

What's New At Empirical

- We are excited to introduce our new Client View Portal! View daily reporting of performance, holdings and allocation. In addition, a secure (using 128bit encryption) two way file sharing system will allow you and your Empirical Team to share documents with each other. For a visual overview of the Client View Portal, please go to client.empiricals.com. To sign up for the Client View Portal, please email Simon Liu at techsupport@empiricals.com. To receive *paperless* statements going forward, please include the word "*paperless*" in your email.
- Please welcome Lorne Enquist, CPA, PFS, MPAcc to the Empirical Team! Lorne will be working with clients in Seattle and has extensive expertise in tax strategizing.
- On June 1st, Empirical will be moving to a larger suite on the 31st floor!
- Follow us on Twitter and Facebook for the latest news, developments and research.
- Tune into Empirical Investing Radio every Thursday at 2PM PST on the VoiceAmerica business channel: business.voiceamerica.com

Is Modern Portfolio Theory Still Relevant?

Most people are familiar with the general concept of diversification and the idea of risk *and* return. However, few investors realize that before the 1950's, these concepts were not widely used. It was not until 1952, when Harry Markowitz combined the principals of *diversification* and *risk/return*, with the less familiar idea of *correlation*, to form the mathematical framework for building a *portfolio* of securities; what we now call Modern Portfolio Theory (MPT). The key take away from his work is that if you are interested in balancing risk *and* return, then you must consider how each part of your portfolio fits within the whole, rather than each part in isolation.

Kenneth Smith had the pleasure of interviewing Harry Markowitz on an episode of Successful Investing Radio, where Markowitz describes how people invested before MPT:

"You have to have been here before 1952, the process was completely different. Instead of thinking in terms of portfolios and asset classes and efficient allocations and things like that, we thought in terms of hot stocks. The Markowitz revolution has thus changed the point of view which large institutional investors use, which financial planners use, which 401k advisory almost universally use. There are many billions, or actually a small number of trillions which are managed that way."

At the time, investment practitioners were just as clueless as academic theorists. Further in the radio program Markowitz explains his fundamental insight:

"The thing that finance theorists before me didn't understand is that it takes a special kind of analysis to take into account that risks are correlated, that some things tend to go up and down together more than other things tend to go up and down together."

With this insight, investors began to use MPT as a way to understand which combinations of investments would produce the most effective portfolios, assuming someone

ⁱ(Markowitz, 1952)

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looking ahead

Discussion on Social Security ♦

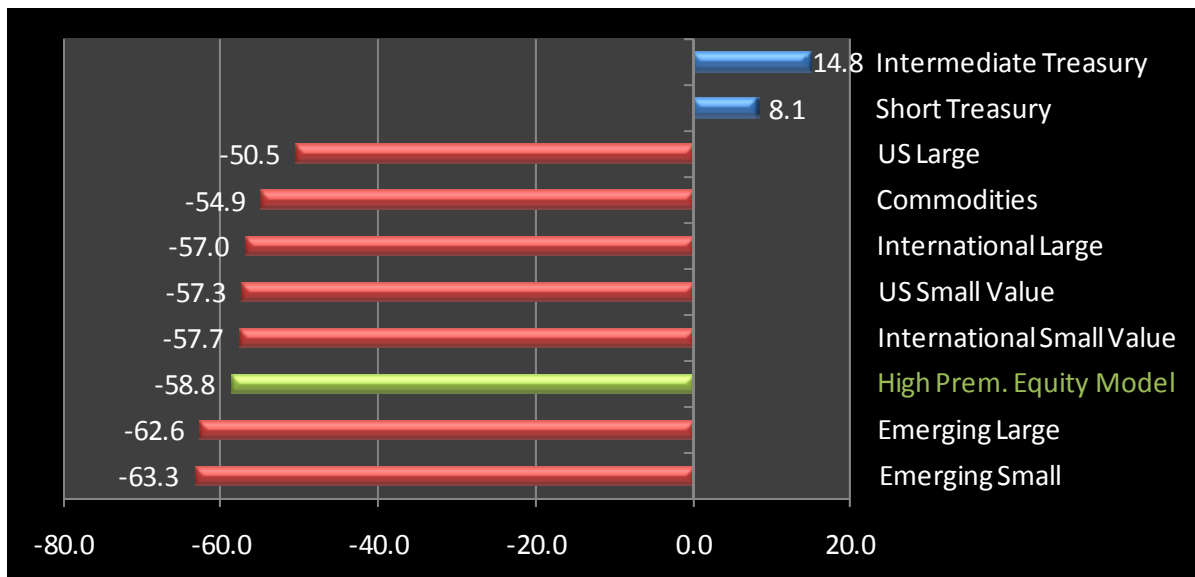
wanted to balance risk with return. After all, if the goal was simply to maximize return with no regard for risk, the "best" portfolio, by definition, would be to own 100% of the highest returning asset, *not* a diversified portfolio. However, Markowitz rejects that approach, as it fails the fundamental principal of diversification. Instead of focusing only on return, MPT explains a method of maximizing return for a given level of risk, *assuming* that the investor maintains a diversified portfolio. MPT is intended to be used as a tool to reach a portfolio with an "optimal" risk/return balance; thus, separating Modern Portfolio Theory from pre-Modern Portfolio Theory.

In 1990, Harry Markowitz won the Nobel Prize in Economics for his research, and is now known as the Father of Modern Portfolio Theory. In spite of this fact, and the self-evident usefulness of the core principals of MPT, some commentators and pundits have been particularly critical, saying the theory itself is more "outdated" than "modern". Since Empirical embraces certain aspects of MPT, we decided to review MPT and examine whether it is still applicable in light of recent market activity, or outdated and worthy of replacement.

Impact of MPT on Diversification

The concept of diversification has been around for hundreds, if not thousands, of years. According to the ancient Jewish

Figure 1: Total Returns November 2007 – February 2009 (Market Decline)



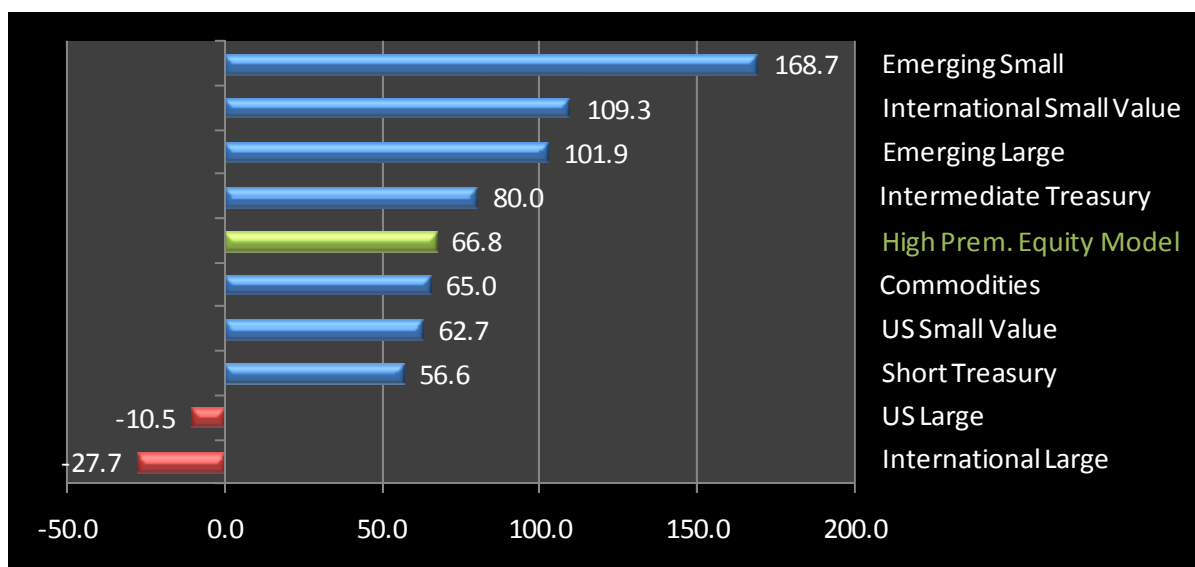
Source: Dimensional Fund Advisors See performance disclosure.

text, The Talmud, “every man [should] divide his money into three parts, and invest a third in land, a third in business and a third let him keep by him in reserve.” The concept also turns up in *The Merchant of Venice*, written by Shakespeare between 1596 and 1598, when Salarino asks Antonio whether the riskiness of his business ventures make him worry. Antonio’s response is:

*Believe me, no: I thank my fortune for it,
My ventures are not in one bottom trusted,
Nor to one place; nor is my whole estate
Upon the fortune of this present year:
Therefore my merchandise makes me not sad.*

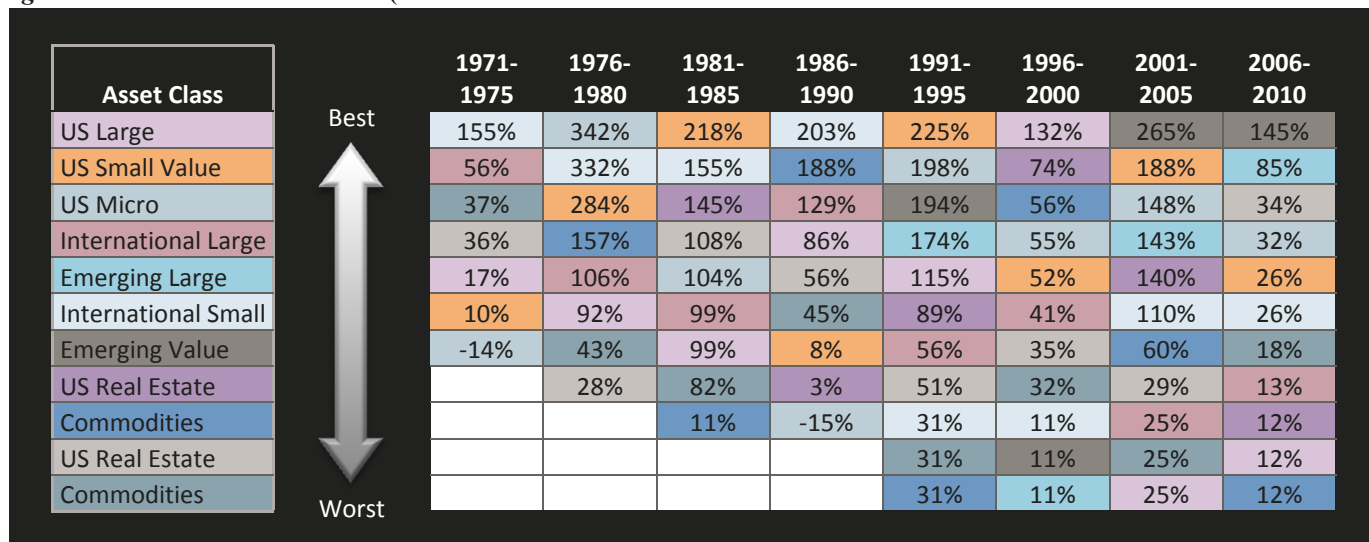
Over time, the idea that you should not “put all of your eggs in one basket” has become a truism. Yet, many investors seem to ignore that advice. We believe there are two main reasons for this: 1) while it is sage advice, it lacks precision as to how exactly to implement, and 2) the concept may have been oversold. Many critics seem to believe that a diversified portfolio could not experience substantial declines. However, **Figure 1** shows that during the recent downturn, all equity asset classes went down at once. A portfolio diversified across many stock asset classes helped investors reduce the risk of being exposed solely to the worst asset class. However, since losses were significant across the spectrum, few investors lauded the benefits of global equity diversification. Owning high quality fixed income would have been the only reprieve from significant losses.

Figure 2: Total Returns for Ten Year Period (March 1999 - February 2009)



Source: Dimensional Fund Advisors. See performance disclosure.

Figure 3: Randomness of Returns (Five Year Total Returns of Selected Asset Classes 1971-2010)



Some cells are blank because certain indexes do not have data for all time periods.

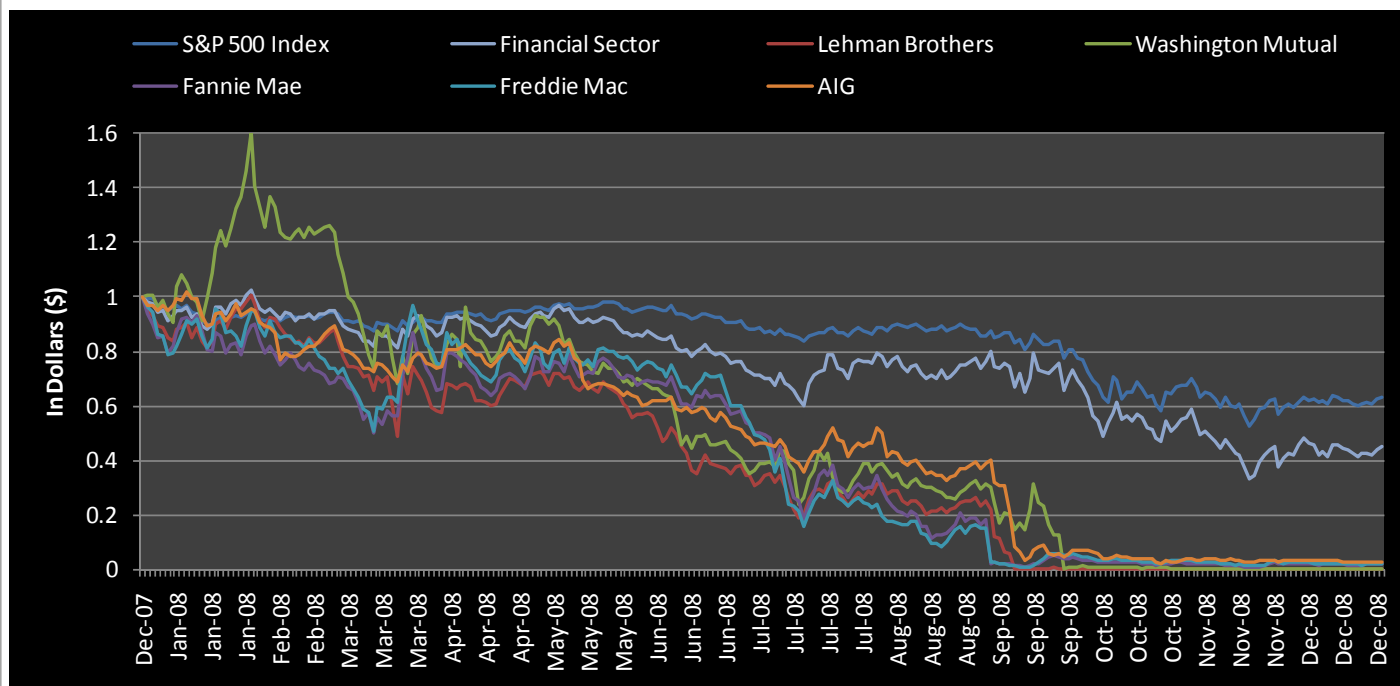
Source: Standard and Poor's Index Services Group, Dow Jones Indexes, MSCI, Center for Research in Security Prices, Fama/French, Dimensional Fund Advisors, Ibbotson Associates and BofA Merrill Lynch. See performance disclosure.

However, over a longer time frame, diversifying among equity asset classes has been a great hedge. Whereas, **Figure 1** shows the one year and four month period leading up to March 2009, **Figure 2** shows the ten year period ending in February 2009. The longer time frame shows a wider variation among asset classes. US large cap equities were still negative over the time frame, but emerging markets did quite well. A globally diversified investor would not have missed out on these returns, as seen by the performance of the Empirical High Premium Equity Modelⁱⁱ.

Figure 3 demonstrates the value of asset class diversification even further. The asset class that doubles or triples in value during one, five-year period may end up being the worst performing asset class during the next period. The only sure way to capture the impressive growth of every asset class is to diversify across them all.

Now that we have discussed the importance of avoiding concentrated positions in a single asset class, we will look at concentrated positions in a single company, sector or country.

Figure 4: 2008 Top 5 Worst Performing Stocks of the S&P 500 (Growth of a Dollar)



Source: Standard and Poor's, Yahoo Finance and Google Finance. Financial Sector represented by Financial Select Sector SPDR. See performance disclosure.

ⁱⁱThe Empirical High Premium Equity Model places an emphasis on Small Company, Value, and Emerging Markets.

The Dangers of Stock Selection

2008 was the worst year for US stocks since 1931. All ten sectors, from Energy to Telecommunications, experienced double-digit losses. No level of diversification among equities was able to prevent a serious decline. When a market decline is so widespread, it is hard to see the advantage of diversification because every investor, from the individual stock-picker to the diversified mutual fund owner, seemed to have experienced similar losses. However, **Figure 4** disproves this notion by showing the performance of the five worst returning stocks of the S&P 500. Surprisingly, all five stocks are household names, formerly large companies that seemed sensible and safe, before the financial crisis. In one year they each lost over 95% of their value, compared with a 37% drop in the S&P 500. In the 2.25 years since, they have shown no signs of recovering, while a diversified portfolio has already recuperated from 2008 losses.

The chart also shows the risk of concentrating in a particular sector. The Financial sector represents a basket of over 80 stocks, yet it declined 30% more than the S&P 500. Owning a large number of securities does not provide adequate protection when those securities are concentrated in a particular sector or asset class. (Robertson, 2008)

Diversification was equally important among countries, as shown in **Figure 5**. While the US stock market declined

portfolio invested only in Freddie Mac or Bulgaria could seem like a reasonable portfolio. Modern Portfolio Theory helps investors avoid the worst declines of certain countries or companies.

Systematic Versus Unsystematic Risk

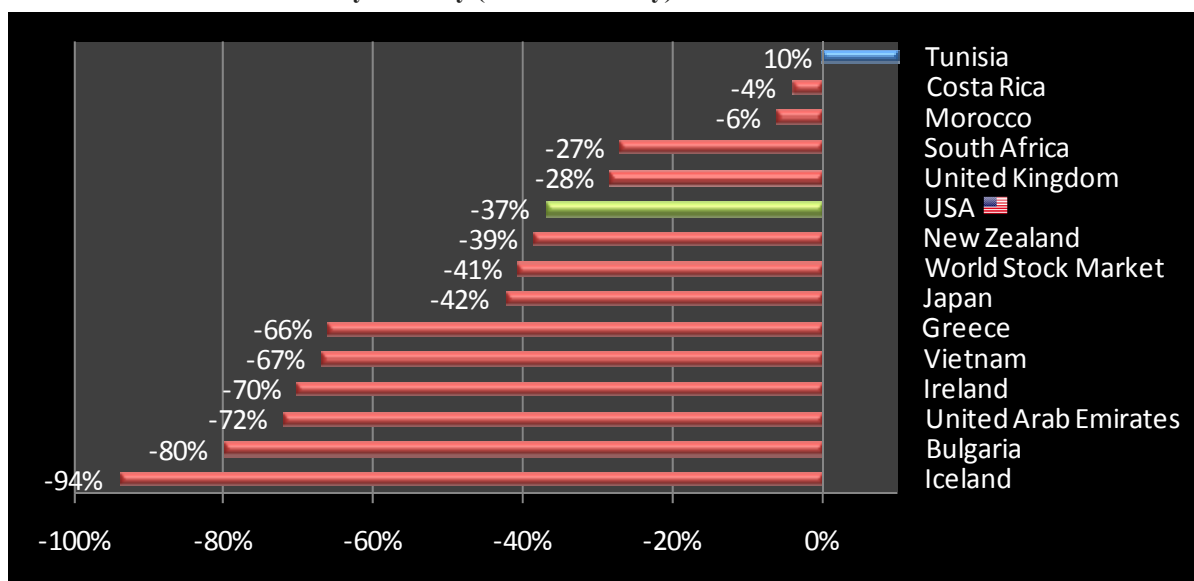
Investors with a passing understanding of Modern Portfolio Theory probably consider it as a tool to reduce risk in equity portfolios. However, a more nuanced description of Modern Portfolio Theory is that it is a tool to reduce *unsystematic* risk.

Unsystematic Risk: Risk that is independent to a particular security or asset class. Examples are a company's bad earnings announcement, an isolated stock fraud, or a downturn in the energy sector.

Systematic Risk: Risk that affects all securities in the market. Examples are war, natural disaster or a financial crisis that affects the entire world.

The most interesting point of distinction between these two categories of risk is that, over time, investors who take on greater unsystematic risk should not expect greater returns, even though they expose themselves to greater risk of loss. Unsystematic risk is often referred to as unrewarded risk. By owning a large number of securities, an investor can reduce their exposure to unsystematic risk. When a security

Figure 5: 2008 Stock Market Returns by Country (Local Currency)



Source: MSCI, (Robertson, 2008). World Stock Market represented by the MSCI All-Country World Index (local currency). See performance disclosure.

significantly, many other countries did much worse. An example of this is Iceland: prior to 2008, investors experienced huge gainsⁱⁱⁱ, but lost nearly all of their investment during the financial crisis. At the same time, some countries fared much better. For example, Tunisia managed to have a positive return.

If investors ignore the insights gleaned from MPT, then a

experiences a catastrophic decline (as seen in **Figure 4**), there is less of an impact when it makes up a small percentage of your portfolio. As for systematic risk, when every security declines, no amount of diversification will help. Although this may seem like a flaw of Modern Portfolio Theory, the theory never claimed to protect against systematic risk.

The above discussion considers systematic risk in the context

ⁱⁱⁱ From January 2000 to July 2008 Iceland's main stock market index, the ICEX1 increased over 4 times. Source: Trading Economics.

of a 100% equity portfolio. However, investors can temper their exposure to equity risk by including high quality fixed income instruments. Historically, high quality bonds such as US Treasuries perform relatively well during severe stock market declines; as seen in **Figure 1**, this last downturn was no different. This simple concept of managing risk at a portfolio level is a direct extension of MPT.

The empirical evidence is clear:

- Investors using the building blocks of MPT to guide an all equity portfolio avoided the catastrophic risk of losing everything with no hope of recovery.
- Investors with shorter time horizons or a lower tolerance for equity risk were able to use MPT to reduce the severity of decline experienced during the downturn.

Was the Recent Downturn Unprecedented?

For almost everyone, it was the worst market volatility experienced in their investing career, but it wasn't entirely unprecedented. **From 1929 – 1932, US stocks fell over 80%.** By comparison, during the recent downturn, stocks fell 50%.

By combining the historical risk and return data with Modern Portfolio Theory, practitioners develop models that quantify and predict risk and return within a statistical range. These ranges follows a “normal distribution,” or “standard bell curve”. This assumption allows you to easily calculate the probability of a certain magnitude of downturn in the model. Critics of these models point out that they underestimate extreme market movements, especially at the daily level. For example, on October 19, 1987, the Dow Jones Industrial Average fell 22.6%. **Such an extreme movement would be rare if it occurred every few billion years**, according to the bell curve model. Interestingly, when you look at longer periods of time the simple risk model performs much better.

The 37% decline in the S&P 500 in 2008 was exceptional. If you assume, annually, that distributions of stock market returns follow a bell curve, this decline should only happen every 96 years. Looking at three year returns, from 2008-2010, the S&P declined a total of 8.32%. Such a decline should happen every 23 years.

These rough risk calculations are not meant to represent an airtight risk model for equities. What they are meant to show is that the stock market experiences extreme short term volatility, which can be hard to predict. Over longer time periods, such as one year or three years, the volatility is less severe and more predictable. Investors should have time horizons of at least several years, so long term volatility should be their primary concern.

Dealing with Probabilities and Regret Avoidance

Imagine losing a bet that you placed a large amount of money on because it offered you a 99% chance of winning. You went with the odds, so theoretically it was a good bet. However, after losing, many of us would experience feelings of regret and the experience could affect our future decision making.

When faced with decisions involving probability, investors often have difficulty selecting the choice that maximizes wealth. Unlike computers, we have emotions and we deal with feelings of regret when decisions don't work out the way we hoped, or the way the odds should have gone. Our past experiences begin to affect how we make decisions and the weight we place on our desire to avoid feeling this way in the future. To counter this, it is important to accept that the best decision is the one that presents the most prudent approach, *before the fact*, regardless of the subsequent outcome.

Investors sometimes reprimand themselves for not having predicted the unpredictable. For example, an investor with a longer term horizon, who invested their cash in a 60/40, stock/ bond portfolio in 2007, may have experienced regret after the

Figure 6: Illustration of Assets with Negative Correlation

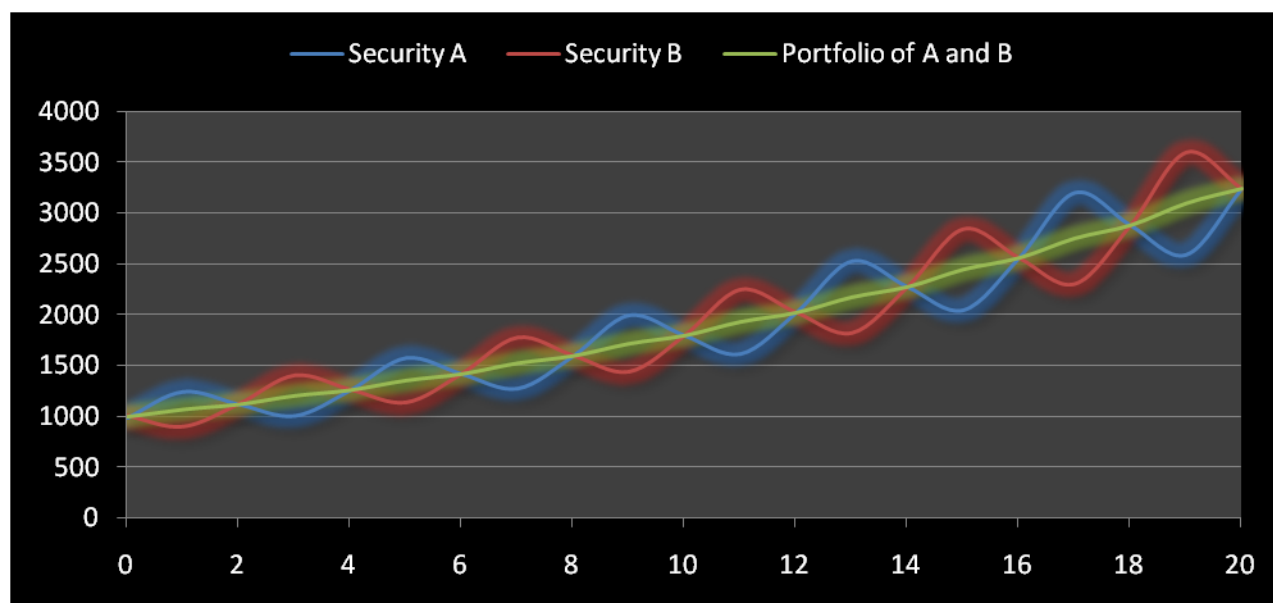
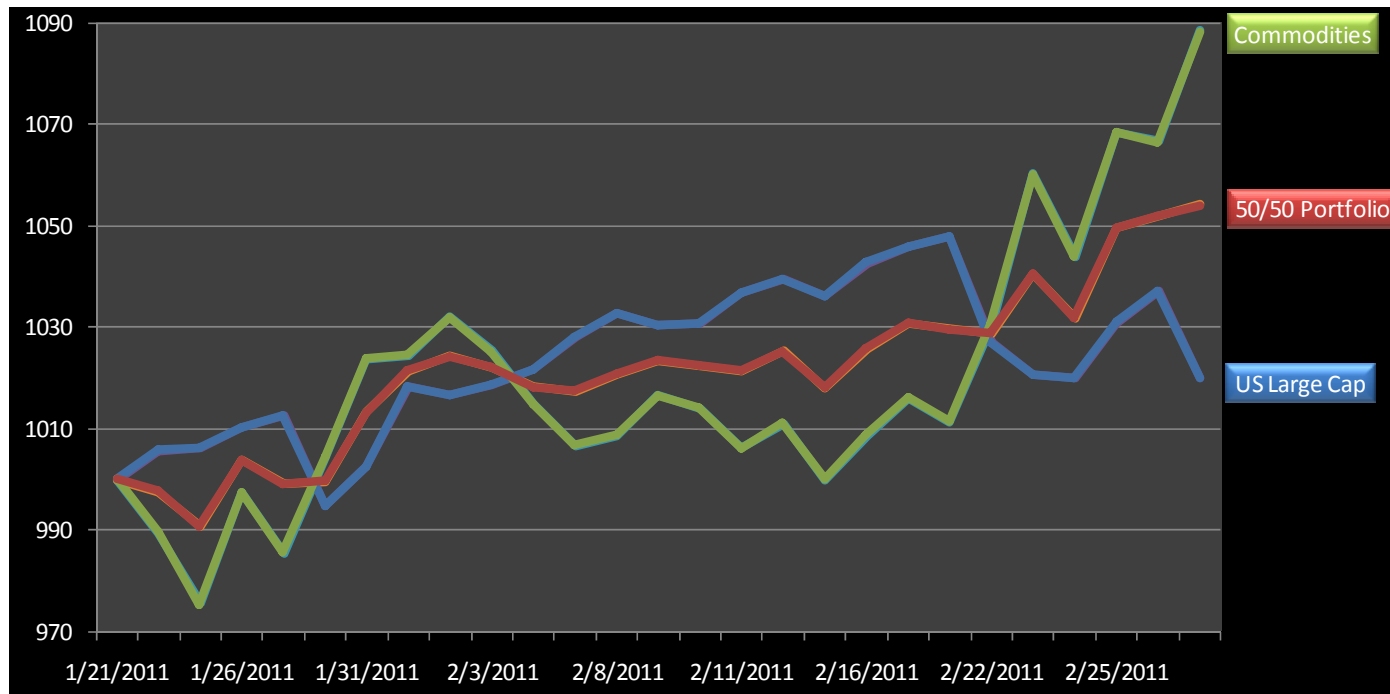


Figure 7: Correlation Illustration between of US Stocks and Commodities during the Egyptian Crisis



Source: Yahoo Finance

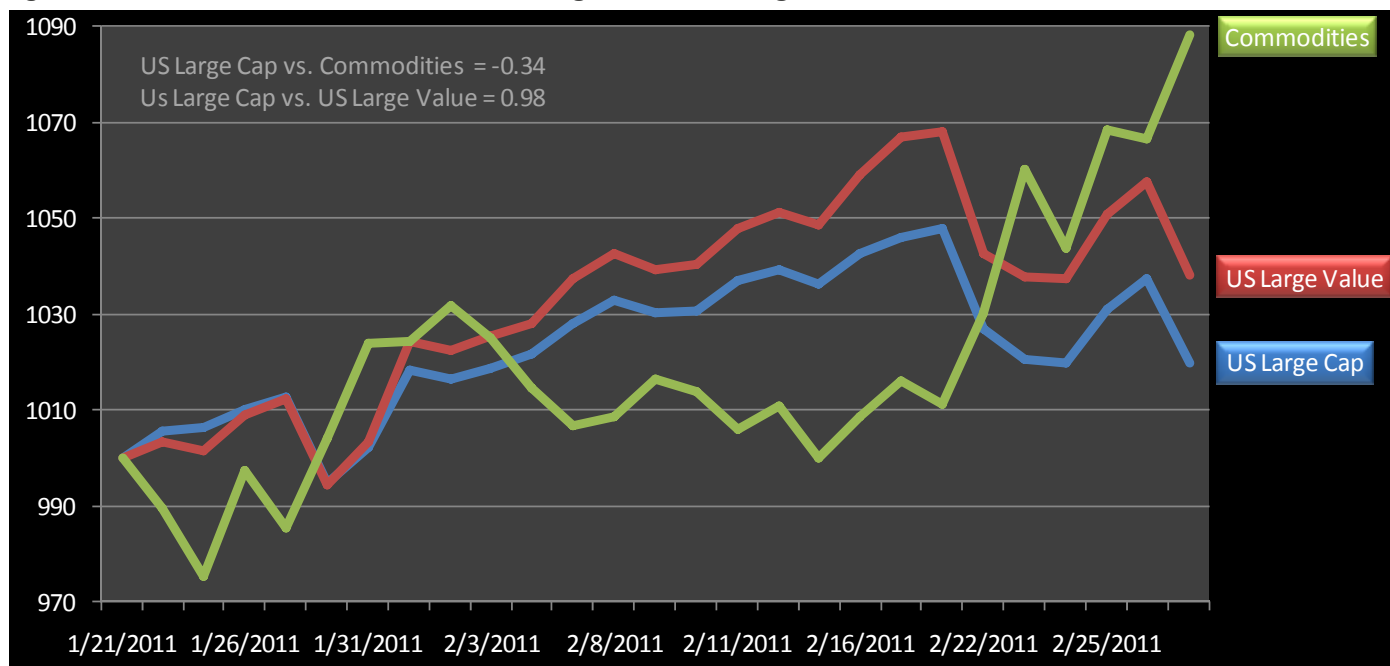
stock market subsequently crashed. The unfortunate outcome did not change the prudence of the decision. Because in 2007, the preponderance of empirical and theoretical evidence suggested that stocks would outperform bonds over the investor’s time horizon. The evidence also showed that stocks have much higher short term volatility. The 2007 investor who invested in a portfolio consisting of high-performing stocks and volatility-reducing bonds would have correctly utilized this information. Attempting to predict short term

market movements has proven a futile exercise, even for the most sophisticated investors.

Correlation

As mentioned before, a key tenet of Modern Portfolio Theory is that a security should not be evaluated in isolation. Knowing risk and return characteristics alone, is not sufficient; an investor must know how the security behaves in relation to the rest of the portfolio. As in the basket of eggs, if

Figure 8: Correlation Illustration between US Large Stocks, US Large Value Stocks and Commodities



Source: Yahoo Finance. See performance disclosure.

Figure 9: Annual Correlation of Returns 1990-2010

Asset Class	Correlation with S&P 500
US Large Cap	1.00
US Large Value	0.91
US Small Cap	0.80
Developed International Large	0.75
US Microcap	0.70
US Small Value	0.63
Developed International Small	0.55
Emerging Markets Large	0.48
US Real Estate	0.48
International Real Estate	0.46
Emerging Markets Small	0.40
One-Month US Treasury Bills	0.14
Diversified Commodities	0.10
Inflation	0.09
Long-Term Corporate Bonds	0.08
Long-Term Government Bonds	-0.19

Sources: Standard and Poor's Index Services Group, Dow Jones Indexes, MSCI, Center for Research in Security Prices, Fama/French, Dimensional Fund Advisors, and Ibbotson Associates.

one egg breaks, because the basket falls off the cart, how likely is it that the other eggs break at the same time? In Modern Portfolio Theory, that relationship is calculated using correlation. The correlation between two numbers is represented by a value between -1 and 1 (think of this range as + or - 100%). A correlation of 1 means that the two securities go up and down at exactly the same time, and a

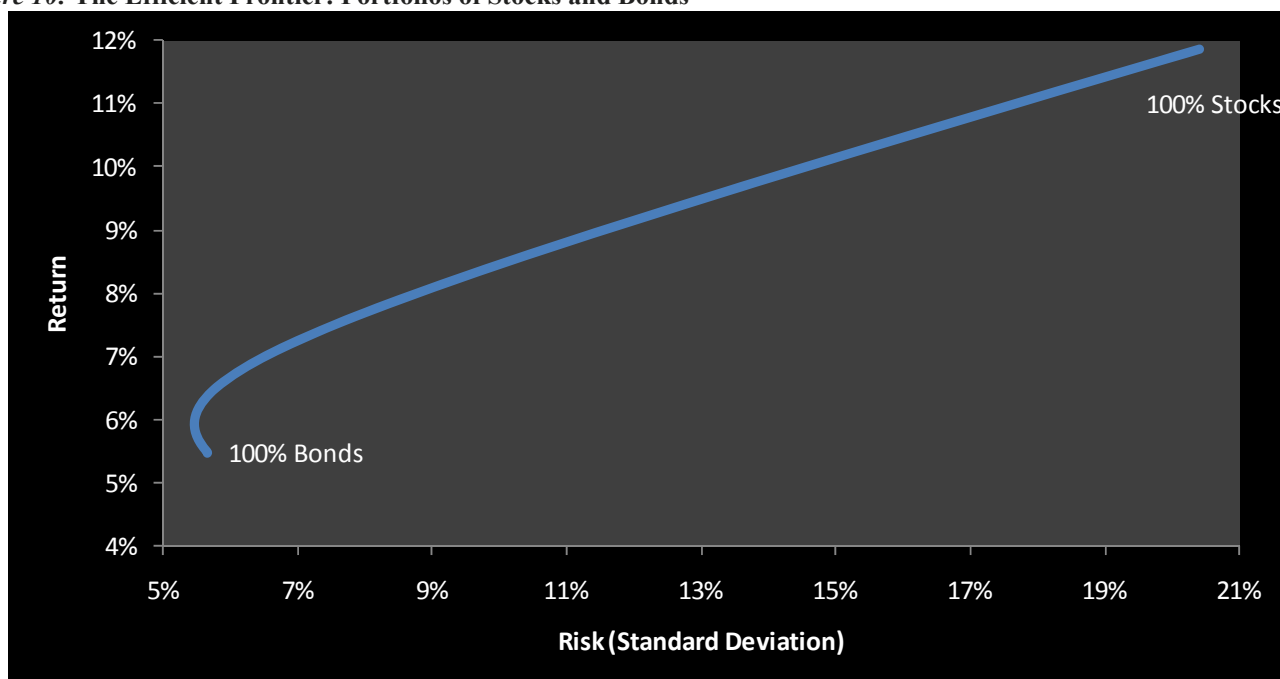
correlation of -1 means that every time one security goes up, the other goes down. A correlation of zero means that the movements of each security have no relationship with each other.

Ideally, a security would be negatively correlated with your portfolio. When the portfolio does poorly, the security tends to do well. **Figure 6** shows the performance of two hypothetical assets with perfectly negative correlation. While both are risky on their own, a portfolio of the two assets experiences no volatility at all (See **Appendix A** for examples of various correlations).

In the real world, no two reasonable investment choices exhibit perfectly negative correlation. However, there are times when two components of the Empirical portfolio show some negative correlation. When oil prices rise, historically, our diversified commodity fund (which has a high allocation to oil) tends to do well. At the same time, we have witnessed stocks decline in value (since high oil prices limit the amount of money consumers can spend on other goods and services). As shown in **Figure 7**, during periods of high oil volatility, like the beginning of recent political revolts in North Africa and the Middle East, this effect is most pronounced. **Figure 7** uses a hypothetical portfolio, which is 50% US stocks and 50% commodities. This portfolio, as a whole, experienced less volatility than just stocks or just commodities alone. While we would never recommend a portfolio with that much commodities exposure, it provides a useful illustration on the benefits of negatively correlated assets.

Figure 8 shows the performance over the same time period of the same asset classes, with the addition of US Large Value. This shows that US Stocks and Commodities had a negative correlation (-0.34) over the time period, whereas, US Large Cap and US Large Value stocks were highly correlated (0.98).

Figure 10: The Efficient Frontier: Portfolios of Stocks and Bonds



Source: Standard and Poor's and Ibbotson Associates. Stocks represented by the S&P 500 Index. Bonds represented by Five Year Treasuries.

Figure 9 shows the correlations for some major asset classes over the last twenty years. One notable fact is that small cap stocks have lower correlation with the S&P 500 than large cap stocks. This is true for US, developed international and emerging markets. Also, the lowest correlating assets tend to be bonds. Within bonds, longer term bonds have lower correlations than short term bonds, and government bonds have lower correlation than corporate bonds. Commodities are the one equity-like asset with near zero correlation.

The Efficient Frontier – Explanation of the Empirical Logo

You have probably seen Empirical’s logo. It represents the Efficient Frontier, a concept from Modern Portfolio Theory.

We can explain the concept of the Efficient Frontier with an example. Going back to 1926, stocks on average had a return of 11.9%, while bonds had a return of 5.5%^{iv}. In using standard deviation, we can see the average risk is 19.2% for stocks and 4.4% for bonds (with standard deviation a lower number is less risky). This is where the idea of connecting risk with return comes from and how it is expressed mathematically. If you plot the point where the risk and return for portfolios ranging between 100% stocks and 100% bonds, you get the curve shown in **Figure 10**. This line represents the most “efficient” portfolios: the point where return is maximized for each level of risk. This line is called the “Efficient Frontier”.

We understand that this tool does have limitations since it is constructed using historical data, meaning that it cannot provide perfect solutions for the future. It can, however, provide insight into the complex relationships between risky and less risky portfolios. For example, we would expect that a portfolio consisting of a single stock, would not be optimal because it does not maximize return relative to the amount of risk being taken. This is true because the long term future expected return of a stock cannot be higher than all stocks combined (adjusting for certain equity risk factors like size and style) yet there is a significantly greater risk of a single stock going to zero than an entire market. Understanding this type risk and return relationship is exactly what Harry Markowitz believes MPT shows us.

Conclusion

This letter highlights aspects of Modern Portfolio Theory that are relevant to investors. These principles serve as foundations to the evolving body of work known as Modern Portfolio Theory. In past letters, we have gone into more detail on topics, such as the Efficient Market Hypothesis (Q4 2006), Capital Market Expectations (Q4 2008) and Risk Premiums (Q1 2010).

After reviewing Modern Portfolio Theory, we believe it remains a foundation to any sensible investing strategy.

Those who reject it are entering a world of far greater uncertainty and risk. Without MPT, investors have no framework for managing risk, and nothing prevents them from owning a few securities that could all fall sharply at the same time. We have to agree with Markowitz when he said, “[MPT] was relevant 1,000 years ago and will be relevant 1,000 years from now”. Thus we believe investors should stay diversified and be aware of the risks in their portfolio. Modern academic research continues to evolve and as investors we should as well.

Sincerely,

Kenneth R. Smith, CFP®, MS
Principal | Chief Executive Officer

Steven Guichard, CFA
Portfolio Manager | Financial Analyst

Ethan Broga, CFP®, MS
Principal

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Robertson, J. (2008, December 29). Stock markets in 2008: a year to forget or learn from? *BBC World News*.

Performance Disclosure

Past performance is not a guarantee of future results. Even a long-term investment approach cannot guarantee a profit. Economic, political, and issuer-specific events will cause the value of securities, and the portfolios that own them, to rise or fall. The investment returns are hypothetical model returns, not actual returns and should not be interpreted as an indication of such performance. The portfolios were designed well after the beginning date of the performance time period. These portfolios were created with the benefit of hindsight, and do not take into account actual market conditions and available knowledge that would have impacted an investment advisor’s decisions. The investment strategy that the back-tested results were based upon can be changed at any time in order to show better performance, was based on hindsight, and can continue to be tested and adjusted until the desired results are achieved. The model performance includes advisory costs estimated by Empirical’s maximum fee, 1%. All performance data includes dividends. Prior to each fund’s inception month, the performance of a similar fund or index adjusted by the fund’s expense ratio is used. When index performance is used, estimated mutual fund expenses are deducted from index performance each month. The estimate used is the expense ratio of the current fund in the Empirical portfolio. Since indexes do not represent actual portfolios, they do not include several important costs, such as trading costs within funds, market impact costs, bid/ask spreads and other factors, which negatively impact performance. Portfolios are assumed to be rebalanced annually. Model portfolios do not include an allocation to cash. Taxes and trading costs are not included.

^{iv}Stocks are represented by the S&P 500 index from Standard & Poors, bonds are represented by the Five Year Treasury Index from Ibbotson Associates. The time period is 1926-2010.

Appendix A: Examples of Correlation

