G4G14 Gift Exchange

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This exchange item consists of two papers that served as the basis for "The Risk Premium Factor" (Wiley 2011). They are in the realm of behavioral economics and establish the relationship between stock price and Loss Aversion/Prospect Theory (Kahneman and Tversky, 1979) for which Kahneman won the Nobel Prize in Economics.

The first paper was published in the Journal of Applied Corporate finance and describes a simple mathematical model that explains the level of the S&P 500 Index with considerable accuracy. The second was not published and instead was incorporated into the author's book. It expands the discussion to explore the relationship of stock price to loss aversion coefficients associated with Prospect Theory (Kahneman and Tversky, 1979) for which Kahneman won the Nobel Prize in Economics.

- The RPF Model for Calculating the Equity Market Risk Premium and Explaining the Value of the S&P with Two Variables (Journal of Applied Corporate Finance Spring 2010)
- How the Risk Premium Factor Model and Loss Aversion Solve the Equity Premium Puzzle (Unpublished)

About the Author

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In This Issue: **Strategy and Valuation**

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The RPF Model for Calculating the Equity Market Risk Premium and Explaining the Value of the S&P with Two Variables

by Stephen D. Hassett, Hassett Advisors

While driving increases in shareholder value is one of the most important responsibilities of any business leader, many executives are handicapped by their limited understanding of what drives value. And they are not alone. Even prominent economists say that stock market valuation is not fully understood. For example, in a 1984 speech to the American Finance Association, Lawrence Summers said,

It would surely come as a surprise to a layman to learn that virtually no mainstream research in the field of finance in the past decade has attempted to account for the stock-market boom of the 1960s or the spectacular decline in real stock prices during the mid-1970s.[1]

Some people see the stock market as arbitrary and random in setting values. But despite occasional bouts of extreme volatility (including, of course, the recent crash), most academics (and many practitioners) would likely agree with the proposition that the market does a reasonably good job of incorporating available information in share prices. At the same time, however, certain factors can clearly cause the market to misprice assets. These include problems with liquidity, imperfect information, and unrealistic expectations that can knock valuations out of line for a period of time. But such limitations notwithstanding, over a longer horizon the market appears to be reasonably efficient in correcting these aberrations.

The RFP Valuation Model introduced in this article is intended to explain levels and changes in market values and, by so doing, to help identify periods of likely mispricing. As such, the model offers a general quantitative explanation for the booms, bubbles, and busts—that is, the series of multiple expansions and contractions—that we have experienced over the past 50 years. The model explains stock prices from 1960 through the present (March 2010), including the 2008/09 "market meltdown." And it does so using a surprisingly simple approach—one that combines generally accepted approaches to valuation with a simple way of estimating the Market or Equity Risk Premium (ERP) that produces remarkably good explanations of market P/E ratios and overall market levels.

To show you what I mean, Figure 1 shows how the P/E ratio predicted by model, when applied to S&P Operating Earnings, explains levels of the S&P 500 over the past 50 years, the earliest date for which I had reliable earnings data.

My approach to estimating the Equity Risk Premium is the most original part of this overall hypothesis. Many if not most finance theorists have assumed that the Equity Risk Premium is a constant that reflects the historical difference between the average return on stocks and the average return on the risk-free rate (generally the return on the 10-year U.S. government bonds). But if we also assume that long-term real interest rates do not change and that real growth can be approximated by real long-term GDP growth (also generally assumed to be stable), then the market-wide P/E would also be absolutely constant over time.

But, of course, the P/E multiple on the earnings of the S&P 500 is volatile, with year-end values ranging from 7.3 in 1974 to 29.5 in 2001. One possible objection to the idea of a constant risk premium is its implication that, when the risk-free rate increases, investors are satisfied with a premium that is smaller as a proportion of the risk-free rate. In this article, I suggest that the Equity Risk Premium is not a fixed number but a variable that fluctuates in direct proportion to the long-term risk-free rate as a fixed percentage, not a fixed premium. When used with the constant growth model, the cost of capital can be determined by the following formula:

$$\text{Equity Risk Premium} = \text{Risk-Free Long-Term Rate} \times \text{Risk Premium Factor} \quad (1)$$

This relationship can be used to explain why and how the risk premium varies over time; as interest rates vary, so does the risk premium. This Risk Premium Factor (RPF) appears to have held steady for long periods of time, changing just twice during the 50-year period from 1960 to the present (July 2009). Based on my calculations, the RPF was 1.24 from 1960-1980, 0.90 from 1981-June 2002, and 1.48 from July 2002 to the present. As we saw earlier in Figure 1, the model does a very good job of predicting market levels, even through the present financial crisis.

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1. Quoted by Justin Fox, *The Myth of the Rational Market: History of Risk, Reward and Delusion on Wall Street*, p. 199. (Harper Collins, New York, 2009).

Figure 1   **S&P 500 Actual vs. Predicted—1960–2009**
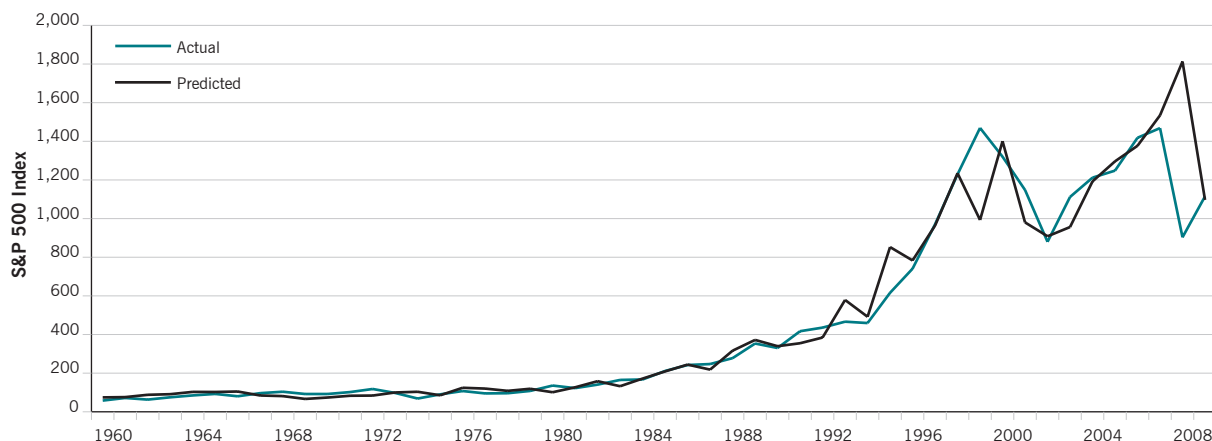
This result is also consistent with investor "loss aversion," the well-documented (by Kahneman and Tversky) willingness of investors to sacrifice significant gains to avoid considerably smaller losses. One of their studies produced a loss aversion coefficient of 2.25,[2] which implies that participants, on average, would be indifferent to the outcome of a coin flip promising either an expected but uncertain $325 or a guaranteed $100. The analogous calculation for the RPF model suggests that if the risk-free rate were 4% and the RPF 1.48, investors contemplating a $1,000 investment would assign roughly equal value to a guaranteed (bond-like) $40 and equities with an expected return of $99.

Valuing Constant Growth

The place to start is with the simplest valuation model, the Constant Growth Equation. This model derives from, and represents a specific case of, the Discounted Cash Flow (DCF) model that is used to determine the net present value of a projected stream of future cash flows. In the case in question, it is a perpetual stream of cash flows with a constant rate of growth. Instead of assuming different levels of earnings in each period, it assumes a constant growth rate off the base year and a constant cost of capital.

The DCF model can be expressed as follows:

$$P = \sum E_1 / (1+C)^1 + E_2 / (1+C)^2 + \ldots + E_n / (1+C)^n \quad (2)$$

where E is cash flow and C is cost of capital. If you assume that E grows at a constant rate (G),

$$P = \sum (E_0 \times (1+G)^1) / (1+C)^1 + (E_0 \times (1+G)^2) / (1+C)^2 + \ldots + (E_0 \times (1+G)^n) / (1+C)^n \quad (3)$$

the result simplifies to:

$$P = E / (C - G) \quad (4)$$

This equation, which is not so much a theory as an indisputable mathematical concept, is the expanded form of the core insight that the value of a perpetual stream is the amount of the payments divided by the required rate of return. In other words, the value of a guaranteed $100 perpetual annuity in a market where the long-run risk-free return is 10% is $1,000 ($100/.10).

The next step is to take the constant growth version of this model (equation 4) and apply it to market valuation by substituting S&P operating earnings for the variable E above.

P = Price (Value of S&P 500 Index)

E = Earnings (Reported operating earnings for the prior four quarters as reported by S&P) as a proxy for cash flow

G = Expected long term growth rate

C = Cost of equity capital

This formula can also be restated to predict the Price-Earning (P/E) ratio of the S&P 500 as follows:

$$P/E = 1 / (C - G) \quad (5)$$

2. Daniel Kahneman and Amos Tversky, "Advances in Prospect Theory: Cumulative Representation of Uncertainty," *Journal of Risk and Uncertainty*, 5 (1992):297-323.

Table 1   Growth Drives P/E

Long-term Growth	Predicted P/E
0%	12.6
2%	16.7
4%	25
6%	50

These two equations, when used with the right assumptions (as discussed below) can be helpful in understanding the valuations of both individual companies and the overall market.

Some academics and practitioners argue that equity should be valued as the present value of not earnings or cash flows, but of the dividend payments actually made to shareholders—an argument that is embodied in the Gordon (or Dividend) Growth Model. Some proponents of this model advocate a modified approach that values all corporate distributions, share repurchases as well as dividends. One well-known advocate of this model is Nobel Laureate Paul Krugman, who wrote:

> Now earnings are not the same as dividends, by a long shot; and what a stock is worth is the present discounted value of the dividends on that stock—period, end of story.[3]

I disagree, and for several reasons. For starters, Modigliani and Miller demonstrated in their famous 1961 article on the "irrelevance" of dividend policy, that it is the underlying expected earnings power of companies, not their dividend payouts, that determine corporate market values.[4] Dividend policy is as much a reflection of a company's capital structure and investment opportunity set as of its expected future profits—and decisions to pay out capital may often reflect a maturing of the business and a scarcity of profitable investment opportunities. What's more, most promising growth companies pay no or minimal dividends—and certainly for those companies, the current levels and changes in earnings are likely to be more reliable indicators than dividends of future profitability.

Why Growth Rate and Cost of Capital Matter— Lessons from the Constant Growth Equation

Assume you have an asset with a cost of capital of 12%, a growth rate of 2% and cash flow of $100. Using the Constant Growth model, the value can be calculated as follows: $100 / (12% - 2%) = $1,000. This might be called the "intrin-

sic value" of the asset and, as such, it offers the best guide to what it should trade for.

We can also apply this model to a share of stock to determine its intrinsic value. In place of cash flow, we use earnings per share (EPS) of $2.00 with the same cost of capital and growth rate, and the result is $2.00/(12% - 2%) = $20.00. Since EPS is $2.00 and price is $20.00, the Price to Earnings Ratio (P/E) is $20/$2 or a P/E of 10. While the market may value it differently, if these assumptions are true, this formula tell us its intrinsic value.

P/E ratios are often used to assess whether share prices are expensive or cheap. A P/E of 8 is considered very low, but when Google had a P/E of 60 or more, some thought it was very high. Is a company with a P/E of 10 a bargain compared to a company with a P/E of 20? We can explore this question using the constant growth equation.

Take the same company and now assume that its cost of capital drops to 8%, its growth rate increases to 3%, and its earnings stay the same. These might seem like small changes, but their impact is dramatic: $2.00/(8% - 3%) = $40.00, a doubling of value with the P/E rising to 20. If growth increases to 5% (in line with nominal long-term GDP growth), the share price rises to $66, and the P/E is 33. (For additional examples of how P/E varies based on growth for a company with an 8% cost of capital, see Table 1.)

The formula P = E / (C – G) shows that earnings relate directly to price. What many managers fail to realize is that investors don't look at earnings in a vacuum; they parse the information in earnings in order to estimate growth. And that's why the reporting of earnings often causes the P/E to change.

So, for all its simplicity, the Constant Growth model has some important lessons:

1. Small changes in growth make a big difference in value

2. Cost of capital is important, so we better get it right

3. Earnings drive value (stock price) but also contain information

While it may not be difficult to project current earnings, the big challenges are forecasting growth and getting the right cost of capital.

A Short Overview of Risk Premiums

The Capital Asset Pricing Model (CAPM) can be used to determine the cost of equity for an individual firm or the market overall. The model takes the form of the following equation: **Cost of Equity = R_f + β x (ERP),** where R_f = Risk-Free Rate (and we will use the yields on 10-year Treasuries as a proxy); β = Beta, which measures the sensitivity of the stock to market risk (which, by definition, is 1.0 for the entire

3. Krugman, Paul, "Dow 36,000: How Silly Is It?", *The Official Web Page of Paul Krugman*, accessed August 2009, http://web.mit.edu/krugman/www/dow36K.html.

4. Franco Modigliani, Merton H. Miller, "Dividend Policy, Growth, and the Valuation of Shares," *Journal of Business*. 1961, vol. 34, no. 4.

Table 2   **ERP Drives Valuation**

R_f	ERP	Cost of Equity	GDP + Inflation	Predicted P/E
5%	3%	8%	5%	33
5%	4%	9%	5%	25
5%	5%	10%	5%	20
5%	6%	11%	5%	17
5%	7%	12%	5%	14

market); and ERP = Equity Risk Premium (the calculation of which will be the main subject of this discussion). Given that the Beta of the broad market is 1.0, the Cost of Equity for the market as a whole can be expressed as $C = R_f + ERP$.

While the risk-free rate is easily determined, the risk premium is not. In fact, there is no clear consensus on how this should be done. The Equity Risk Premium (ERP) is the expected return an investor requires above the risk-free rate for investing in a portfolio of equities. It makes sense that if 10-year Treasury yields represent the safest (risk-free) long-term investment, then investors will require higher expected rates of return to buy riskier securities like corporate bonds or equities. My own considerable experience in valuing businesses has made it clear to me how sensitive valuations can be to one's estimate of the ERP (a topic I return to later).

The most common way of estimating the ERP is to measure the historical premiums that investors have received relative to Treasury yields and assume that investors will expect that rate of return in the future. Depending on method and time-period, this can range from 3% to 7% or more. Other methods include surveys and forward-looking estimates based on current stock market levels. There is a huge body of research on measuring equity risk premiums. Indeed, entire books have been written on the subject.

Many researchers have argued that the Equity Risk Premium changes over time—and that such fluctuations are a major source of stock price changes—and also that the ERP has experienced a "secular" decline during the past few decades. In their book *Dow 36,000*, for example, Kevin Hassett (no relation) and James Glassman pushed this argument to its reduction ad absurdum when suggesting that the risk premium could vanish entirely since, given a sufficient amount of time, stocks appeared virtually certain to outperform bonds.[5] In *The Myth of the Rational Market*, Justin Fox quotes Eugene Fama, one of the pioneers of the

efficient market hypothesis, as saying, "My own view is that the risk premium has gone down over time basically because we've convinced people that it's there."[6] Roger Ibbotson, a well-known compiler of ERP statistics, has suggested that the recent decline in the risk premium should be viewed as a permanent, but non-repeating event, "We think of it as a windfall that you shouldn't get again," he said.[7]

The Effects of Risk Premium on Valuation

Table 2 shows the expected effects of differences in ERP (ranging from 3% to 7%) on valuations and P/E ratios. Using the constant growth model, $P/E = 1 / (C - G)$, if we assume that the market will grow with long-term estimates of real GDP at 3% plus long-term inflation at 2%, our estimate of stock market P/E would have $P/E = 1 / (C - 5\%)$. (Note: Real GDP + Inflation is Nominal GDP). With Treasury yields at 5%, and ERPs ranging from 3%-7%, our range of cost of capital ($R_f + ERP$) is from 8% to 12%. Table 2 also shows the P/E implied for the overall market given this range of estimates of ERP and cost of capital. To provide some perspective on these numbers, if the S&P 500 were at 1,200 with its current P/E of 19, it would increase more than 25% to 1,593 with a P/E of 25 and the same level of earnings!

A New ERP Theory:
The Risk Premium Factor (RPF) Model

Conventional theory says that if the Equity Risk Premium were 6.0% and 10-year Treasury yield was 4.0% then investors would expect equities to yield 10%. The theory also implies that if the 10-year Treasury was 10%, then investors would require a 16% return, which represents a proportionally smaller premium.

For reasons discussed below, I will argue that investors expect to earn a premium that is not fixed, as in the conventional CAPM, but varies directly with the level of the risk-free rate in accordance with a "Risk Premium Factor" (RPF). While this proportional RPF is fairly stable, it can and does change over longer periods of time.

To illustrate the concept, with an RPF of 1.48, equities are expected to yield 9.9% when Treasury yields are at 4.0%. But if Treasury yields suddenly rose to 10%, equities would have to return 24.8% (10 + 1.48 x 10 = 24.8) to provide investors with the same *proportional* compensation for risk. In this example, an increase in interest rates (and inflation) causes the risk premium to jump from about 6% to 15%, suggesting that interest rates have a greater impact on valuation and market price than is generally recognized.

To test this approach, we must determine not only the

5. James K. Glassman and Kevin A. Hassett, *Dow 36,000: The New Strategy for Profiting From the Coming Rise in the Stock Market*, (Times Business, New York, January 1, 1999).
6. Justin Fox, *The Myth of the Rational Market: History of Risk, Reward and Delusion on Wall Street*, p. 263. (Harper Collins, New York, 2009).

7. Ibid.

Figure 2 **10-Year Treasury Yields—1960–2009**[12]

Source: U.S. Treasury

Risk Premium Factor, but estimates for the other variables in the following equation:

$$P/E = 1 / (C - G) \qquad (11)$$

In the analysis that follows, I use the following variables and assumptions:

P = Price (Value of S&P 500)

E = Actual Earnings (Annualized operating earnings for the prior four quarters as reported by S&P). Earnings, while not ideal, are used as a proxy for cash flow and seem to work very well

G = Expected long-term projected growth rate, which is broken down into Real Growth and Inflation, so G = $G_R + I_{LT}$

G_R = Expected long-term real growth rate. Long-term expected real growth rate (G_R) is based on long-term GDP growth expectations on the basis that real earnings for a broad index of large-cap equities will grow with GDP over the long-term. A rate of 2.6% is used with the same rate applied historically.[8]

I_{LT} = Expected long-term inflation, as determined by subtracting long-term expected real interest rates (Int_R) from the 10-year Treasury, where Int_R is 2%; based on the average 10-year TIPs Yields from March 2003 to the present.[9]

C = Cost of Capital is derived using Capital Asset Pricing Model, where for the broad market, C = R_f + ERP

R_f = Risk-Free Rate as measured using 10-year Treasury yields

ERP = Risk Premium Factor (RPF) x R_f

RPF = 1.24 for 1960 – 1980; 0.90 for 1981 – 2001; and 1.48 for 2002 – present. The RPF for each period was arrived at using a linear regression to fit the assumptions above to actual PE.[10]

When using these assumptions for the present period—that is, with an RPF of 1.48—the formula reduces to:

$$P/E = 1/ (R_f \text{ x } (1+RPF) - (R_f - 2\%) - 2.6\%) \qquad (12)$$

Explanatory Value of the RPF Valuation Model

As can be seen in Figures 2-6, the actual values deviated significantly from the predicted values at the end of 2008 and the first quarter of 2009, but had returned to something like parity by June 2009. I believe that these deviations from the model were attributable mainly to the abnormally low yields for 10-year Treasuries that had been in effect since late 2008, when the "flight to quality," along with the Federal Reserve's purchase of notes beginning in March 2009, caused the 10-year Treasuries to be overpriced.[11] As shown in Figure 2, yields then fell to as low as 2.2%, as compared to a more "normal" range of 4.1% to 5.1% in 2006 and 2007 (and rarely

8. "Economic Projections and The Budget Outlook," Whitehouse.gov, Access Date March 15, 2009, http://www.whitehouse.gov/administration/eop/cea/Economic-Projections-and-the-Budge-Outlook/.

9. "H.15 Selected Interest Rates", The Federal Reserve Website, Accessed March-July 2009, http://www.federalreserve.gov/datadownload/Choose.aspx?rel=H.15.

10. All data used in the analysis is available for download at: http://sites.google.

com/a/hassett-mail.com/marketriskandvaluation/Home.

11. "Fed in Bond-Buying Binge to Spur Growth," *The Wall Street Journal Online*, March 19, 2009, http://online.wsj.com/article/SB123739788518173569.html.

12. H.15 Selected Interest Rates", The Federal Reserve Website, accessed March-January 2010, http://www.federalreserve.gov/datadownload/Choose.aspx?rel=H.15.

Figure 3   S&P 500 P/E Actual vs. Predicted—1960–2009 (Annual)

Note: Predicted Y/E 2008 P/E is 18.5 using Treasury yield of 4% rather than actual Y/E yield of 2.8%; actual Y/E was 18.3
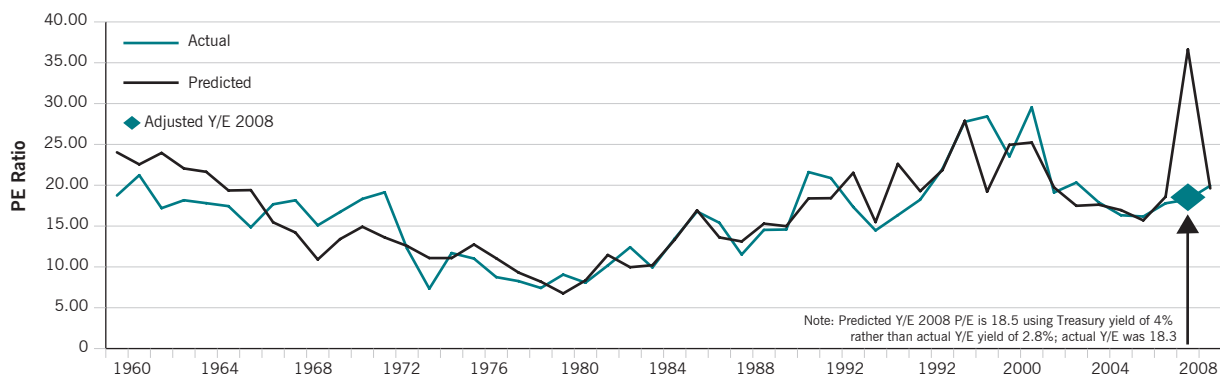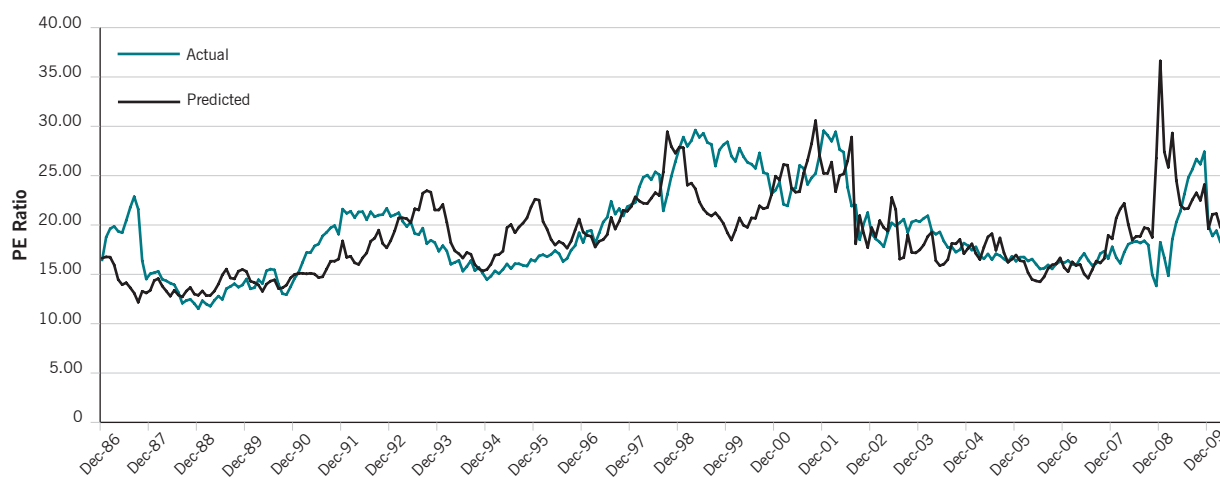
Figure 4   S&P 500 P/E Actual vs. Predicted—1988–March 2010 (Monthly)

less than 4% since 1960).

To compensate for these abnormally low Treasury yields Figure 3 shows the P/E ratios that would likely have prevailed if Treasury yields had remained at a still low, but more normal yield of 4%.[13] And as shown in each of Figures 3-5, when we normalize the 2008 R_f variable in this way, the actual year-end valuations correspond closely with the predicted values. One use of the model is to spot anomalies—and I believe that Treasury yields during the 2008/09 financial crisis were an anomaly.

Also plainly visible in Figure 3 is the decline in P/E ratios in the 1970s, reflecting the increase in interest rates during that period. It also shows the jump in P/Es during the 1980s, reflecting the drop in inflation and interest rates.

Figure 4 shows the application of the same model using monthly data from the end of 1986 through March 2010.[14] Like Figure 3, Figure 4 shows the return of values to parity by middle of 2009. And as can be seen in Figure 5, the RPF model explains overall market valuation levels when actual S&P operating earnings are applied to the P/E ratio during the period 1960–2009.[15] Using both year-end annual data for the past 50 years and monthly data for the past 20 years, then, the RPF model appears to do a very good job explaining valuations. And that in turn would suggest that, at any

13. While earnings are released quarterly, the model was extended to monthly and daily price data by using actual closing prices for S&P 500 and 10-Year Treasury yields along with S&P 500 operating earnings as a constant for each month in the quarter. The quarterly earnings were applied for the month preceding quarter end (i.e., Dec – Feb = Q1) under the assumption that market expectations would have incorporated earning expectations. Again, it assumed that as the end of quarter approaches earnings estimates should be within a reasonably close to those actual earnings ultimately reported and embodied in share prices. Earnings and S&P Averages 1960-1988 from Damodaran

Online: Home Page for Answath Damodaran (New York University) http://pages.stern. nyu.edu/~adamodar/; S&P Earnings and levels from 1988 – Present from Standard and Poors Website, http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indi- ces_500/2,3,2,2,0,0,0,0,0,1,5,0,0,0,0,0.html; Calculations and methodology by the Author.

14. See Note 13.
15. See Note 13.

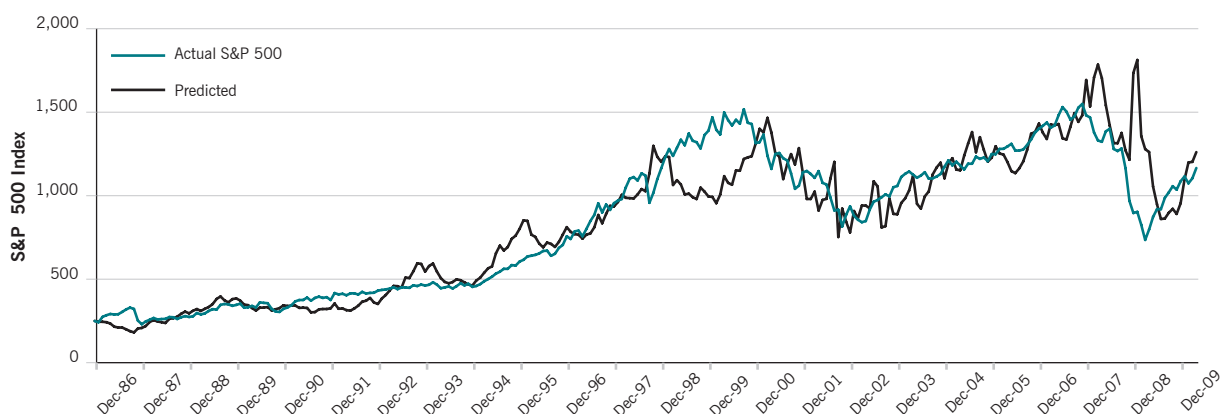**Figure 5   S&P 500 Actual vs. Predicted—1988–March 2010**

Table 3   Estimated Risk Premium Factors

Period	RPF
1960 – 1980	1.24
1981 – Q2 2002	0.90
Q3 2002 – Present	1.48
6%	50

Table 4   RPF Valuation Model R Squared Results

	R Squared	
Dataset	Full Dataset	Excluding Meltdown
1960 – 2008 (Annual)	89.5%	96.3%
1986 – September 2009 (Quarterly)	80.6%	88.0%
January 1986 – September 2009 (Monthly)	86.3%	90.8%
January 1986 – September 2009 (Daily)	86.5%	90.9%

point in time, the general level of market pricing and P/E ratios are driven mainly by just two factors: interest rates and expected earnings.

Estimating the Risk Premium Factor (RPF)

The RPF was estimated by fitting the model to actual levels of the S&P 500 over the period 1960 to the present. This analysis revealed two distinct shifts in the RPF since 1960. Table 3 shows the RFP factors that provide the best fit for each period.

The overall fit was assessed by calculating the R^2s of the regressions using the appropriate RPF for each time period. As previously discussed, the meltdown after September 2008 drove down the risk-free rate to an unsustainable level and left a trail of historical earnings that clearly did not reflect expectations. As also discussed previously, these factors are now back in line. To adjust for this recent anomaly, the R^2 was calculated excluding meltdown time period beginning September 2008.

As reported in Table 4, after excluding the meltdown period, the RPF Valuation Model explains a remarkably high

96% variation of stock prices over the past 50 years, as well as 91% of the daily variation.[16]

Consistency with Prospect Theory/Loss Aversion

As mentioned earlier, Daniel Kahneman and Amos Tversky first developed "prospect theory" in 1979, proposing that individuals have a sufficiently strong preference for avoiding losses that they are willing to pass up considerably larger gains. (Kahneman won the Nobel Prize in Economics in 2002 after Tversky passed away in 1996.) Such "loss aversion" in turn causes individuals to seek compensation for risk that is greater than what would be indicated by expected value of the outcomes. For example, if you were offered a certain $100 or $201 for correctly guessing a coin flip, you *should* prefer the coin flip. Not surprisingly, most people require higher levels of compensation to take the bet.

Numerous studies have been conducted to determine how much additional compensation is required; this is called the loss aversion coefficient. In a 1992 study, Kahneman and

16. For daily calculation, actual closing prices for S&P 500 and 10-Year Treasury are used; daily earnings were derived using same approach as monthly earnings as explained in Note 13.

Tversky reported finding a coefficient equal to 2.25.[17] In other words, people on average were indifferent to a coin flip for $325 versus a guaranteed $100. Other studies found coefficients of loss aversion in the range of 1.43 to 4.8.[18]

Such coefficients are consistent with my RPF findings, in which equities require premiums ranging from 90% to 148% over 10-year Treasury yields (roughly equivalent to loss aversion coefficients between 1.90 and 2.48). And the two concepts appear to have another important similarity. Stock market investors, like the subjects in these studies, appear to expect an incremental return for bearing risk that increases proportionally with the level of the risk-free interest rate. For example, if you were indifferent between $10 guaranteed and $30 on a coin flip, you probably would not accept that same fixed $20 premium over the expected value if the stakes were raised and you were offered a choice between a certain $100 and a contingent $220. Likewise, if the risk-free rate is 4% and the RPF is 1.48, a $1,000 investment in bonds would offer a guaranteed $40 and equities an expected return of $99, or a $59 premium. But if bonds instead yielded 10% and the guaranteed return rises to $100, a $59 premium would probably look much less attractive.

Potential Causes for Shifts in The Risk Premium Factor (RPF)

The RPF has shifted twice in the past 50 years, once in 1981 and again in July 2002. The period from 1960-1981 was characterized by increasing inflation expectations, rising from 1.8% in 1960 to 11.7% in 1981.[19] In 1981, the trend reversed and inflation expectations began to decline. The 1981 shift in RPF from 1.24 to 0.90 could have resulted from this change in inflation expectations driven by world events, with the decline in inflation resulting in higher real after-tax equity returns. Events during 1981 that could have contributed this change include:

• Resolution of the Iran hostage crisis. The reduction of tensions could have increased expectations of stability and a secure oil supply bringing with it lower inflation and less risk of an economic shock.[20]

• Inauguration of the Reagan era, with tax reduction leading to higher real after-tax returns.

At the same time, my analysis shows that the RPF increased from 0.90 to 1.48 in mid-2002. The decline of the rate of long-term inflation ended in 2002, with long-term inflation expectations having declined from a peak of 11.7% in 1981 to 2.0% in 2002. From 2002–2008, the rate of infla-tion has remained fairly stable, fluctuating in the 2% - 3% range. Other events that could have caused or contributed to the shift in 2002 include:

• Department of Justice investigation into Enron. Enron, Tyco and WorldCom's destruction of confidence in reported earnings may have led to increase risk premium factor.

• The enactment of Sarbanes Oxley in response to accounting scandals. The act faced severe criticism for imposing significant costs on public companies. Some suggested high compliance costs would cause capital to flee to less regulated markets, increasing the premium required for U.S. equities.

• Congressional authorization of war in Iraq. Expectations of a protracted war with Iraq could have increased expectations that increased borrowing to fund the war would lead to increased inflation and tax rates in the future.

Potential Weaknesses in RPF Theory and Methodology

Proper application of the model requires an understanding of its potential weaknesses:

• *All data points are current actual or historical.* While the market is forward looking, all data in the analysis are based on actual results. Even 10-year Treasury yields, which embody expectations about future real interest and inflation, were sampled at a single point in time, along with earnings that are not released until well after the quarter ends. Analysts' estimates are widely accepted as being embodied in current share price and would be expected to be reasonably close to actual before the end of each quarter.

• *Reasons for changes in Risk Premium Factor (RPF) are not fully explained.* The RPF has changed twice over the past 50 years and has historically held for long periods of time. While I have suggested a few possible reasons for the two changes in the RPF over the past 50 years, it is clear that further explanation and understanding is necessary.

• *The RPF may seem to be set arbitrarily to fit actual.* Given the good linear regression fit across a relatively large number of data points, the RPF seems to make sense and provide good result. Nevertheless, this remains a valid concern.

• *RPF cannot be projected.* Thus far it only seems possible to discern the RPF with hindsight. Still this would seem superior to other methods for determining risk premiums that produce less definitive results. For example, if the RPF changed just two times over 50 years, one might argue that in any given year there is a 96% chance (48 out of 50) that the RPF will remain constant over the next year.

17. Kahneman and Tversky. (1992), cited earlier.
18. Abdellaoui, Mohammed, Bleichrodt, Han and Paraschv, Corina, Loss Aversion Under Prospect Theory: a Parameter-Free Measurement (October 2007). Management Science, 10:1659-1674.

19. Calculation of inflation expectations based on difference between 10-Year Treasury yield and assumed 2% long-term real interest rate
20. "1981: Tehran frees US hostages after 444 days" BBC Website, Accessed March 15, 2009, http://news.bbc.co.uk/onthisday/hi/dates/stories/january/21/newsid_2506000/2506807.stm.

Declining Interest Rates Explain More than Half of S&P 500 Index Growth Since 1981

Interest rates are much more important than is generally recognized. Some contend that the effects of interest rates on corporate values are limited to the direct impact on corporate borrowing and consumer spending. Such observers tend to argue that although the cost of capital rises with inflation, for the market as a whole, the negative effect of this increase is directly offset by the positive effects of inflation on earnings. In other words, in the equation $V = E / (C – G)$, since C and G increase by the same amount (inflation), the expected impact of inflation is zero.

By contrast, the RFP Model suggests that since the ERP increases proportionally with the risk-free rate, it rises faster than the growth in earnings, causing a decline in valuations. So, in addition to the direct negative impact of interest rates on earnings, higher rates also have a large impact on P/E multiples.

The highest monthly finish of the S&P 500 was October 2007, when it closed at 1549. The highest annual finish of the risk-free rate was 1981, when the 10-year Treasury yield ended the year at 13.7%. Between these two mileposts, the S&P 500 Index increased 1264%, from 122 to 1549. During the same period, S&P Operating Earnings increased only 588%, rising from 15.2 to 89.3. Thus, earnings accounted for only 47% (588%/1264%) of the growth of the S&P 500 during this period.

And since the increase in S&P earnings account for less than half of the increase in its value, much of the remaining increase can be attributed to decreases in the risk-free rate—and with the 10-year Treasury yields falling to 4.47% in October 2007, the cost of capital dropped from over 26% at the end of 1981 to about 11% in 2007. And according to the RPF model, over 50% of the appreciation over the past 29 years is explained by reductions in both the RPF and risk-free rate. More specifically, the model provides a way of explaining the remarkable increases in corporate P/E multiples since the 1960s—one that relies largely on changes in interest rates (which embody expected inflation) during that period.

The RPF Model and Market Efficiency: Exploring Major Market Events From 1986–2009

The RPF Model can help demystify valuation and also help explain major market vents over the past 20 or so years. The exploration of these events may also serve to shed some light on the efficient market hypothesis.

The Efficient Market Hypothesis (EMH) was first fully proposed by Eugene Fama in his doctoral thesis at the University of Chicago in the 1960s. In short, it states that the markets are "informationally efficient" in the sense that all available information is incorporated in the current stock price. The implication is that since all information is embodied in the current price, it should be difficult for investors to beat the market year in and year out.

Over time it has been much debated and variations have emerged that allow exceptions for holders of private information (say, management) small stocks that are not heavily traded. The EMH has been much criticized, particularly by professional money managers who would be out of work if the market were perfectly efficient. After all, if the pros can't outperform the market, why not just buy index funds?

Many people take the EMH to mean that the markets are *always* right. Today even Fama admits the market makes mistakes: "In a period of high uncertainty, it's very difficult to figure out what the right prices are for stocks."[21] And Ken French, a frequent collaborator with Fama and Professor at the Tuck School of Business at Dartmouth, said in an interview jointly conducted with Fama that:

The efficient market hypothesis is just a model and, like all interesting models, it is not literally true. There are mistakes in prices even if one considers just publicly available information and, since people use financial prices to help decide how to allocate resources, those mistakes must affect the underlying reality. Of course, the existence of mistakes does not imply they are easy to find.[22]

How the RPF Valuation Model Explains October 19, 1987 (Black Monday)

U.S. and global markets plunged on October 19, 1987, with the S&P 500 declining more than 20%. The cause of the decline has been much discussed, with program trading often cited as the main culprit along with portfolio insurance (derivatives).[23]

The application of the RPF Model to this period is revealing. As shown in Figure 6, which shows actual versus predicted S&P levels,[24] the market appears to have gotten "ahead of itself"—thereby creating a bubble of sorts—in anticipating an increase in earnings and values. As can be seen in Figure 7, interest rates began to climb in March 1987, rising from 7.25% in March to 9.25% in October, driving down the predicted P/E and the predicted level of the S&P 500.[25] Yet despite flat earnings, the market grew by 12% from February to September (and a total of 25%

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21. "CBS Money Watch, http://moneywatch.bnet.com/investing/article/eugene-fama-why-you-cant-time-the-market/277142/.

22. "Fama/French Forum" http://www.dimensional.com/famafrench/2009/04/qa-bias-in-the-emh.html.

23. "Black Monday 10 Years Later: 1987 Timeline," *The Motley Fool Website*, accessed March 2009, http://www.fool.com/features/1997/sp971017crashanniversary-1987timeline.htm.

24. See Note 13.

25. See Note 14.

Figure 6 **Actual vs. Predicted During October 1987 Crash**[32]
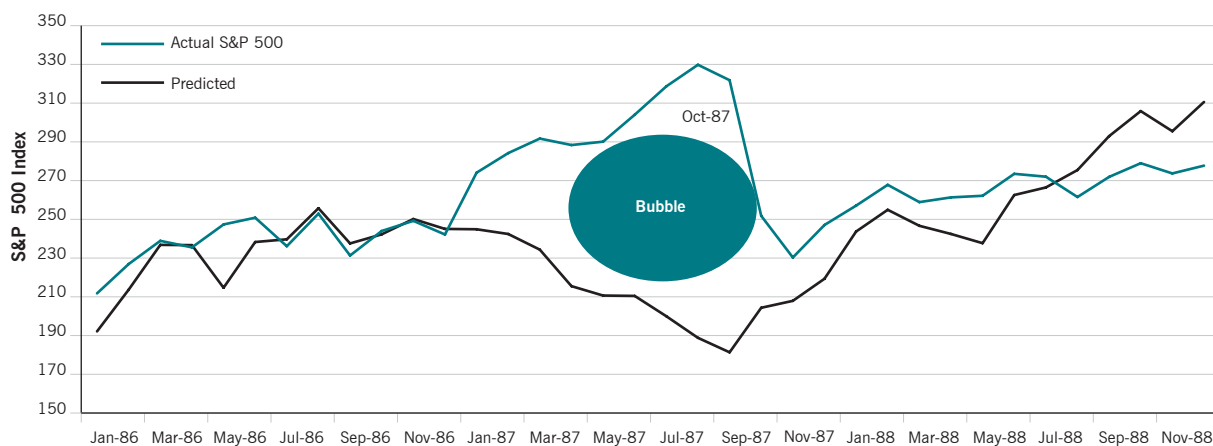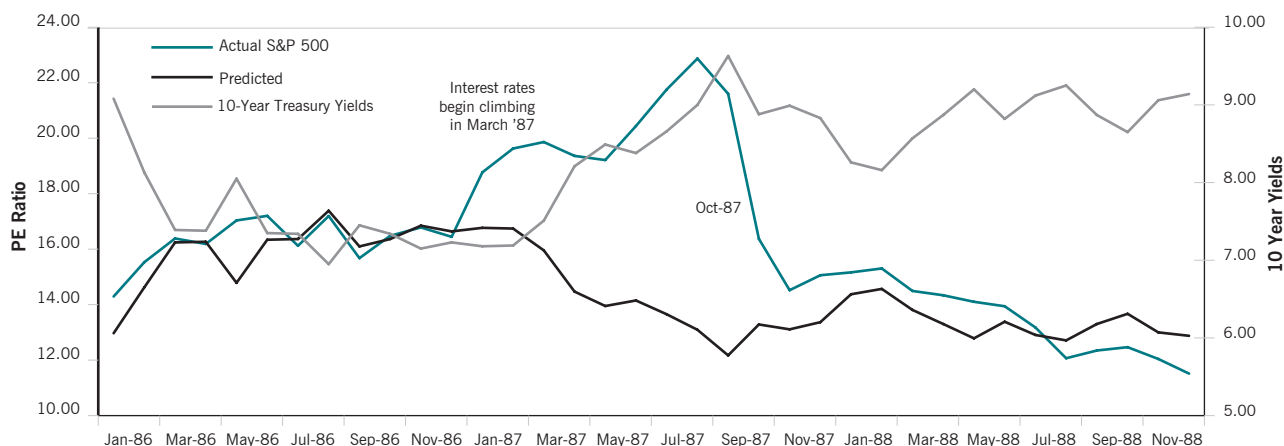

Figure 7 **Interest Rate Impact on October 1987 Crash, Actual S&P 500 Month-end data–10-Year Treasury Yields**

from December). With the market crash in October, the predicted and actual fell back into parity, with both figures suggesting the creation and bursting of a bubble.[26]

The suggestion offered by the RPF model in this case is that the underlying cause of the crash was excessive valuation relative to the sharp rise in interest rates. While actual and predicted levels often deviate, without a shift in the RPF, they tend to fall back in line.

But why did the market fall on October 19 and not November 19? The market began its decline in August. During the days before October 19, Iran had attacked a U.S flagged tanker, exacerbating fears that oil prices would continue to rise.[27] Perhaps this solidified the belief that earnings would not rise and inflation would stay high, keeping interest rates high. And this point of view was rapidly assimilated into the market. My own belief is that these developments were nothing more than the pinpricks that popped the balloon—actions that, while not particularly momentous in and of themselves, were enough to cause an unbalanced state to return to a more sustainable equilibrium. While derivatives and program trading may have aggravated the market decline once the decent began, they were not the fundamental cause, but rather part of the mechanism that helped to restore equilibrium.

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26. See Note 14.

27. "Iranian Attacks on Kuwaiti Port Called Cause for U.S. to Retaliate," *The New York Times*, October 18, 1987, http://www.nytimes.com/1987/10/18/world/iranian-attacks-on-kuwaiti-port-called-cause-for-us-to-retaliate.html.

Figure 8   **Actual vs. Predicted during the 2000 dot.com Bubble, S&P 500 Month-end data–10-Year Treasury Yields**
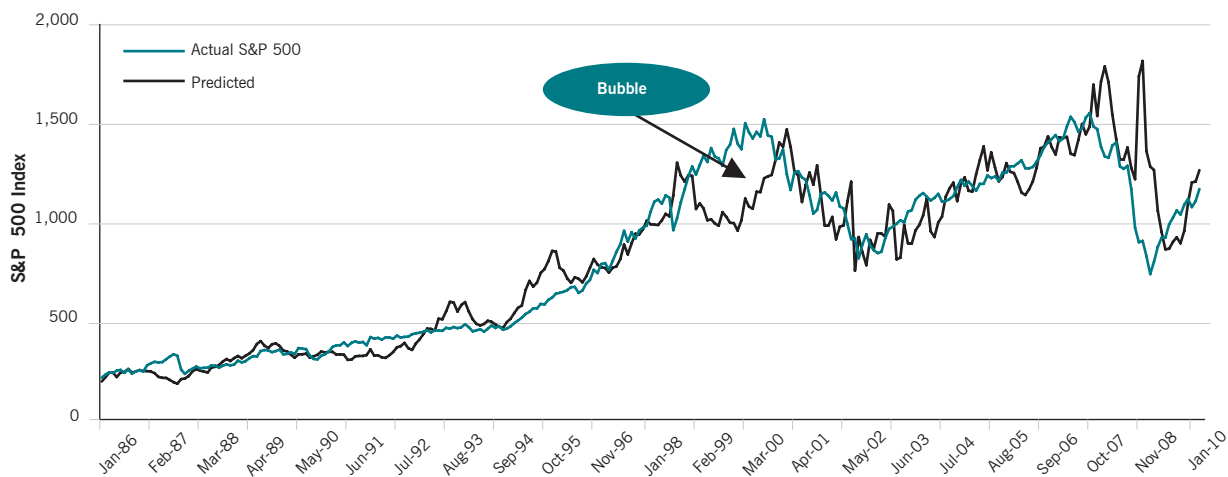
Figure 9   **NASDAQ January 1999–May 2002**

2000 "Dot Com" Bubble: RPF Model Suggests Significant Bubble for the S&P 500

The NASDAQ peaked on March 10, 2000, at 5,132 in what is widely considered to be a bubble driven by excessive valuations of the Internet and other technology companies. Many economists such as Robert Schiller, author of *Irrational Exuberance*, argued that the entire market was embroiled in a speculative bubble throughout this period.[28]

Application of the RPF Model to the S&P 500, strongly suggests that a significant bubble did exist. Indeed, Figure 8 suggests that the dot.com bubble of the late 90s was by far the largest during the period 1986 through 2009.

The model was not applied to the NASDAQ because it would be inappropriate to assume that the long-term growth of the smaller cap and technology heavy NASDAQ would equal long-term GDP growth and that volatility (Beta) would be the same as the S&P 500. As shown in Figure 9, the NASDAQ had declined by 32% in mid-April 2000 from its March 10 high, and by 51% by the end of 2000.

What explains this plunge in prices? From November 1998 until March 2000, 10-year Treasury yields increased from 4.6% to 6.2%. While the NASDAQ began to run up in late 1999, as can be seen in Figure 10, the S&P 500 Index began to diverge from RPF Model predictions in January

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28. Robert J. Schiller, *Irrational Exuberance*, (Princeton University Press).
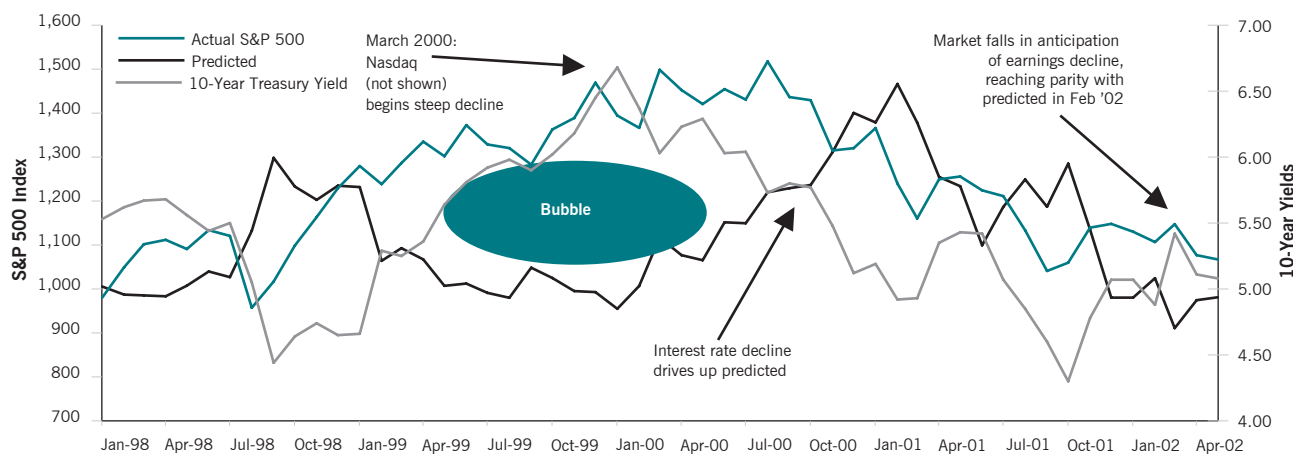
1999. As also shown in the figure, the S&P 500 Index did not begin its decline until August 2000. (Remember the model is applied using actual reported operating earnings, so predicted levels at any point are backward looking and do not reflect expectations.) However, the market began to anticipate that the NASDAQ meltdown would have a negative impact on earnings and the index followed.[29] And since S&P earnings fell by 27% from March 2000 to December 2001, the RFP Model appears to have "signaled" that earnings would fall well in advance of the actual reported drop.

The implication, then, is that the bubble was created by the combination of inflated earnings levels with rising 10-year Treasury yields that the market was somehow slow to recognize. To the extent the increases in interest rates were orchestrated by the Fed to cool an overheating economy, investors may have misread the signal and expected the increase in interest rates to be temporary. But, as the rate increases began to affect earnings, the market began a sharp repricing as the new point of view was assimilated.

How the RPF Valuation Model Explains 2008–2009 Meltdown and Recovery

The bursting housing bubble and mortgage crisis ultimately led to the meltdown that began September 2008. By August 2008, the S&P 500 had already fallen by 16% from its May 2007 peak. During this period, 10-year Treasury yields declined from around 5% to less than 4%. As illustrated in Figure 11, this led to an increase in predicted levels of the S&P 500 index.

According to the Case-Schiller Home Price Index, home prices fell more than 10% from second quarter of 2006 to the fourth quarter of 2007 and a total of 18% by the second quarter of 2008.[30] This historically large decline led to (well-founded) concerns about financial instability and the elimination of an important source of disposable income. Once again, in anticipation of a decline in earnings, the S&P 500 index fell while the RPF Model (using reported operating earnings) showed an increase in predicted levels as interest rates declined. The lines for expected and actual S&P values in Figure 11 begin to converge in August 2008, just before the worst of meltdown began in September and October. Investors were unable to absorb the seriousness of the pending crisis, so while the market fell in anticipation of an earnings decline, the expectations did not come close to reflecting the magnitude of the situation.

As can be seen in Figure 11, the flight to quality and resulting drop in Treasury rates clearly drove up the predicted levels to abnormal highs. But, as interest rates returned to a more normal level by June 2009, the predicted and actual levels returned to parity.

RPF Model implications for efficient markets?

• Over a longer period of time, the market is efficient if one allows for oscillations around true value, but is also subject to making mistakes. These mistakes can create bubbles.

• Over time the bubbles are deflated and the market returns to predicted levels as new long-term views are assimilated.

• The RPF Valuation model has shown to be useful in identifying bubbles before they pop.

This pattern supports the contention that the valuation model would have worked well during this period with a

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29. See Note 13.
30. "S&P/Case-Schiller Home Price Indices," *Standard and Poors Website*, accessed March to April 2009, http://www2.standardandpoors.com/spf/pdf/index/csnational_values_022445.xls.
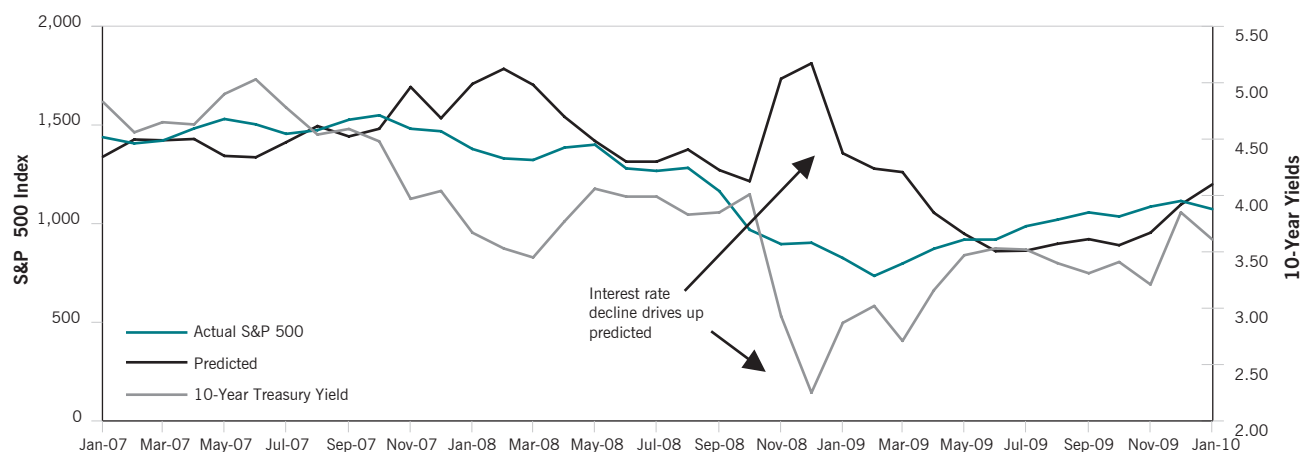
normalized interest rate. It also shows how the market led predicted levels as it incorporated expected rather than actual historical operating earnings.

In sum, analysis of these major market events with the RPF Model supports the contention that markets make mistakes in processing information. It also suggests that market prices oscillate around a true fair value price. But, as highlighted throughout this discussion of three major market events, these deviations can be very large.

2010 Outlook

As of this writing, on April 14, 2010, the S&P 500 Index closed at 1,211, as compared to a predicted level of 1,260—still 4% below the predicted level. In addition to looking at the market today, the model can help inform an opinion about the future. S&P estimates 2010 operating earnings of $75.27. If we also assume the 10-year Treasury remains unchanged at 3.83%, the S&P 500 Index would be predicted to end the year at 1,485—a gain of another 23%. But if the bond rate rises to 5%, even with the growth in earnings, the S&P's predicted value at year end is 1,107—a drop of 9% from the current level.

Conclusions

Many people view the market valuation process as a black-box driven by emotion, leaving many managers unsure what strategies they can pursue to increase shareholder value. Using two main variables, the RPF Valuation model highlights a number of important principles that can be used to inform the valuation of all companies in most (though not all) circumstances:

1. The Equity Risk Premium is not a constant, but a relatively stable Risk Premium Factor (RPF) that is applied to the risk-free rate (10-year Treasury yields).

2. The Risk Premium Factor is consistent with the loss aversion coefficient associated with the prospect theory (of Kahneman and Tversky).

3. The Risk Premium Factor Valuation Model [$P = E / (R_f \times (1+RPF) - (R_f - Int_R + G_R))$] effectively explains both P/E and S&P 500 Index levels using readily available information and simplifying assumptions.

4. Growth is a critical component of valuation, and the impact of growth on value is easily quantified using the RPF model.

5. Interest rates drive market value—and the fair value of the market (P/E Ratio) cannot be estimated without considering interest rates.

6. Interest rates have a greater impact on market price and valuation than is generally recognized, with low rates more beneficial and high rates more punishing.

7. Declining interest rates were a major factor in the long bull market from 1980 through 2007.

8. The RPF model suggests that if Treasury yields remain in the low 4%–5% range and earnings recover to 2006/07 levels, the market could stage a rally and recover to record levels, with the S&P 500 Index rising to the range of 1,300–1,700.

9. Though efficient and rational over longer time periods, the market is prone to occasional, generally short-lived oscillations and pricing errors.

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How the Risk Premium Factor Model and Loss Aversion Solve the Equity Premium Puzzle

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Abstract

The term "equity premium puzzle" was coined in 1985 by economists Rajnish Mehra and Edward C. Prescott. The equity premium puzzle in considered one of the most significant questions in finance. A number of papers have explored the fundamental questions of why the premium exists and has not been arbitraged away over time. This paper expands upon the findings implicit in the Risk Premium Valuation Model (Hassett 2010) that the equity risk premium is a function of risk free rates. Since 1960 the equity risk premium has been 1.9 – 2.48 times the risk free rate. The long term consistency of this relationship with loss aversion coefficients associated with Prospect Theory (Kahneman and Tversky, 1979) suggest it as a solution to the equity premium puzzle and support the experimental findings of Myopic Loss Aversion (Thaler, Tverseky, Kahneman and Schwartz, 1997).

Introduction

The equity premium puzzle in considered one of the most significant questions in finance. The term "equity premium puzzle" was coined by Mehera and Prescott in their 1985 paper, "The Equity Premium, A Puzzle,"[1] referring to the inability to reconcile the observed equity risk premium with financial models.

In the analysis, they use short-term treasuries as the risk free rate to calculate the real return on equities over numerous historical periods. They conclude that on average short-term treasuries have produced a real return of about 1% over the long-term, while equities have yielded 7%, implying a premium of about 6% or seven times the risk free return. Unable to reconcile a 7 x premium with financial models, they term it a puzzle.

Since then numerous papers have also attempted to explain the difference, including Shlomo Benartzi; Richard H. Thaler, "Myopic Loss Aversion and the Equity Premium Puzzle"[2] which attempts to explain it in relation of loss aversion as first described in a paper by Daniel Kahneman and Amos Tversky in 1979.[3] They state:

> "The second behavioral concept we employ is mental accounting [Kahneman and Tversky 1984; Thaler 1985]. Mental accounting refers to the implicit methods individuals use to code and evaluate financial outcomes: transactions, investments, gambles, etc. The aspect of mental accounting that plays a particularly important role in this research is the dynamic aggregation rules people follow. Because of the presence of loss aversion, these aggregation rules are not neutral."

Our mental accounting for gains and losses determines how we perceive them.

Loss Aversion

Loss aversion refers to the fact that people are more sensitive to decreases in wealth than increases. Empirical estimates find that losses are weighted about twice as strongly as gains (e.g., Tversky and Kahneman (1992)[4]; Kahneman, Knetsch, and Thaler (1991)[5], Thaler, Tversky, Kahneman, Schwartz (1997)[6]). The pain of losing $100 is roughly twice the perceived benefit of gaining $100, so on average their subjects required equal odds of winning $200 to compensate for the potential loss of $100. In other words, the average subject required a gain of twice the potential loss to take a gamble that had equal chance of loss or gain. This was in stark contrast to the belief that people, as rational beings, evaluated the expected value and would be indifferent to a chance of gaining $100 to losing $100 if the odds were 50/50; if the gain were tilted to be slightly favorable they should take the bet. In reality, losing hurts more; people on average do not find the prospect of gaining $101 along with an equal

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chance of losing $99 to be an attractive wager. In their experiments, they found that subjects required about $200 to be willing to accept the 50/50 proposition of losing $100. Kahneman won the Nobel Prize in Economics in 2002 after Tversky passed away in 1996. Of course all people do not behave this way all the time, otherwise Las Vegas would not exist!

Loss Aversion and Corporate Decision Making

Incorporating loss aversion into financial thinking is in many ways a significant departure from how finance is often taught and practiced. In business school, I was taught to rely on net present value and expected value. A project with positive net present values should be pursued and that when faced with a range of outcomes, the expected value can be calculated by assigning probabilities to each outcome. The mantra: Pursue all NPV positive projects.

My experience has been that the business world rarely works this way. Due to corporate as much as individual loss aversion, decision makers are often much more risk averse, viewing the consequence of failure much greater than the rewards for success. Investments that have only slightly positive NPV or expected value are usually not pursued. Even the more risk tolerant individuals would tend to avoid risk if the organization takes a very dim view of loss.

This is why it is so important for organizations to employ incentive structures that reward sustainable growth in value and prudent risk taking. My own experience is that organizations without such incentives tend to be very risk averse. When decisions come down the internal calculus that investing successfully results in no reward, while failure results in unemployment or at least limited advancement, investment and growth are sure to slow. I would also argue that this also explains risk taking for traders on Wall Street where outsized rewards are given for success compared to the stigmas and punishments for failure. It's not that traders have high tolerance for risk, it's that in using OPM (Other People's Money) the penalty for failure is small.

Attempts to Solve The Equity Premium Puzzle

As discussed above, Mehra and Prescott(1985) coined the phrase "Equity Premium Puzzle" because they estimated that investors would require a very high coefficient of relative risk aversion (of the order of 40 or 50) to justify the observed equity risk premium of 7%. Mehra and Prescott revisited the topic two decades later with their 2003 paper, "The Equity Premium in Retrospect" where they continued to try and solve the puzzle by comparing real returns and ask whether the equity premium is due to a premium for bearing non-diversifiable risk. They conclude the answer is no unless you assume the individual has an extreme aversion to risk; many times higher than the 2x return seen in the lab.

They approach the problem using a general equilibrium model and compared short-term real risk free rates to observed equity premium. While I am not in a position to opine on the use of these models in evaluating equity premium, for several reasons I will discuss shortly, I believe that the use of short-term real rates is mistaken. I am not surprised they could not explain the rational for investors to such a dramatic disparity, since in my opinion they are not making the right comparison. Rather than using short-term real rates, they should be using long-term nominal rates.

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What they did was a bit like measuring the speed of one moving vehicle from another moving vehicle. If Car A is moving at 60 mph and Car B is behind it at 66 mph and car C is next traveling at 61 mph, car C will see itself gaining on car A at just 1 mph. From the perspective of car C, car B is gaining on car A at a rate of 6 mph or 6 x faster than itself. This is all fine unless we care about their speed relative to a neutral observer who is not moving. Relative to the neutral observer, Car B is only going 10% faster than Car A.

Mehra and Prescott did not pick the right relative observation point. By using real returns they are measuring the difference from a moving vehicle. If we look at this from the perspective of real returns then the relative premium looks huge. But if we look at from the perspective of nominal returns, the neutral observer, then the premium it is not unreasonable. This is consistent with both the way individuals have been shown to evaluate gains and losses and with financial theory.

The mental accounting of investors focuses on the nominal returns. It's what investors track and how money managers are compensated. So it makes sense that that proper basis for evaluating the risk premium relative to the risk free rate is long-term nominal returns. For example, let's assume inflation is 2%. If an investor is considering a $1,000 investment with Treasuries at 4%, the yield is guaranteed to be $40 per year with a full return of principal. While the investor is exposed to interim fluctuations in value, the coupon and return of principal are guaranteed. Alternatively, the same investor considering an investment in the S&P 500 Index, would be evaluating the expected return relative to the nominal long-term rate rather than the real short term rate. In this case, expected equity returns of 10% would look good, yielding on average $100 per year rather than $40. If we calculate real returns by subtracting the 2% inflation, the $80 return for equities dwarfs the $20 for treasuries.

Now let's assume that expected inflation rises to 6% and the risk free rate jumps to 8%, so a new $1,000 bond would yield $80. If you applied the same 6% premium for equities, you get an expected yield of $140. Sure the real returns are the same, but doesn't the risky $140 look less attractive compared to a guaranteed $80?

Is it the right thing to track? Maybe not, but it is the reality. If investors compare their returns on equities to the nominal return of other investments, any attempt to explain the premium must compare the relative return as perceived by investors. Nominal not real returns should be used.

Long-term Treasury rates are used in determining cost of capital since they embody the market's best guess on long-term inflation. Even though this means they are not truly risk free, it is the best market estimate of expected interest rate and inflation risk; it is the right reference point. While it's true that using real equity returns accounts for the actual inflation component, it does not account for interest rate risk. In order account for expected inflation, most practitioners use long-term treasuries as the risk free rate. In doing so, they also incorporate a risk factor for interest rates.

Required return can be thought of as follows:

Nominal Equity Return = Real Equity Return + Inflation (1)

= Short-term Risk Free Rate + Inflation + Interest Rate Risk Premium + Equity Risk Premium (2)

If you subtract inflation from both sides to derive the real required return, you are still left with interest rate risk, which includes risk of unexpected inflation. So by using real equity returns and short-term risk free rate, you still have to account for the interest rate risk premium.

Real Equity Return = Short-term Risk Free Rate + Interest Rate Risk Premium + Equity Risk Premium (3)

Essentially, what Mehra and Prescott were calling the equity risk premium, was really the equity risk premium plus the interest rate risk premium.

Some believe that interest rates do not have a material impact on equity returns since inflation will result in earnings growth and since equities are priced as a multiple of earnings, as earnings grow equity prices increase with inflation. As I will discuss later, inflation has a huge impact on equity prices.

In "Myopic Loss Aversion and The Equity Premium Puzzle," Benzarti and Thaler (1995) they posit that the high degree of loss aversion is due to "myopic loss aversion" in that investors are sensitive to interim losses as equity markets fluctuate. They suggest that investors look at nominal returns since that is what is reported, therefore that's what investors look at. They find that a loss aversion factor of 2.25 to 2.78 is consistent with observed risk premiums if investors evaluate their portfolios about once a year and overall results are very sensitive to frequency of evaluation. In "The Effect of Myopia and Loss Aversion on Risk," Thaler, Tversky, Kahneman, Schwarts (1995), looked at this question through lab experiments found that subjects were more loss averse when they evaluated their returns more frequently and that they viewed guaranteed outcomes as a reference point with an evaluation period of about one year (13 months). In other words, investors evaluate their portfolios annually and expect a premium proportionate to the nominal risk free rate. As we will see below the RPF Valuation Model provides real world support for these findings.

Determining the Equity Risk Premium

In introducing the Risk Premium Valuation Model[7] (Hassett 2010), I posited that rather than being a fixed premium, the Equity Risk Premium fluctuates with the risk free rate, maintaining a constant proportionate relationship. The Equity Risk Premium equaled the Risk Free Rate times a constant factor. That factor (Risk Premium Factor) ranged from 0.9 – 1.48 between 1960 and today. So substituting into the formula where Cost of Equity = Rf + ERP,

Cost of Equity = Risk Free Rate + Risk Free Rate x Risk Premium Factor (RPF) (4)

Simplifying to:

Cost of Equity = Risk Free Rate x (1 + RPF) (5)

The RPF does not change frequently. In fact it has shifted only twice since 1960:

Period	RPF
1960 – 1980	1.24
1981 – Q2 2002	0.90
Q3 2002 – Present	1.48

Table 1: Estimated Risk Premium Factors

A Risk Premium Factor of 0.9 – 1.48, means Cost of Equity equals the Risk Free Rate times 1.9 – 2.48, very close to the findings on loss aversion factors.

The factor was determined by applying a set of simplifying assumptions to the constant growth formula:

$$P = E / (C - G) \text{ or } P/E = 1 / (C - G) \tag{6}$$

Variables and assumptions used are as follows:

$P =$ Price (Value of S&P 500)

$E =$ Actual Earnings (Annualize operating earnings for the prior four quarters as reported by S&P). Earnings, while not ideal, are used as a proxy for cash flow and seem to work very well

$G =$ Expected long term projected growth rate, which is broken down into Real Growth and Inflation, so $G = G_R + I_{LT}$

$G_R =$ Expected long-term real growth rate. Long-term expected real growth rate (G_R) is based on long-term GDP growth expectations on the basis that real earnings for a broad index of large-cap equities will grow with GDP over the long-term. A rate of 2.6% is used with the same rate applied historically.[8]

$I_{LT} =$ Expected long-term inflation, as determined by subtracting long-term expected real interest rates (Int_R) from the 10 Year Treasury, where Int_R is 2%; based on the average 10 Year TIPs Yields from March 2003 – present.[9]

$C =$ Cost of Capital is derived using Capital Asset Pricing Model, where for the broad market, $C = R_f + ERP$

$R_f =$ Risk Free Rate as measured using 10 Year Treasury yields

$ERP =$ Risk Premium Factor (RPF) x R_f

$RPF =$ 1.24 for 1960 – 1980; 0.90 for 1981 – 2001; and 1.48 for 2002 – present. The RPF for each period was arrived at using a linear regression to fit the assumptions above to actual PE. All data used in the analysis is available for download at: http://sites.google.com/a/hassett-mail.com/marketriskandvaluation/Home

Including all assumptions, the formula reduces to:

$$P = E / (R_f \times (1+RPF) - (R_f - Int_R) - 2.6\%) \tag{7}$$

$$\text{Or } P/E = 1/ (R_f \times (1+RPF) - (R_f - Int_R) - 2.6\%) \tag{8}$$

The model explains stock prices from 1960 - 2009 with R Squared around 90%[10] to actual index levels from 1960 – 2009 as shown in graph below.
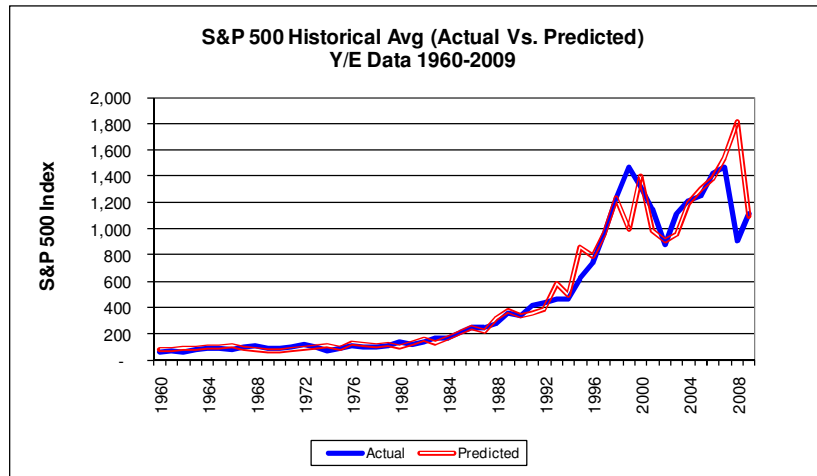
Figure 1: S&P 500 Actual vs. Predicted - 1960- 2009

The model only works if we assume that the Equity Risk Premium is conditioned on the Risk Free Rate, meaning that it gets bigger when the Treasury yields increase and smaller when they shrink. In fact one reason that I suspect many studies compared real returns, rather than nominal returns, may be the belief that inflation does not impact valuation. One common belief is that since profits will grow with inflation, inflation does not matter when discounted back. Another look at the constant growth equation can help understand this thinking:

$$P / E = 1 / (C – G), \text{ where} \qquad\qquad (9)$$

$$C = Rf + ERP \qquad\qquad (10)$$

$$G = \text{Real Growth} + \text{Expected Inflation} \qquad\qquad (11)$$

$$Rf = \text{Real Interest Rate} + \text{Expect Inflation} \qquad\qquad (12)$$

We can restate the equation for P/E as:

$$P/E = 1/ ((\text{Real Interest Rate} + \text{Expect Inflation}) – (\text{Real Growth} + \text{Expected Inflation}), \quad (13)$$
Expected Inflation is canceled out and:

$$P/E = 1/ (\text{Real Interest Rate} + \text{Real Growth}) \qquad\qquad (14)$$

Since we assume the Real Interest Rate and Real Growth are a constant over the long term, P/E is also a constant. And, this would be true if the Equity Risk Premium were a constant. But if we assume that the Equity Risk Premium moves with the Risk Free Rate, then we get the relationship charted above, which is a very good fit with historical data.

Impact of Inflation on Value
Some argue that inflation should not have an impact on equity values, since higher costs can be passed on in the form of higher prices, so on average, earnings growth should keep up with inflation. If you

assume P/E ratios should be a constant, say, 19 then with earnings of $2.00 share a company would trade at $38.00. With 5% inflation, earnings would grow to $2.10 and the share price to $39.90 – a gain of 5% which just matches inflation.

We get the same result using a constant growth model and a fixed Equity Risk Premium. Let's assume the Equity Risk Premium is 6%, the Risk Free Rate is 7%, which embodies 5% inflation, and real long term growth rate of 2.6%. Using the formula P/E = 1 / (C-G) we get, P/E = 1 / ((7%+6%) – (5%+2.6%) for a P/E of 18.5. If we lower the inflation rate to 2% the risk free rate drops to 4% and we calculate P/E = ((4%+6%)-(2%+2.6%)) = 18.5. As shown earlier, any change inflation cancels itself out.

However, if we derive the Equity Risk Premium using the RFP Model, then the Equity Risk Premium varies with inflation.   More inflation results in a higher risk premium. Using a 2% real interest rate, Table 2 below demonstrates the impact of inflation on P/E:

Inflation	R_f	ERP	Cost of Equity	G	Predicted P/E
2.0%	4.0%	5.9%	9.9%	4.6%	18.8
3.0%	5.0%	7.4%	12.4%	5.6%	14.7
4.0%	6.0%	8.9%	14.9%	6.6%	12.1
5.0%	7.0%	10.4%	17.4%	7.6%	10.2
6.0%	8.0%	11.8%	19.8%	8.6%	8.9

Table 2: Inflation Drives Valuation

Since investors expect a proportionately higher return over risk free, as inflation rises they apply a greater discount to future earnings, resulting in a lower present value, resulting in a lower multiple.

Back to Loss Aversion

We know that individuals have different tolerances for risk. If the RPF is 1.48, that implies the market as a whole has a loss aversion coefficient of 2.48. That is the average of all investors, not every individual. We would expect some to have lower coefficients and others higher. Gambling addicts destroy their own lives, knowing the odds are not better than even, implying a loss aversion coefficient of less than 1.0**.** Likewise, some people are more risk averse than average.   This is one of the factors that act to set price.

The prices for individual stocks are set at the margin. For example, Google closed today at $476 and traded about 2.5 million shares. But with 320 million shares outstanding, that is less than 1%. The price is set by the investors trading that 1%. The implication is that the owners of the remaining 99% think Google is worth more than the current $476 and some number of investors would be willing to buy Google at a lower price. Mechanically the way this works is that sellers offer to sell a number of shares at a certain price, called the Ask, and potential buyers offer to buy at a specified price, called the Bid. The Bid for Google might be 200 shares at $476.07 and the Ask 700 shares at $476.18. The difference, $0.11 in this case, is called the Bid-Ask spread. These are the current best offers to buy and sell. For

high volume stocks like Google, the Bid-Ask spread is small, just 0.02% in this case. For lower volume equities the spread will generally be higher.

If an investor places a marker order to, say, buy 500 shares, the first 200 shares will be filled at the current Bid price for 200 shares at $476.17. The remaining 300 shares will be filled by the next best ask price, which will be $476.17 or higher. It is not the consensus or average estimate of value that determines the price, but the price at which investors at the margin are willing to buy or sell at any moment. So if I don't own shares of Google and I think it's worth just $400 or even $100, I am not a factor in setting the price. But if in the moment described above, I enter a bid for 200 shares at $476.18, the order is immediately filled and, for that moment, I am the price setter.

Similarly, investors with loss-aversion coefficients at the extremes should not be expected to have much market impact. An investor with a loss aversion coefficient well above 2.5 will be risk averse and have portfolio skewed towards government bonds, while and investor with a loss aversion coefficient near 1.0 will always have a portfolio that is mostly equities. Therefore neither will have much impact on price setting. On the other hand, investors with loss aversion coefficients around 2.5 will be more likely to be shifting their portfolios between bonds and equities and have a larger impact on pricing.

Conclusion

Loss aversion is hard wired into us and drives a number of decision processes that seems to include how investors set prices in the stock market. Thaler, Tversky, Kahneman, Schwarts (1995) found evidence of what they called Myopic Loss Aversion and demonstrated the expectations of risk premiums were consistent experimental findings for loss aversion if portfolios were evaluated annually.   The Risk Premium Factor Valuation Model (Hassett 2010) provides real world evidence that the market actually behaves this way. Combing evidence that the risk premium varied with the risk free rate in a proportion consistent the findings in behavioral studies, suggests that Loss Aversion is the answer to the equity premium puzzle.

Endnotes

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[10] See Hassett (2010)