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By the Numbers: A Discussion of  
Risk Management and Quantitative  
Investing with Robert B. Litterman, PhD

# By the Numbers

## A Discussion of Risk Management and Quantitative Investing with Robert B. Litterman, PhD

A recognized expert in risk management and quantitative investment strategies, Robert B. Litterman, PhD, can point to a career that spans the theoretical to the practical, anchored at one end by his work in academia and at the other by his twenty-three-year tenure with Goldman Sachs & Co. Along the way, he worked with renowned economist Fischer Black, PhD, to develop a key asset allocation tool and published a number of groundbreaking papers on asset allocation and risk management. Today, Dr. Litterman serves as senior partner and chairman of the risk committee at Kepos Capital LP, a global macro investment management firm based in New York.

Dr. Litterman was raised in Arizona and earned a bachelor of science in human biology from Stanford University in 1973. Following a stint as a journalist, he decided to pursue his interest in economics, earning a PhD in economics from the University of Minnesota in 1980. He then accepted a position as assistant professor of economics at the Massachusetts Institute of Technology, where he taught for two years before returning to Minneapolis as assistant vice president in the research department at the Federal Reserve Bank of Minneapolis. In 1986, Dr. Litterman joined the fixed income research department of Goldman Sachs in New York, where he served as co-director with Dr. Black. In 1994, he was named partner and head of risk management at Goldman, and he is credited with envisioning and leading the creation of Goldman's first firmwide, integrated risk-management program. He assumed responsibility for the Quantitative Investment Strategies Group of Goldman Sachs Asset Management division in 1998, overseeing portfolio management as well as institutional investment research as the group's chairman until he retired from the firm in 2009.

Among his many accomplishments while at Goldman Sachs, Dr. Litterman worked with the late Dr. Black to develop the Black-Litterman global asset allocation model, which was introduced in 1990 and published in 1992. The model addressed problems that investors encountered in the practical application of modern portfolio theory by providing the ability to adjust equilibrium market returns with the incorporation of an investor's individual views. Using this input, the model could then generate an optimal portfolio adjusted for the investor's risk tolerance.



Robert B. Litterman, PhD

In addition to numerous professional papers, Dr. Litterman has co-authored several books, including *The Practice of Risk Management* and *Modern Investment Management: An Equilibrium Approach*. In 2006, the *Journal of Portfolio Management* presented Dr. Litterman with the annual Jacobs Levy Award, the top honor for 2004–2005 as determined by *Journal* subscribers, for his article, “The Active Risk Puzzle.” He was appointed executive editor of

*Financial Analysts Journal* in 2011.

In 2005, Dr. Litterman was one of the original inductees into *Risk Management Magazine's* Risk Hall of Fame. In 2008, he was honored by the CFA Institute Board with the Nicholas Molodovsky Award, which is presented to individuals “who have made outstanding contributions of such significance as to change the direction of the profession and to raise it to higher standards of accomplishment.” He also received the 2008 International Association of Financial Engineers/SunGard Financial Engineer of the Year award, which recognizes individual contributions to the advancement of financial engineering technology. In 2012, Dr. Litterman was the inaugural recipient of the S. Donald Sussman Fellowship at MIT's Sloan School of Management, which cited his outstanding analytic contributions to the financial services industry.

Dr. Litterman serves on a number of boards, including the World Wildlife Fund, the Commonfund, the Sloan Foundation, and the Robert Wood Johnson Foundation. He also served as advisor to the Singapore Government Investment Corporation (GIC) investment committee and risk committee from 2004 to 2010.

In December 2013, Dr. Litterman spoke with members of the *Journal of Investment Consulting* Editorial Advisory Board about risk management and some of the lessons of the financial crisis, the development and uses of the Black-Litterman model, and quantitative investing after the quant crisis. Taking part in the discussion were Margaret M. Towle, PhD, CPWA®, the *Journal* editor-in-chief; Mark Anson, PhD, The Bass Family Office; Edward Baker, The Cambridge Strategy; Ludwig Chincarini, PhD, University of San Francisco and IndexIQ; Michael Dieschbourg, CIMA®, Federated Investors; Geoffrey Gerber, PhD, TWIN Capital Management; and Ron Kahn, PhD, BlackRock. This interview is the fifteenth in the *Journal's* Masters Series, which presents topical discussions

with leading experts and visionaries in finance, economics, and investments.

**Margaret M. Towle:** Before we delve into your professional career, please share with us a bit of personal history, such as where you grew up and individuals you encountered early in your life who had a profound influence on you. We'd like to gain an understanding of the origins of your career.

**Robert Litterman:** I grew up in Arizona. My undergraduate school was Stanford University, where I was a human biology major. My first job was as a journalist, and I decided that I wanted to specialize in economics. I earned my PhD in economics from the University of Minnesota. Then I taught for two years as an assistant professor of economics at the Massachusetts Institute of Technology (MIT) before I decided to go back to Minneapolis, to the Federal Reserve Bank there, where I worked for five years. It was during that time that I also became involved in a software venture, VAR Econometrics. We had one product, a regression program called RATS, or regression analysis of time series.<sup>1</sup>

In 1986, I received a call from Goldman Sachs inviting me to come to Wall Street. I spent the next 23 years at Goldman, initially in fixed-income research, then risk management. I became a partner and the head of risk management for Goldman from 1994 to 1998. In 1998, the firm asked me to take over the quantitative group in the asset management division that had been headed by Cliff Asness<sup>2</sup> before he decided to start his own firm, AQR. Goldman asked me to take over that business, which I ran until 2009 when I retired. Then I joined some of the folks that used to work for me at Goldman—Mark Carhart, Giorgio De Santis, and others—at Kepos Capital.<sup>3</sup> We just celebrated our third year managing money.

**Margaret M. Towle:** That's a very diverse background with some interesting origins, especially journalism and human biology. If you look back on that background and all that you've accomplished, what were the major factors that helped to shape your career? You have a great combination of very theoretical experience in terms of your study at Stanford and Minnesota and your academic experience as well as applied experience with the Federal Reserve and Goldman Sachs.

**Robert Litterman:** In terms of major factors, I would have to start with earning my PhD at the University of Minnesota in the late 1970s. As you probably know, that was a center of research in rational expectations.<sup>4</sup> My advisors were Tom Sargent and Chris Sims,<sup>5</sup> who shared the Nobel Memorial Prize in Economic Sciences in 2011. One of the other students there, who was a year ahead of me and also a Sargent and Sims student, was Lars Hansen.<sup>6</sup> He received the Nobel Memorial Prize in Economic Sciences in 2013. So it was an incredibly special place to be at that time. That had a big influence on me, and it led to my getting a job at MIT, which also was a great place to meet a lot of very smart and interesting people. That includes Fischer Black.<sup>7</sup> Actually, I guess I first met Fischer when he stopped by and gave a talk

at Minnesota, and then he was a colleague at MIT and later at Goldman Sachs.

As to other important factors, I like to note that, when I was growing up in Arizona, there were no computers in the whole state. I was in high school before the first computer arrived, and I had this naïve but powerful dream that I would someday have access to computers and figure out how to use them to solve problems. I've had many opportunities to do that throughout the years, both in academia and at the Federal Reserve Bank. My PhD dissertation was on economic forecasting. Then I actually had the opportunity in quantitative asset management to use computers in even more powerful ways. So that was another major factor. I also was very lucky in terms of being hired by Goldman Sachs back in 1986, when I think investment banks were first really realizing that quantitative techniques could be very important, useful, and powerful on Wall Street. Right from the beginning at Goldman, I was asked to focus on risk management. In 1986, it really wasn't practical to understand, quantify, and aggregate all of the positions at the firm because we just didn't have the networks or computer power, but that was certainly something that Goldman was interested in and that I was able to work on. Then, in the early 1990s, the technology caught up with the desire to create a global, firmwide, real-time measure of risk, so that took my career in a different direction, in a very interesting direction. All of these things just came together.

**Margaret M. Towle:** One of the questions that we like to ask our Masters is what they view as their major achievements. Often the answers are obvious, but occasionally we're surprised at what we learn. For example, the Black-Litterman model<sup>8</sup> is something that everyone connects with you and Fischer Black. What do you see as your greatest or major achievement and what is the biggest challenge that you've faced in your career?

**Robert Litterman:** Well, I would have to say the development of the Black-Litterman model was probably the biggest achievement of my career, although I wouldn't want to take too much credit for that. I was in the right place at the right time, and Goldman needed someone to build an asset allocation model. I was given the assignment, and I had the opportunity to work with Fischer Black. Really it was Fischer who suggested to me the idea of incorporating a global equilibrium into the problem. I remember at the time thinking that was a very academic type of suggestion, but I was happy to try to run with that idea. It turned out, in retrospect, to be a brilliant suggestion. I also just happened to have the Bayesian<sup>9</sup> tools from my work on macroeconomic forecasting to implement the original version of the Black-Litterman model, which was really a rather simple idea. I would call it a reformulation of the standard asset allocation model. Instead of having to forecast returns for all assets, the equilibrium allowed the user to focus just on a discrete set of views that he or she really wanted to incorporate in the portfolio. The Bayesian context, I think, turned out to be a more realistic and flexible way and probabilistic context to address the asset allocation problem.

It turned out to be one of those things that you can never predict, but which ended up working very successfully. So I think that was my major achievement. In terms of the biggest challenge, I'm currently working very hard to get carbon emissions priced globally, and that remains a huge challenge.

**Geoffrey Gerber:** To follow up on the work on the Black-Litterman model for asset allocation, the real crux was the idea of global equilibrium. As you know, many practitioners today are suggesting a risk-parity<sup>10</sup> approach, in which they allocate assets to balance risk. I was wondering what your thoughts are on risk parity as an asset allocation model and comparisons between that and the Black-Litterman model?

**Robert Litterman:** Risk parity is a particular allocation, and there are various versions of it. Perhaps I should disclose that at the firm where I work now, we have what we call an exotic beta portfolio,<sup>11</sup> which is our own particular version of allocating to risk premia. I think the various versions of risk parity are best thought of as expressing a particular view. The simplest version is probably the one where you put together several different asset classes so that each has equal volatility. If you had all uncorrelated asset classes, where you thought the expected returns or the risk premia<sup>12</sup> were proportional to volatility rather than covariance to the market or anything else, then the optimal portfolio would be the risk-parity portfolio. So that's a particular set of views, it seems to me, about expected returns. I would contrast that with the Black-Litterman model, which is a framework for combining views with equilibrium. At Kepos, for example, we think more about risk factors, we recognize that those factors are correlated, and we put in views about the expected returns of those factors. Then we use the Black-Litterman model to optimize the portfolio.

So Black-Litterman is a tool. It can be used to structure a portfolio, but it doesn't tell you anything about the views themselves, and there are various sources of views. I think that's the best way to think about risk parity or investing in general, that is, it represents a set of views. The positive aspect of some of these risk-parity portfolios—I prefer to think of it as investing in risk premia—is that the capital asset pricing model (CAPM)<sup>13</sup> is a very simple, one-factor model, and we realize that the actual world is much more complex and that there are many risk factors that are priced. On the other hand, the risk premia do vary over time. So in practice, a number of considerations go into the ways you allocate risk across those different premia, and Black-Litterman is a tool that allows you to do that.

**Michael Dieschbourg:** There seems to be a lot of interest in looking at downside risk protection<sup>14</sup> first and not using just volatility and expected return, but adding a third factor to try to figure out how to minimize drawdown. A number of previous risk-parity products have really taken a beating in 2013 because they don't have those same types of protection on the downside, and now new products are coming out. What's your view about factoring in volatility, but also adding in downside protection versus expected return and volatility?

**Robert Litterman:** I'm not sure about the downside protection. Many of those risk-parity products have significant equity allocations, and if they have a significant positive allocation to equities, they've done okay in 2013. If they have a particularly large allocation to fixed income, maybe they've had a little bit of trouble. However, if you think about downside protection focusing on equity, it's a very expensive protection to buy. I'm not sure that it makes a lot of sense to both create exposures to equities and then try to hedge the downside. In fact, as you probably know, I wrote an article in the *Financial Analysts Journal* a few years ago (2011), where I talked about the fact that a better approach might be to reduce an equity allocation and sell some downside protection, where you really get paid significantly for providing that insurance. The point of that article was that some investors are more sensitive than others to the particular environment where downside protection pays off. They probably should be buyers of the protection, and those who are not particularly sensitive should be sellers.

“ [S]ome investors are more sensitive than others to the particular environment where downside protection pays off. They probably should be buyers of the protection, and those who are not particularly sensitive should be sellers. ”

**Ludwig Chincarini:** You talked about your work at Kepos. Many people believe the quant crisis<sup>15</sup> was caused by crowding<sup>16</sup> and other sorts of problems of that nature. How has risk management either at Kepos or other firms evolved since then, or has it?

**Robert Litterman:** First of all, I think the quant crisis was very much a crowding event, and basically there was a run for the exits. It was a combination of the fact that there was a tremendous flow of assets and risk capital into the quant space, and many of those portfolios were investing in the same risk factors, if you will, the same well-known quantitative factors. Then you had the financial crisis that caused significant demand for liquidity and risk reduction, and folks in the quant space got scared because they correctly anticipated that there was very significant leverage in some of those portfolios, and they tried to get out. So that was indeed the essence of what happened. As to what has happened since then, first of all, the space has deleveraged to a very dramatic extent. The amount of assets being managed in those quantitative portfolios is a very small fraction of what it was at the peak.

You asked about what we've done at Kepos. We've moved out of the quant equity space virtually completely for that reason, and we're pursuing a set of strategies that we think are much less crowded and less subject to exactly those phenomena for that reason. I think that's true of many of the folks who had been in that space.

**Ron Kahn:** Other than moving out of the quant equity space entirely, do you think there are lessons for people who decided to stay in the quant equity space?

**Robert Litterman:** There are a number of lessons there. I would say first of all, the lesson about the ability of things to spill over. When the financial crisis began, and I guess I first started seeing it in 2006, I sat on the Goldman Sachs risk committee at that time, and we could just feel the tensions rising in one space after another, particularly in the spring of 2007. It was one of those things where, week after week, there was a mantra of "avoid crowded trades, don't take a lot of risks, stay close to home, make markets but don't be a hero," and I didn't think that had anything to do with the business I was managing. So I didn't see it coming. But obviously, as it progressed, we all realized that these things do tend to spill over. So what was happening in the mortgage market and then the credit market started showing up in the money markets and auction preferreds. Then in July and August 2007, it completely caused a run in the quant space. The interesting thing about that was how quickly it ended. You know, it really only lasted a few days, but it was certainly enough to cause a huge problem in the quant space. So I think a big lesson is how things like this can spill over into seemingly unrelated areas.

Another lesson is that you really have to monitor the stresses in financial markets and the connections. The crowding itself is difficult to quantify, but particularly for me, one of the lessons was not to think about crowding in terms of the level of assets but rather the flows of assets. We knew the quant space was crowded in some sense because there was so much money being managed that way, but as long as flows were continuing to go into the space, the returns were very positive. So through June 2007, our hedge fund was up very sharply for the year. Although the space seemed crowded in terms of the amount of assets, it was the change in flows—and obviously the fact that those flows could accelerate exponentially as people got scared. So that was another lesson. In addition, leverage—that is, the dangers of leverage in that situation—was emphasized. There are many, many other lessons about risk management and so on, but those are some of the big ones.

**Mark Anson:** Were there any instances, let's say at Goldman Sachs, where risk management had to have a faceoff against the asset managers? Could you relate one of those instances, and who won the faceoff? Was it the asset-management team or the risk-management team?

**Robert Litterman:** When I was head of firmwide risk at Goldman (1994–1998), we instituted a weekly risk committee meeting. One of the issues concerned who would attend that meeting. The asset management division basically argued

that it didn't belong in the meeting, and we agreed with that to some extent because we felt there should be a separation between the risks that the firm faces on its capital account versus the risks that are being taken on behalf of clients in the asset management division. On the other hand, we also had each of the divisions come before the committee once a year and talk for an hour about how that division thought about managing its risk. So the question was whether we should bring the asset management division into that, and my boss, John Thain,<sup>17</sup> who was chief financial officer at the time, thought that was probably a good idea. So, in the end, we did have the asset management division come before the firm's risk committee. I think this probably happened a couple of times, and they gave an overview of how they thought about risk management. However, they didn't have a risk manager in the asset management division. Then at the end of 1998, the firm asked me to move into the asset management division and take over the quant business after Cliff Asness left as well as to create a risk-management function. In 1998, that was a rather new idea. There weren't many asset management businesses that had a position titled "risk manager." So part of what we had to figure out was what does that person do, and how does that function in the context of asset management? It was—and is—very different from the broker-dealer side, because there are tradeoffs between, for example, covering positions and the transaction costs of moving in and out of positions. All of those kinds of decisions have to be the responsibility of the portfolio manager. You can't have a risk manager overriding a portfolio manager and telling him to sell positions. You can't have mixed responsibility for the results of the portfolio.

Our view was that the role of the risk manager is primarily to identify risks, to quantify risks, and to highlight those risks to the folks who are responsible. On the broker-dealer side, that chain of responsibility goes all the way up very quickly to senior management. On the asset management side, that responsibility lies with the portfolio manager, and really the only decision that management has is whether or not they have confidence in that portfolio manager. So it's a little bit different, although obviously the main role of the risk manager in both cases is to identify and quantify the risks and pass that information on to the appropriate people.

**Ed Baker:** You mentioned that you're now pursuing some new kinds of strategies, away from more-quantitative strategies. Could you elaborate a bit on what you're finding to be novel and interesting?

**Robert Litterman:** Let me be clear about Kepos—it's a totally quantitative shop. So what we've moved away from is the quant equity space. I don't know if you want me to go into too much detail, but it's basically what we would call macro statistical arbitrage. It's still totally quantitative, but it's basically focusing on the liquid markets, futures, swaps, and so on; for example in equities we trade primarily equity index futures, not individual equities; in terms of basic markets we trade fixed income, currencies, and commodities, equities,

and volatility. That's in our primary strategy, which is an alpha strategy. Then as I mentioned before, we also have what we call an exotic beta strategy where, again, we're not using individual equities. However, exotic beta is very different, much slower moving. Basically, we create exposures to risk premia in different venues around the world. The main difference, I would say, between what we used to do in macro at Goldman Sachs and what we do at Kepos is in terms of the time frequency. The average holding period at Goldman in our macro fund was on the order of months, whereas our average holding period at Kepos is really a matter of days. Rather than looking primarily for value and momentum factors, as we did at Goldman, at Kepos we're much higher frequency and shorter term. It's not high frequency. It's not in and out in a matter of microseconds. That's certainly not our specialty, but it's really looking at the patterns across markets and over relatively short periods of time and trying to take advantage of those. So from an economic point of view, I would say it's primarily liquidity provision.

“ I'd say one of the lessons of risk management is that you can't really use any one model and depend on it that way. ”

**Ludwig Chincarini:** Since you had a formula at Goldman that worked, what made you jump to this shorter horizon? It seems like getting out of your comfort zone.

**Robert Litterman:** In terms of portfolio construction and in terms of what quants actually do, it's all very similar: It's about forecasting and incorporating those forecasts into a portfolio that will benefit if those forecasts turn out to be accurate. So it's all the same tools, but it's really a question of which factors you look at and in which markets you apply them. We decided that this was a relatively less crowded space, and that's exactly why we moved there.

**Ed Baker:** Is the risk-management framework similar or substantially different, and if different, how so?

**Robert Litterman:** The main difference is in terms of how you think about transaction costs, because when you're moving assets around much more quickly, over the course of a year there's much more buying and selling per dollar invested, so that's one of the differences. Also, the risk management is much more sophisticated. For example, for many, many years at Goldman, most of the time I was there, as part of managing assets we targeted a particular volatility. We told clients that's what we were aiming at, and we tried to achieve it. So that meant if volatility in the marketplace went down, we expanded the sizes of our exposures to maintain that volatility. Of course, that volatility can change overnight, particularly when it's been low, and that's exactly what we saw

during the quant crisis. At Kepos, we recognize that you do have to adjust your volatility, and we try to adjust it appropriately. We also try to figure out which of the strategies and risk factors are going to do well in a stressful environment versus an environment where the stresses are lower. We look at a huge variety of factors. When we were at Goldman, we had to a certain extent optimized a covariance matrix<sup>18</sup> in terms of a decay rate. I'd say one of the lessons of risk management is that you can't really use any one model and depend on it that way. So we have lots of different covariance matrixes with different decay rates that we use. We use what we call flexible probabilities, where rather than simply looking at observations based on how old they are, we look at observations based on whether they were from a period of stress similar to what we have today. In other words, we've put more weight on observations from a similar environment. Currently, our measure of financial stress is quite low, so we look at observations from low stress periods and give them more weight. In a period of high stress we would put more weight on previous periods of high stress.

Basically the bottom line is that we look at half a dozen different models and what they say, and sometimes they give very different answers. Obviously, we look at lots of stress tests, we look at measures of diversification in the portfolio, we look at the beta of the portfolio, and we look at the portfolio's correlations, both in terms of risk factors and also in terms of other quantitative hedge funds. We monitor the decomposition of risk, not only in terms of volatility but also in terms of contribution to tail risk.<sup>19</sup> The number of factors we look at is an order of magnitude larger than what we were doing when we were at Goldman, and it's driven by the advances in risk management as well as lessons learned from events during the financial crisis.

**Ed Baker:** How do you measure transaction costs for the asset classes that are over-the-counter (OTC) and spread-based, such as currencies and commodities? You said those were an important part of your framework.

**Robert Litterman:** They are. How you trade and how you measure transaction costs are incredibly important when you get into the higher-frequency space. I would say that in the over-the-counter market, we've actually developed some very interesting auction techniques. When we're trading instruments such as variance swaps<sup>20</sup> and other OTC instruments, we have an auction, and we get bids and offers automatically from broker-dealers. We have a good sense of the spreads in those markets, and we don't reveal ahead of time which way we're trading.

**Ed Baker:** Do you capture those spreads and somehow model what you might have gotten versus what you did get?

**Robert Litterman:** Absolutely, every time. We have huge amounts of data because we capture that data and save and analyze it. You could say that every day we have a forecast of what we expect to see, and then we have actual data on what we did see. So there's a lot that can be done in terms of modeling transaction costs. We are very cautious about when

we transact, how we transact, and how we build those costs into our models.

**Geoffrey Gerber:** Regarding asset allocation, we see many public pension plans, foundations, and endowments thinking about or already beginning to reduce their target rate of return. I was just wondering, given your outlook on equity, fixed income, and alternative rates of returns over the next ten years or so, do you think it's a prudent idea to be lowering the target rate of return?

**Robert Litterman:** I do think it's appropriate. Basically, the rate of return for institutional investors is going to be the real risk-free rate plus some risk premia, depending on the exposures that they have, plus some expected inflation. We're currently in a very low real interest-rate environment with low expected inflation, and the risk premia are really rather hard to predict. We've had a great year in equities in 2013 but, looking forward, it's realistic to recognize that nominal returns are likely to be lower. I think it's appropriate to build that into the expectations rather than try to take more risk in order to increase those nominal returns.

**Ed Baker:** Pension plans are now using alternatives as part of their allocation, so obviously that would tend to bring expected returns down as well, would it not, for the overall framework?

**Robert Litterman:** I think that alternatives, to the extent that they capture risk premia other than the basic equity premia, are a good way to diversify and reduce the amount of risk in the portfolio while at the same time increasing—or at least not lowering—the expected returns. However, the point is that investors do have to be realistic. It does seem that over several decades there has been a decrease in the Sharpe ratios<sup>21</sup> and net returns coming from alternatives.

**Michael Dieschbourg:** Many pension plans are looking at being more dynamic in their decision making, and it sounds like at Kepos your modeling now is more active—or what some people might call market timing. What would you recommend for advisors and consultants on how to answer the question about the importance of being active and dynamic in today's markets versus just static as in the old days?

**Robert Litterman:** Actually, I think there's been a trend over the years, especially with institutional investors, toward recognizing that it's difficult to add a lot of value through active management. In other words, a recognition that asset allocation is really the dominant determinant of returns in the long run, a recognition that perhaps you can improve the overall risk and return of the portfolio by diversifying across different sources of return, but in a relatively passive way. Certainly there have been huge increases in allocations to index funds, exchange-traded funds, and other passive approaches. So I think that's the bigger trend. There's always going to be a role for asset managers like ourselves who try to create value through active management, because someone has to make the markets efficient. However, in terms of the impact on the overall portfolios of large institutional investors, active management has perhaps been decreasing and will continue to do so.

“ I think many of them are switching, and I think more of them should switch. It's probably basically a question of education on the benefits of reducing transaction costs. ”

**Margaret M. Towle:** Related to that, Meir Statman, who was unable to join us today, passed along a question about investors' understanding of that trend, particularly in public equities where markets are really quite efficient. He referred to Ken French's study that estimated U.S. investors would save more than \$100 billion a year if they abandoned their attempts to beat the market and used low-cost index funds (French 2008). Now, Meir is of the behavioral finance school, but assuming that investors are aware of the benefits of investing in index funds, why don't advisors and individual investors switch to these low-cost funds?

**Robert Litterman:** I think many of them are switching, and I think more of them should switch. It's probably basically a question of education on the benefits of reducing transaction costs. To the question of why they haven't switched more quickly, I suppose I'll leave that to the behavioral finance guys to explain. However, I would also say there's a little bit of an incentive problem here, because it's not always in the advisor's best interests—or self-interest, let's put it that way—to create a low-cost product for clients.

**Margaret M. Towle:** What is your view on environmental, social, and corporate governance investing (ESG),<sup>22</sup> especially considering the mixed performance results of this type of investment strategy?

**Robert Litterman:** I don't think of myself as an expert in ESG or sustainable investing. I think of that as being more a part of the fundamental space. There probably are characteristics of firms that might be considered associated with sustainability or good governance with which it might be possible to forecast returns, and maybe there are managers who can use those to that effect. However, I don't think it really lends itself very well to quantitative investing. I don't think those metrics are that well-developed, and we don't have enough history to look for publicly available metrics that are clearly associated with positive results.

**Ludwig Chincarini:** On a different topic, it seems to me that there are currently two camps of thought: One camp believes that the Federal Reserve's buying programs are actually good because we're in a deflationary environment, while the second thinks that we're going to have high inflation, with bubbles popping up everywhere. Do you have any thoughts on this and what you think might happen?

**Robert Litterman:** I worked at the Fed for five years back in the 1980s, so I guess my views are tempered by that experi-

ence. I'm not a Fed watcher, but from my perspective, the Fed did an incredibly good job of handling the financial crisis. They certainly created a huge increase in the money supply, and I'm actually rather surprised and gratified that we haven't seen more inflation. However, I think that lack of inflation is, in large part, a reflection of the hard-won credibility that the Fed developed during the period under Paul Volcker,<sup>23</sup> and we've been a beneficiary of that credibility. Now, having said that, that credibility can be lost, and I think the Fed has a tough job here in terms of reining in its quantitative easing. In the long run, you can't separate monetary policy from fiscal policy, so it's really not just Fed credibility, it's really the credibility of government policy. Right now the government is not behaving in a way that would tend to shore up its credibility. So I think the Fed is in a difficult position going forward, but I wish them all the luck in the world in being able to unwind this easing program without creating inflation.

**Geoffrey Gerber:** You mentioned that twenty years ago, very few asset management firms—and plan sponsors—had a risk-management department. Today, they are much more common. How do you see the focus and importance of risk-management departments changing over the next ten to twenty years?

**Robert Litterman:** Risk management has become a well-developed science, so to speak, and many areas need to be pushed further over the next twenty years, particularly the area of systemic risk. We've got a fairly good handle now on ways that individuals can manage their own portfolios and that traders can manage their positions, and so on. However, when you think about systemic risk, that's an area where there are network effects<sup>24</sup> and spillovers that are hard to identify. So there's a lot more room for progress to be made there. The other area that I've been very focused on has been pricing carbon emissions. That's also really a risk-management problem. Going forward, society as a whole needs to make a lot of progress on incorporating and pricing catastrophic risk appropriately.

**Margaret M. Towle:** I agree. Given all that we've talked about today and your comments on systemic risk and so forth, what do you see as the appropriate role for investment consultants and advisors, both for institutional investors and individual investors? Do you see consultants fulfilling those roles today?

**Robert Litterman:** Consultants have a number of roles, and of course there are many different types of consultants, and they operate at many different levels. For individual investors, there is a lot of opportunity for consultants in the area of online capabilities, in terms of enabling people who have very different circumstances—very different risks, liabilities, and so forth—to structure appropriate portfolios and to advise them on ways to do that. In terms of institutions, with the smaller institutions—\$50 million to \$500 million—there is an important role for consultants to help in terms of risk management, asset allocation, and providing information and access to high-quality managers. There has been a large move

into that sort of outsourced chief investment officer space, if you will. I think that's a very important role.

**Margaret M. Towle:** In terms of what the future holds for the investment industry, given some of the things that you've talked about, where do you see the industry headed, either within the context of regulation or new investment ideas or just generally the direction we're taking?

**Robert Litterman:** Clearly we're going through a period of evolving regulation. I think, appropriately, a lot of risk taking is going to move out of the “systemically important, too big to fail” institutions into hedge funds and private equity firms and so on. The asset management business is going to be focused on creating low-fee products for individuals and for institutions as well. So there is going to be fee compression in the industry. Maybe I'll leave it there. 

## Endnotes

- 1 RATS (regression analysis of time series) is a software package used for analyzing time-series and cross-sectional data, developing and estimating econometric models, and forecasting. The forerunner of RATS was written by Christopher Sims while at the University of Minnesota and expanded by Tom Doan, then of the Federal Reserve Bank of Minneapolis, who went on to found Estima, Inc., the consulting firm that owns and distributes RATS software.
- 2 Clifford S. Asness (1966– ), a quantitative financial theorist, is former managing director and director of quantitative research for Goldman Sachs Asset Management. In 1998, he co-founded AQR Capital Management, an investment management firm that offers quantitatively driven hedge fund and traditional investment vehicles to institutional clients and financial advisors.
- 3 Founded in 2010, Kepos Capital LP is an investment management firm headquartered in New York that provides services to family offices, endowments, foundations, pension funds, and other institutional investors. Mark Carhart serves as chief investment officer of Kepos Capital, and Giorgio De Santis is director of research. Both formerly were with Goldman Sachs Asset Management's Quantitative Investment Strategies Group.
- 4 Rational expectations is an economic theory that holds that investors make financial decisions based on several factors, including a rational outlook, all available information, past experiences, and their own best interests. The theory suggests that current economic expectations are equivalent to the future state of the economy. That is, on average, investors can correctly predict future conditions, even if they do not fully understand the cause-and-effect associations underlying events. Any errors in predictions are usually due to random and unforeseeable causes. The rational expectations theory is used in many contemporary macroeconomic models, game theory, and applications of rational choice theory.
- 5 Thomas J. Sargent (1943– ) is a U.S. economist specializing in the fields of macroeconomics, monetary economics, and time-series econometrics; he currently is professor of economics at New York University. Christopher A. Sims (1942– ) is a U.S. econometrician and macroeconomist; he currently is professor of economics at Princeton University. In 2011, Sargent and Sims were awarded the Nobel Memorial Prize in Economic Sciences for their “empirical research on cause and effect in the macroeconomy.”



- <sup>6</sup> Lars Peter Hansen (1952– ), the David Rockefeller Distinguished Service Professor of Economics at the University of Chicago, is a macroeconomist who focuses on the links between the financial and real sectors of the economy. He earned a PhD from the University of Minnesota in 1978. In 2013, he—together with Robert J. Shiller and Eugene Fama—was awarded the Nobel Memorial Prize in Economic Sciences for contributions to the study of asset prices.
- <sup>7</sup> Fischer S. Black (1938–1995) was a U.S. economist, best known as one of the authors of the famous Black-Scholes equation. Professor Black taught at the Massachusetts Institute of Technology from 1975 until 1984, when he joined Goldman Sachs, where he worked until his death.
- <sup>8</sup> The Black-Litterman model is a mathematical model for asset allocation developed at Goldman Sachs by Fischer Black and Robert Litterman in 1990 and published in 1992. It is designed to overcome problems that institutional investors encountered in the practical application of modern portfolio theory. The model starts with the equilibrium assumption that the asset allocation of a representative agent should be proportional to the market values of the available assets and then modifies that to take into account an investor's specific opinions about asset returns to arrive at a customized asset allocation. Instead of requiring the user to input estimates of expected return, which can be difficult to derive, the Black-Litterman model assumes that the initial expected returns are whatever is required so that the equilibrium asset allocation is equal to what is observed in the markets. The user is only required to state how his assumptions about expected returns differ from the market's assumptions and his degree of confidence in the alternative assumptions. From this, the Black-Litterman model computes the desired (mean-variance efficient) asset allocation.
- <sup>9</sup> Bayesian refers to methods in probability and statistics named after Thomas Bayes (1702–1761), an English mathematician and minister, particularly methods related to statistical inference. The term "Bayes theorem" refers to Bayes's proposed solution to a problem of inverse probability, which argued for using a uniform prior distribution for a binomial parameter and not merely a general postulate.
- <sup>10</sup> Risk parity (or risk premia parity) is an approach to portfolio management that focuses on allocation of risk, or volatility, rather than allocation of capital. The risk-parity approach states that when asset allocations are adjusted (leveraged or deleveraged) to the same risk level, the risk-parity portfolio can be more resistant to market downturns than the traditional portfolio. Interest in the risk-parity approach increased after the financial crisis of the late 2000s because portfolios constructed using this approach tended to fare better than traditionally constructed portfolios during that time.
- <sup>11</sup> The term "exotic beta portfolio" can be used to denote an investment in exotic assets, such as shipping freight, wine, or sports teams, using normal strategies, or the application of "exotic" strategies to "normal" securities using new trading styles to find new arbitrages in traditional markets. The development of exotic beta portfolios stemmed from the search for alpha or—simply expressed—the part of a rate of return that cannot be attributed to outside factors (as opposed to beta, or the part of a return that can be explained by external factors such as rising indexes or economic growth).
- <sup>123</sup> Risk premium refers to the minimum amount of money by which the expected return on a risky asset must exceed the known return on a risk-free asset or the expected return on a less-risky asset in order to persuade an investor to hold the risky asset rather than the risk-free asset.
- <sup>13</sup> The capital asset pricing model (CAPM) is used to determine the required rate of return of an asset if it is to be added to a diversified portfolio, given that asset's nondiversifiable risk. The model takes into account the asset's sensitivity to nondiversifiable risk (also known as systematic risk or market risk), often represented by beta, as well as the expected return of the market and the expected return of a theoretical risk-free asset. The CAPM was introduced by Jack Treynor, William F. Sharpe, John Lintner, and Jan Mossin, working independently in the early 1960s and building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Sharpe, Markowitz, and Merton Miller jointly received the 1990 Nobel Memorial Prize in Economic Sciences for their work on CAPM. Despite the development of more modern approaches to asset pricing and portfolio selection (e.g., arbitrage pricing theory, Merton's portfolio problem), CAPM remains popular because of its simplicity and utility in a variety of situations.
- <sup>14</sup> Downside risk protection involves the use of an option or other hedging instrument in order to limit or reduce losses in the event of a decline in the value of an underlying security. Methods of downside protection include the purchase of an option to hedge a long position, the use of stop losses, or the purchase of assets that are negatively correlated to the asset being hedged.
- <sup>15</sup> The quant crisis of August 2007 occurred when most quantitative long-short equity funds experienced losses far greater than their risk-management systems would have predicted, during the first week of August 2007.
- <sup>16</sup> Crowding refers to the overconcentration of investing in a limited group of securities. Similar to herding, crowding occurs when investors imitate each other's behavior in following popular trends or are attracted to particular investments or strategies based almost entirely on the purchases of other investors.
- <sup>17</sup> John A. Thain (1955– ) is a U.S. businessman and investment banker who currently serves as chairman and chief executive officer of the CIT Group. He formerly worked at Goldman Sachs as head of its mortgage securities division during 1985–1990, chief financial officer and head of operations, technology, and finance during 1994–1999, and president and co-chief operating officer during 1999–2004.
- <sup>18</sup> In financial economics, the covariance matrix plays a key role in portfolio theory and the capital asset pricing model. The matrix of covariances among various assets' returns is used to determine, under certain assumptions, the relative amounts of different assets that investors should (in a normative analysis) or are predicted to (in a positive analysis) choose to hold from the perspective of diversification.
- <sup>19</sup> Tail risk is the risk that an asset or portfolio of assets will move more than three standard deviations from its current price. The majority of investment managers are particularly interested in downside risk, i.e., moving more than three standard deviations below the current price. Tail risk also can be defined less strictly as the risk or probability of rare events.
- <sup>20</sup> A variance swap is an over-the-counter financial derivative that allows one to speculate on or hedge risks associated with the magnitude of movement, i.e., volatility, of some underlying product such as an exchange rate, interest rate, or stock index.

- <sup>21</sup> The Sharpe ratio—also known as the Sharpe index, the Sharpe measure, and the reward-to-variability ratio—provides a method for measuring risk-adjusted performance. The ratio measures the excess return (or risk premium) per unit of deviation in an asset, portfolio, or trading strategy, gauging to what extent the investor was compensated for the risk taken. The ratio is named for its creator, William F. Sharpe.
- <sup>22</sup> Environmental, social, and corporate governance (ESG) refers to the three areas that serve as the major factors in measuring the sustainability and ethical impact of an investment in a company or business. Another term for the criteria used in socially responsible investing, ESG covers issues such as climate change, hazardous waste, nuclear energy (environmental); diversity, human rights, consumer protection, animal welfare (social); and management structure, employee relations, executive compensation (corporate).
- <sup>23</sup> Paul A. Volcker, Jr. (1927– ) was chairman of the Federal Reserve during 1979–1987, serving under Presidents Jimmy Carter and Ronald Reagan. He is widely credited with ending the high levels of inflation seen in the United States during the 1970s and early 1980s. He also served as chairman of the Economic Recovery Advisory Board under President Barack Obama during 2009–2011.
- <sup>24</sup> A network effect (also called network externality or demand-side economies of scale) is the effect that one user of a good or service has on the value of that product to other users. Common examples of the network effect include the telephone and, more recently, social

networks. That is, the more people who own telephones or use social networks, the more valuable the service is to each user.

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