Basic Risk Factors. So, in our investment approach, we seek to ensure diversification of beta exposures. We start with five basic risk factors: interest rate risk, credit risk, equity risk, inflation risk, and currency risk. We have secondary and tertiary risk factors as well. In many institutional portfolios, about 80%–90% of the risk is equity risk, so that is the most important risk.

Currency risk is actually the second-largest risk. Investors often use a 50% hedge to manage currency risk, which is like saying, “I do not want to be right or wrong, so I will just hedge 50%.” Interestingly, depending on the home currency, this strategy actually increases the portfolio’s overall risk and tail risk.

We also certainly want to exploit the alternative assets’ risk premium. There are hedge fund strategies that are not just equity based. In a multistrategy or fund-to-fund hedge fund portfolio, anywhere from 20% to 40% is equity beta, which is expensive equity beta. An investor can obtain equity beta exposure more cheaply through an equity index than by paying 2% of year-end portfolio value and 20% of annual performance or, through a hedge fund of funds, 3% and 20%. Hedge funds can be used to capture risk premiums that are different from those five primary risk factors.

Research by Fama and French led the way to factor investing by highlighting how factors (value-, size-, and momentum-based investing) can produce superior risk-adjusted portfolios. Those anomalies are available today in a much more cost-effective way than just long only, and the factors are helpful to diversify against the five major risk categories.

In addition, having alpha strategies—that is, currency management, tail risk management, and active managers to add value—is important. Private assets fit into this alpha strategy, too; they just need to be broken into their risk factors.

Risk Premium Diversification

I am going to discuss half a dozen lenses we use to construct risk-based portfolios. At Wurts & Associates, we usually apply 12 basic risk lenses and run the portfolios through them every single day. All the position holdings are loaded into a risk engine, and then we derive a very detailed risk dashboard. I am going to demonstrate the difference between a 60/40 portfolio and a truly diversified portfolio.

Normal Market Risk. When working with boards or with chief investment officers, the first thing to do is to define normal market risk. But this risk is an *ex ante* measure rather than an *ex post* risk for the past 6–12 months or the past three years. A 60/40 portfolio is running about 9% risk on a forward-looking basis right now. The risk-diversified

portfolio has about 8.5% risk, so the risks are about the same.

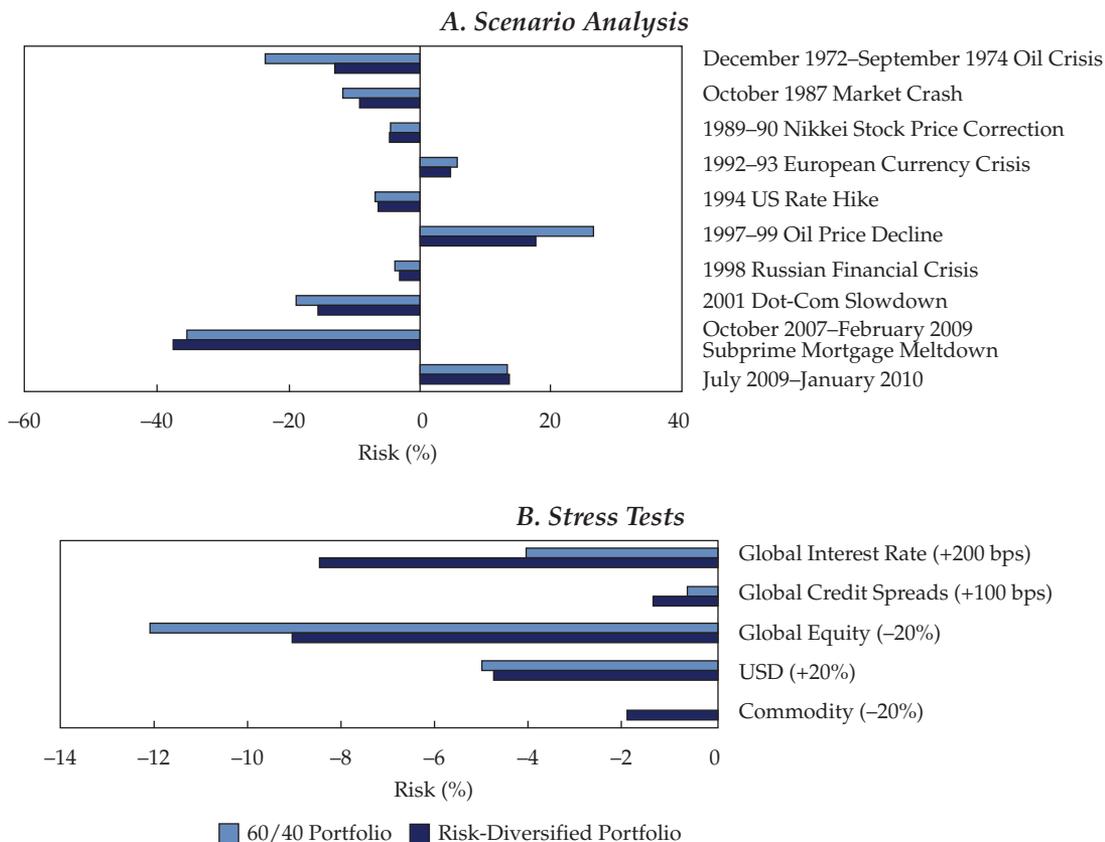
Risk Decomposition. The risk decomposition is dramatically different. The 60/40 portfolio has about 86% of its risk dominated by equity.

The risk-diversified portfolio benefits from the diversification effect and hence is less dominated by equity risk than the 60/40 portfolio. In fact, 63% of risk in a diversified portfolio is equity risk, compared with 86% in a 60/40 portfolio. The risk-diversified portfolio also has credit, currency, inflation, and selection risk; the interest rate risk is washed out through diversification. We manage large portfolios in the neighborhood of \$10 billion, and to meet their return objectives and to live within leverage limits that are allowed from a governance perspective, we could not run a full risk parity portfolio. A risk parity portfolio would have equal risk allocation in each of the categories of risk.

Scenario Analysis. Scenario analysis is vital. None of the scenarios of the past are going to be repeated exactly, but similar events will occur. Panel A of **Figure 2** shows extreme events from 1972 to 2010. This period includes both sides of the distribution—from down markets to up markets. At Wurts & Associates, we considered how the strategic asset allocation and actual portfolio would perform if they went through each of these events to provide us with a sense of the tail risk: 20%–40% of these portfolios can be lost.

With a long time horizon, the risk-diversified portfolio will have a higher return because of reduced drawdowns. During the 2007–09 financial crisis, the risk-diversified portfolio would have picked up additional return from coupons and dividends; this model assumes instantaneous shocks. This process gives us a sense of what is happening in the left tail: Is the portfolio truly diversified, or are there some instances where the drawdown is too significant?

Stress Tests. Panel B of Figure 2 shows single-risk-factor stress tests for the two portfolios—the 60/40 and the risk-diversified portfolio. When global interest rates move dramatically, the risk-diversified portfolio takes a hit. Having interest rate exposure in one country would create a portfolio that is susceptible to rising interest rates; hence, diversification is required in each of the primary risk factors. For the past 10 years, people have been saying that interest rates are going to rise, which is reflected in the forward curve. Ten-year Treasuries one year out are already pricing in a rise of 40 bps. Many do not understand the forward curve concept, but chief investment officers and investment managers have to address it with boards.

Figure 2. Examples of Drawdown Risk

Notes: The 60/40 portfolio consists of 60% MSCI All Country World Index (ACWI) and 40% Barclays Capital aggregate index. The risk-diversified portfolio consists of 35% MSCI ACWI, 5% global long Treasuries, 5% US long Treasuries, 5% global credit, 5% global high yield, 5% emerging market debt local currency, 5% commodities, 5% hedge funds, 5% style premiums, 10% alternative beta, 15% risk parity.

If an instantaneous shock to all interest rate exposures around the entire globe occurred, a diversified portfolio would have a greater loss: There is more interest rate sensitivity to this risk-diversified portfolio.

Return Comparison. Table 1 shows the return statistics of the risk-diversified portfolio versus those of the 60/40. Using our capital market assumptions, the Sharpe ratio on an *ex ante* basis is more efficient for the risk-diversified portfolio—about a 20% improvement in efficiency. The reason for that efficiency is better drawdown characteristics in tail risk events and more diversification; the compounding of wealth over time is higher.

Historical Return Analysis. Table 1 also shows that the risk-diversified portfolio outperforms the 60/40 portfolio. The compounded return is 9.9% for the risk-diversified portfolio versus 7.8% for the 60/40 portfolio. The Sharpe ratio for the 60/40 portfolio is 0.52; historically, that is a little higher than we would expect. The Sharpe ratio of the risk-diversified portfolio is 0.8, which is also high. Over this time period, inflation is falling around the globe, as are interest rates around the globe for the most

part, and good economic growth and prosperity are occurring. This risk-diversified portfolio, based on past performance, produced higher wealth and a superior risk-adjusted return.

Risk Rebalancing Strategy vs. a Traditional Strategy

Investment policies typically include a rebalancing strategy, most of which are little more than a periodic rebalancing every quarter. Alternatively, set bands can define the asset class rebalancing strategy. Consider a 60% allocation to equities. When it gets to 70%, it must be brought back down to target. If it gets to 50%, it must be brought back up to its 60% target. This strategy uses dollar allocation to maintain a static asset allocation.

Periodic rebalancing is probably the worst strategy. The dollar allocation strategies are better, and I am going to present a simple example of risk rebalancing being superior to all of them.

William Schreyer, ex-chairman/CEO of Merrill Lynch, said, “Life wasn’t designed to be risk free. The key is not to eliminate risk, but to estimate it accurately

Table 1. Return Statistics, 31 December 1992–31 December 2013

| | 60/40 Portfolio | Risk Diversified | 60/40 Portfolio with Hedge | Risk Diversified with Hedge |
|---------------------|--------------------|------------------|----------------------------------|--------------------------------|
| Annualized return | 7.8% | 9.9% | 8.5% | 10.7% |
| Sharpe ratio | 0.52 | 0.81 | 0.61 | 0.91 |
| Maximum drawdown | –35.0% | –29.0% | –33.0% | –27.0% |
| Realized volatility | 9.5% | 8.5% | 9.1% | 8.2% |

Notes: The hedging strategy was implemented starting July 1997; the notional value is 50% of the portfolio value. It consists of buying a put spread (buy 40 delta put, sell 25 delta put) and selling a 40 delta call. The hedge trigger rule is that at quarterly intervals, if the Chicago Board Options Exchange Volatility Index (VIX) is between 16 and 28 and 60-day VIX volatility is between 80% and 120%, the hedge is put on. Proceeds from the hedge are reinvested. The 60/40 portfolio is 60% MSCI ACWI and 40% Barclays US aggregate index. The maximum drawdown is calculated from the monthly return stream. Returns are calculated based on quarterly rebalancing.

The risk-diversified portfolio consists of 35% MSCI ACWI, 5% Barclays global treasury ex-US, 5% Barclays US long Treasury, 5% Barclays global credit, 5% Barclays global high yield, 5% J.P. Morgan Government Bond Index-Emerging Market (in local currency), 5% Dow Jones–UBS Commodity Index, 5% HFRI Fund of Funds Composite Index, 5% AQR style, 10% AQR Delta, and 15% Bridgewater all weather risk parity index. The 10% volatility performance is multiplied by 50% to get 15% volatility. J.P. Morgan Emerging Market Bond Index Global Diversified, HFRI, and US credit indices are used to link performance with all emerging market debt, alternative assets, and credit indices with start dates after 1992.

and to manage it wisely.” At Microsoft, we ran 10,000 positions through the system every day, and we have a similar process at Wurts & Associates today. We run thousands of positions and data to measure risk—using many different lenses—and then manage the associated risk.

Portfolios need to be managed with an understanding of the risk that is in the portfolio; risk should be the driver. And the risk comes in many different forms—normal market risk, tail risk, duration risk, credit risk, momentum risk, currency risk, equity beta risk, and so forth. In 2008–2009, *ex post* risk measures show that risk went up. According to Wurts & Associates, in 2007, risk was 6%; then in 2008, it was suddenly 16%. Risk is a very dynamic number. Most managers were not changing their portfolios, but they were running much higher risk. The pricing of options and implied volatility was rising dramatically throughout 2008, before and after the Lehman Brothers crisis. If managers had adjusted their portfolios for risk, they may have reduced the magnitude of the drawdown.

Also, in the last five years, we have experienced a tremendous equity bull market. If managers had reduced their risk exposure in 2007 and 2008 and then started increasing the risk exposure in 2009 onward, their portfolio would have outperformed a standard buy-and-hold strategy. The risk in these years was very dynamic; managers can try to truncate the portfolio drawdowns using *ex ante* risk models.

Table 2 shows a risk-diversified portfolio with 25% in risk-managed strategies. Having those in the portfolio is an automatic way to reduce the volatility of the volatility—that is, the volga.

We calculate the performance of a simple two-asset portfolio of bonds and stocks for January 2000–February 2014; adding risk-managed strategies can improve the total portfolio efficiency by 15%–20%.³ Again, this portfolio is non-diversified. It is just a simple concept of managing the *ex ante* risk.

Active Tail Risk Management

The financial crisis of 2008 and 2009 might be considered a once-in-a-lifetime event. But in fact, the average drawdown is about 28% over five-year rolling periods from 1930. Historically, a drawdown greater than 20% occurs about 40% of the time. It is not once in a lifetime. It happens frequently. Thus, portfolios need to be risk diversified; if they are not, tail risk management—especially the left tail—is vital.

There are many different ways to manage tail risk. Programmatically, buying a 20% out-of-the-money S&P 500 put every quarter is wasting money. Doing just the opposite and selling that 20% out-of-the-money option would be better.

Active direct strategies, such as portfolio insurance, are famous for the 1987 crash. Active indirect hedging involves investing in spread trades, correlation trades, and so on. The best option is to find a firm or a team that can do some variation of these strategies. My recommendation would be somewhere between active direct and active indirect hedging.

³This volatility-managed portfolio has a 10% volatility target, rebalanced after 8%–12% limits are breached. Portfolio volatility is calculated using 50% weight to 90-day historical volatilities and 50% weight to 12-month historical volatilities. The equity allocation range is 40%–80%.

Table 2. Asset Class/Strategy Allocations of a 60/40 Portfolio and a Risk-Diversified Portfolio

| Asset Class/Strategy | 60/40 | Risk Diversified |
|---------------------------------------|-------|------------------|
| <i>Equities</i> | | |
| Global equity (MSCI ACWI) | 60% | 35% |
| <i>Rates</i> | | |
| Barclays US Aggregate | 40 | |
| US long Treasury | | 5 |
| Global Treasury ex-US | | 5 |
| <i>Credit</i> | | |
| Global investment-grade credit | | 5 |
| Global high-yield credit | | 5 |
| Emerging market debt (local currency) | | 5 |
| <i>Inflation</i> | | |
| Commodities | | 5 |
| <i>Managed risk strategies</i> | | |
| Alternative beta (hedge fund beta) | | 10 |
| Style risk premiums | | 5 |
| Risk parity (15% volatility) | | 15 |
| Hedge fund (active) | | 5 |

Many have been saying that in 2008 and 2009, diversification did not work, that all the correlations went to 1. In reality, they did not all go to 1, but pretty much all the assets that were held by institutional portfolios went to 1. Ironically, correlations for many assets moving to 1 benefits active indirect tail risk management.

In some periods, markets go up, but the perception of risk also goes up, which is a signal of trouble—for example, in 2006–2008. The perception of risk is manifested in the implied volatility of the markets. In fact, the best time to buy tail risk hedging is when the perception of risk is low (i.e., when markets are calm and asset prices are steadily increasing).

Only an active, disciplined approach to tail risk hedging involving a combination of opportunistic and programmatic strategies across asset classes can consistently add value to the portfolio.

So, the best option is to invest in strategies that are going to work in a tail risk environment and that are not priced high right now. Waiting until the event happens is like calling the insurance agent when your house is on fire. You are not going to get fire insurance, at least not for a very good price.

Today's environment is a perfect example. The stock market is going up. The VIX is still low. It is a good time to consider adding strategies to diversified portfolios. Table 2 compares a risk-diversified portfolio with a 60/40 portfolio and overlays a simple tail risk hedging strategy to try to produce alpha in down markets.

In bad markets, sponsors typically do not have money for extra contributions. So, what is needed in the portfolio is something that will provide extra contributions, which is happening with these strategies. Investors lose less and compound greater wealth with diversified risk-managed portfolios. The volatility goes from 9.5% volatility in the 60/40 portfolio to 8.2% volatility in the risk-diversified portfolio, and the return is 7.8% in the 60/40 portfolio versus 10.7% in the risk-diversified portfolio.

Conclusion

I am not advocating any specific risk-diversified portfolio. What I am advocating are the concepts of diversification, risk rebalancing, and opportunistic tail risk management. Using these concepts will help improve a portfolio's efficiency.

This article qualifies for 0.5 CE credit.

Question and Answer Session

Jeffrey C. Scott, CFA

Question: The fees associated with these strategies are very different, considering the different risk drivers and implementations. How do you take the different fees into account?

Scott: The risk is that the fee budget is beyond the board's level of comfort. We have implemented this in a quasi-government entity recently; we realized upfront that the fee budget is not unlimited. We could have created a more efficient portfolio if we had been able to spend 65–75 bps by adding some higher-cost alpha or alternative beta structure in the portfolio.

The reality, however, is the board was not going to allow us to move that far from the entity's peers. This entity happens to be in Canada. Interestingly enough, Canadian plans often have much lower fees than US plans. Even though we did increase fees, we demonstrated to the board what we are gaining for the additional fees.

The board did not approve the full changes that we wanted, partly because of those fees. We used long-only managers, and we moved more to beta allocation rather than to long-only active. Hence, we were able to take fees from a traditional long-only strategy and apply it to an alternative beta and risk parity strategy. Incidentally, one of my pet peeves at the Alaska Permanent Fund was seeing performance reports gross of fees. You cannot eat gross of fees, only net of fees, so make sure that you see everything net of fees in both your *ex post* and *ex ante* analysis.

Question: In a perfect world, if you did not have a leverage constraint, would you use the full risk parity-type allocation?

Scott: It depends on the liabilities and the objectives. For most institutional portfolios, I probably would not use 100% risk parity. At the Alaska Permanent Fund, we outsourced to several different managers, giving them \$500 million each to manage. A couple of those managers used risk parity, and they are pretty well known.

I demanded no more than 20% drawdown risk and 5% real return. Nobody used 100% risk parity. I think that risk parity is a good foundation, and then alternative beta and private assets should be added to improve the overall risk–return characteristics.

Question: In a plan that has a very long horizon—50 to 75 years—should you even hedge tail risk or just try and harvest the premium?

Scott: That is interesting. Someone like Warren Buffett would probably say just to harvest the premium and not to hedge it. Because my career is not going to last that long, I would use an opportunistic tail risk management program because the time horizon of evaluation is much shorter. Even if the evaluation period is 5 or 10 years, if the drawdown can be reduced from 30% to 25% or 20% in 1 of those 10 years, the long-term wealth will be dramatically higher. So, I am not in agreement with just walking away and leaving it unhedged.

Question: In the different risk factors that you listed, there was no mention of liquidity risk. How do you think about that, and do you actually think there is a premium for liquidity?

Scott: There are two separate issues here. In our risk dashboard, we take liquidity seriously, and we run liquidity forecasting in a three-factor model. We look at liquidity risk today as well as in stressed environments, and we look at the policy versus the portfolio, which includes future commitments, both in private assets and to our sponsor. It is a critical piece.

Regarding the liquidity risk premium, there is quite a bit of debate of late, and some academic studies have come out recently questioning whether it exists. I think it does, looking at the numbers as well as considering it from a qualitative standpoint. But all risk premiums can oscillate from cheap to rich. For example, interest rate risk premium is pretty narrow right now—250 or 260 bps on the 10-year bond before inflation. The liquidity risk premium is not always there either; we have seen a flood of money flow into private equity assets in the last decade.

If you take a look at the commitments that institutional portfolios want to make, you can find that they are way off of their targeted allocations. I think all this investor interest is eroding that private equity illiquidity premium. If you were able to capture some of this illiquidity premium and move with agility in 2009, then you were lucky. Fortunately for us, the Alaska Permanent Fund board has the governance structure to move quickly and made such a move into distressed debt and mezzanine debt. We were able to capture a risk premium that was wide for credit and also probably reflected some illiquidity premium. I do not think there is a lot of liquidity risk premium out there today. There is a lot of capital, and interest rates are zero, so all this spare capital has driven down illiquidity premiums considerably.