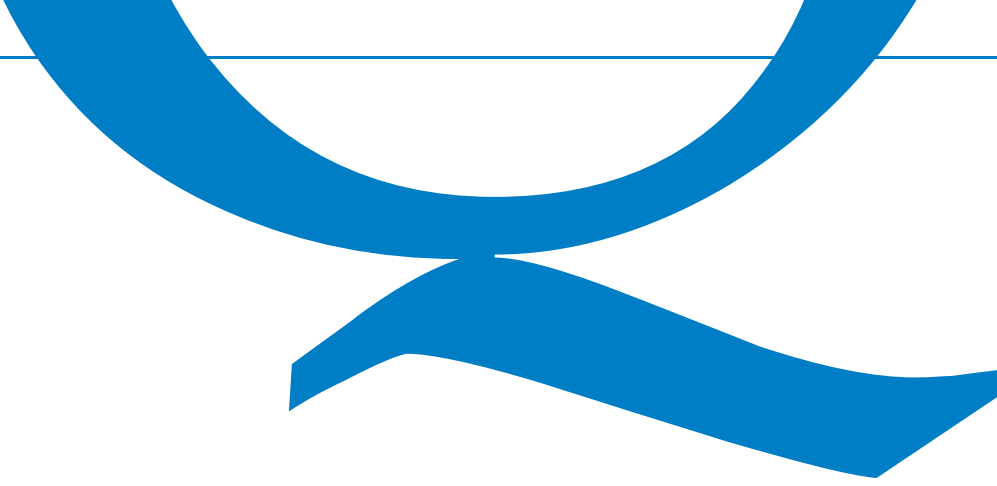
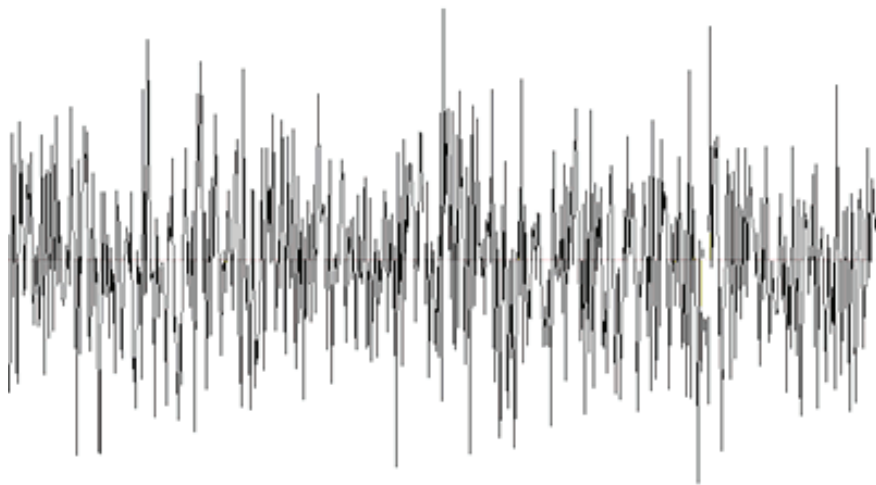




SPRING 2012 SEMINAR SUMMARY

Saddlebrook Resort, Wesley Chapel, Florida
Sunday, April 1, 2012 to Wednesday, April 4, 2012



BEHAVIOR, NOISE AND EXCESS RETURNS

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INTRODUCTION, SUMMARY AND CONCLUSIONS

The Q-Group[®] provides a number of ways for the attendees and their colleagues to access the presentations from past meetings. First there are brief overviews of the themes and insights presented during a meeting, such as the ones shown below for the Spring 2012 Q-Group[®] Seminar series. If you want more information about a particular presentation after reading these, you can read the full summaries of each presentation which are also in this report. For even more information, copies of the slides used during each presentation and the paper from which the presentation was derived, as well as the complete audio recordings for each presentation and question and answer period are available from the Q-Group website at *The Q-Group*: The Institute for Quantitative Research in Finance.

Themes and Insights Spring Meeting 2012

The ideal lab for research, The Financial Crisis, continued to influence the work of many practitioners and academics. Post crisis research attempted to understand how it happened and focused on institutional mechanisms and failures. In this seminar, there were many new ideas about why crises occur, whether they can be predicted. Presenters even look at whether this Financial Crisis was “different”.

The long established focus on systematic risk is being supplanted by systemic risk due to its importance to investors and policy makers, said Mark Kritzman, Windham Capital Management. To help us understand and predict systemic events, he creates a new measure, “the absorption ratio,” that captures an asset’s riskiness and

its connectivity to other risky assets during periods of high systemic risk. He uses it as a trigger in a productive dynamic switching market timing strategy. Another Kritzman creation, a measure of centrality, a statistical representation of an entity’s vulnerability to failure and connectivity to other risky entities, is used to create a list of systematically important stocks and industries.

The Global Financial Crisis focuses Geert Bekaert, Columbia University, on the role of contagion, correlation over and above what one would expect from economic fundamentals. He concludes that the Crisis was not the result of globalization or herd behavior, as many suspected. Rather it was a wake-up call during which investors re-focused on country characteristics and punished markets with poor fundamentals. While banking policy helped to decouple returns, he says, the world is still relatively segmented and domestic factors are critical.

Rational agents, bubbles and a financial crisis do not go together says David Laibson, Harvard University. Instead of being rational, he says that investors assume that good times (or bad times) last forever. This impacts the strength and length of bubbles. Why? Because investors fail to incorporate sufficient history into their forecasts: the shorter the period of history used to create the forecast, the more precipitous the

reversion to post shock levels. He finds that a longer period, 10 years, reduces this precipitous reversion effect. A provocative finding of his work is that rational agents should hold high equity allocations on average and follow a counter-cyclical asset allocation policy.

Terrance Odean, University of California- Berkeley, said that most studies of asset pricing bubbles have focused on non-emotional factors such as liquidity. However, bubbles could result from people's sensation seeking and financial trading could represent an important source of physiological arousal. In a simulated market where he pre-conditioned subjects with an exciting, stimulating video, he finds that a bubble develops (even when the subjects know prices are well above fair value) before prices finally crash at the end. Furthermore, a highly arousing incidental experience can produce an even larger bubble. Emotion, the factor studied by behavioral economists, appears to play a very large role in bubbles. Rational agents, if they even exist, seem to deviate from rationality.

Jiang Wang, MIT, concludes that if the Financial Crisis taught us anything, it is that liquidity is essential for markets. During normal times, an abundance of arbitrage capital forces prices close to fundamentals, smoothing out variations around the yield curve. During times of crisis, a shortage of arbitrage capital allows prices to deviate from fundamentals. Thus, limited arbitrage capital allows more noise in yields. He creates a measure

of that noise and concludes that the sharp rise of the noise measure occurs during crises of different origins. This suggests that the noise measure may capture market-wide liquidity risk before it occurs.

One hallmark of the Q-Group seminars is addressing difficult and complex problems that impact investing, investors and public policy. In this seminar, defined benefit pension plans and one particularly large DB plan, Social Security, were the focal point.

Barton Waring, **Barclays** Global Investors (retired), goes straight at the problem of funding defined benefit pension plans and the role of the discount rate. He calls actuaries good hearted but misguided. Waring says that a shift away from the risk-free rate to a return on the liability-matching asset portfolio as a discount rate makes the problem more tractable. The issue is that investors do not get the expected return just because they are long term investors, although the assumed actuarial discount rate depends on it. This results in the pension plan assets being worth 42% of what was expected. He says that a compound average return of 16% per year for the next 12 years will be necessary to make up this shortfall. Waring states, "No wonder there is a pension crisis."

As for Social Security, Stephen Zeldes, Columbia University, notes that after a quiet period, the long standing issues that confront it are front and center to the public policy discussion again. He means

to answer the big questions about the system's health, its present value short fall, the tax increase needed to restore the Social Security balance, and whether it would save money to index Social Security to prices instead of wages. He lays much of the blame for problems at the door of the discount rate used to estimate the actuarial value. Thus he proposes a new approach that shows a modest to significant reduction in the shortfall. Zeldes urges a change to a market value model and a market value discount rate.

One constant question that concerns investors is how to make money. Two presentations address this.

Lisa Goldberg, MSCI, developed a risk-parity strategy based on the lower-beta-higher-return/higher-beta-lower-return anomaly to test whether the anomaly is leverage based. She develops a strategy and tests it against unlevered risk parity and fixed-asset-mix strategies. Without taking into account costs (including realistic borrowing rates) levered risk parity outperforms the others from 1926-2010 and most sub periods. However, when realistic costs are assessed, it is

the fixed asset mix of 60% stocks and 40% bonds that is superior.

Stephen Figlewski, New York University, examines the risk neutral probability distribution (RND). Market prices for risky assets depend on the market's assessment of the probability distribution (P) for its future payoff risk aversion (Q). Neither Q nor P can be observed directly. Together they create the RND. Since it measures how options are being priced, this should be of tremendous concern to investment managers who use delta-hedging to manage risk. In search of some ways to deal with the too simple BS problems, Figlewski's unfinished research poses more questions than he answers: what return and volatility-related factors are most important to investors in forming the forecasts of the empirical probability density that are embedded in the RND; is the market primarily forward-looking or backward-looking in gauging volatility; what are the relevant time horizons on which the market focuses; what factors influence the process of risk neutralization; do the answers to these questions differ for long-maturity vs. short-maturity options and do they do so over different time periods? Stay tuned for updates.

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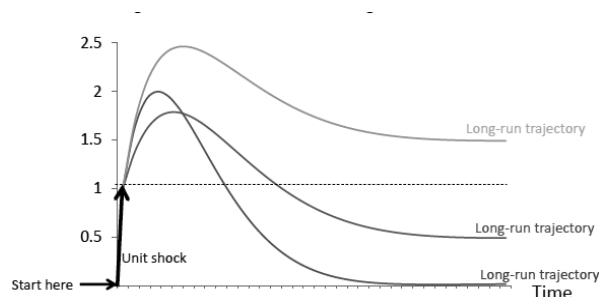
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1. Natural Expectations, Economic Fluctuations, and Asset Pricing

David Laibson, Robert I. Goldman Professor of Economics, Harvard University and NBER, made the first presentation of the Spring 2012 Q-Group Meetings, “Natural Expectations and Macroeconomic Fluctuations” coauthored with Andreas Fuster, Federal Reserve Bank of New York, and Brock Mendel, Ph.D. candidate in Economics, Harvard University.

Laibson starts by reminding us that in recent decades, research in economics and finance has largely focused on the rational actor model: economic agents process all available information perfectly. Because this model rules out unjustified optimism or pessimism as an amplifying force for aggregate fluctuations, it struggles to explain some of the most prominent events including large swings in asset prices and credit and investment cycles that contribute to the length and severity of economic contractions.

He starts with two assumptions. First, he assumes that the fundamentals such as earnings momentum in the short-run and earnings mean reversion in the long-run follow a humped shape dynamic. The process starts with a pulse of news that inflates the market (he calls this a unit shock) followed by a reversal in 2-3 weeks before reaching a steady state. Laibson shows the trajectory of earnings from three different unit shocks in the chart below.



His second assumption is that agents estimate simple models that are tractable and parsimonious, the typical models used in economics literature. He goes on to discuss the reasons for parsimony.

1. Economic: A tradeoff between model flexibility and over fitting when there are numerous potential parameters.
2. Psychological reasons that limit the number of parameters:
 - a. Myopia
 - b. Regency bias
 - c. Complexity aversion
 - d. Preference for tractability

Anchoring and representatives also lead agents to underestimate the mean reversion.

The parsimony, however, comes with consequences:

1. Agents recognize the short-term momentum but miss some of the long-run mean reversion.
2. Asset returns are excessively volatile and exhibit overreaction.
3. Real economic activity has amplified cycles.
4. The equity premium is large even though long-run equity returns co-vary weakly with long-run consumption growth. This premium, he notes, nearly vanishes if agents have rational expectations.
5. Rational agents should hold high equity allocations on average and follow counter-cyclical asset allocation policy.

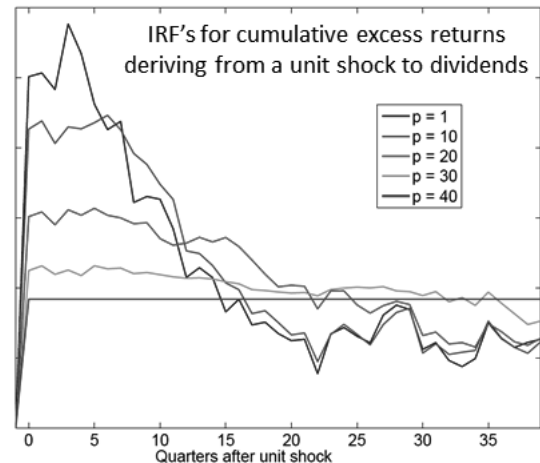
Laibson suggests that relaxing the assumption of perfect rationality is a potential way of explaining aggregate volatility. Unfortunately, economists lack a consensus on how to do this.

He uses a quasi-rational model which falls between the rational expectations and intuitive (naïve) expectations models. He calls this a natural expectations model. Laibson finds that this model is sophisticated enough to capture the short-run momentum, but fails to fully reflect the more subtle long-run mean reversion. Hence, when the true dynamics are hump-shaped, natural expectations overstate the long-run persistence of economic shocks. Clearly, agents with natural expectations turn out to form beliefs that assume that good times (or bad times) last forever.

One thing is clear to Laibson: investors primarily rely on recent data in setting expectations. Thus, they over emphasize the period of the recent unit shock and neglect longer term historic data, data from well before the time of the shock. In doing so, investors fail to incorporate the past lower mean into their forecasts. The chart below shows the impulse response functions (IRFs) for cumulative excess returns caused by a unit shock to dividends: the shock quickly drives up the cumulative returns and is followed by post-shock decline. Most important to this analysis is the historic period incorporated into the forecast. Laibson incorporates historic data of from 1 to 40 months and finds that the shorter the period of incorporated history, the more the shock impacts dividends and the more precipitous the reversion post shock levels. The model that results in the lowest shock and subsequent reversal is based on 40 months of data. Clearly an emphasis on recent history can exacerbate shocks.

For Laibson, history makes a difference and the longer the history, at least up to 10 years,

the better. The precise amount of history may vary from market-to-market around the world, he says, but the effect exists in all markets.



Using this insight Laibson creates a model that combines natural expectations with a simple dynamic macroeconomic model. He finds this the model's predictions match many observed patterns: high volatility of asset prices; predictable up-and-down cycles in equity returns; and a negative relationship between current consumption growth and future equity returns. He tests the model using annual real per-capita consumption data, excess returns and P/Es from 1929-2010 and finds a number of interesting things:

1. Low order forecasting equations miss some of the mean reversion in fundamentals, thus resulting asset prices that exhibit excess volatility and long-run mean reversion.
2. There are cycles in consumption and investment.
3. The covariance of returns and consumption growth first rises and then falls.

There are important consequences that Laibson notes:

1. Since agents do not recognize the mean reversion, equity is perceived as many times riskier than it actually is. In fact, equities are about 9 times less risky than they are perceived to be.
2. Rational investors should hold far more equity than typical investors.
3. Rational investors should follow a countercyclical investment strategy.

Since high earnings should be a bearish indicator, in the future Laibson wants to use what he has learned to build a new predictor for bear markets.

2. The Market Value of Social Security

Stephen P. Zeldes, Benjamin M. Rosen Professor of Economics and Finance, Graduate School of Business, Columbia University and NBER presented, "The Market Value of Social Security" coauthored with John Geanakoplos, James Tobin Professor of Economics, Yale University.

Social Security is on the national agenda again and yet, Zeldes says, we continue to face the same questions:

1. How healthy is the U.S. Social Security system?
2. What is the present value shortfall?
3. How large an increase in taxes would it take to restore Social Security balance?
4. Would it save money to index Social Security to prices instead of wages?

The answers to all of those questions, he says, depend on the choice of discount rate for Social Security's revenues and benefits.

Typically, to calculate the actuarial value, in spite of the riskiness of the Social Security cash flows, a Treasury bond yield is used as a discount rate. Zeldes advocates a change from actuarial value to market value that is calculated using a risk-adjusted discount rate. He says that the market value provides a more accurate assessment of the projected revenue-benefit shortfall than does the actuarial value.

While advocating market value, Zeldes cautions that estimating the risk-adjusted discount rate in this or any other pension related application has its challenges:

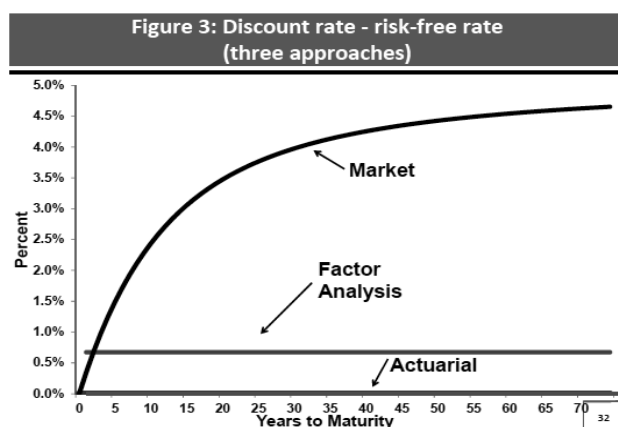
1. Risk-adjusting discount rates for wage-linked cash flows is more complicated than it is for stocks and bonds.
2. Imputing the right discount rates requires estimating:
 - a. How much uncertainty there is about the path of future wages and how that uncertainty varies with horizon.
 - b. How correlated wages are with the factors that determine asset prices (e.g. aggregate stock market and consumption) and how that correlation varies with horizon.

He says there are two possible models he can use to understand the process: the standard general equilibrium macroeconomic model or a reduced-form that links wages and stock prices. The standard model implies a strong contemporaneous correlation between wage growth and stock returns. This, Zeldes says, is counter to empirical evidence. To break this link, he adds a "news shock" in each period during which

agents get “news” about future productivity growth. Thus Zeldes’ model incorporates asset prices that react today to news about future wages, wages that change only when the future is realized. As a result his model has:

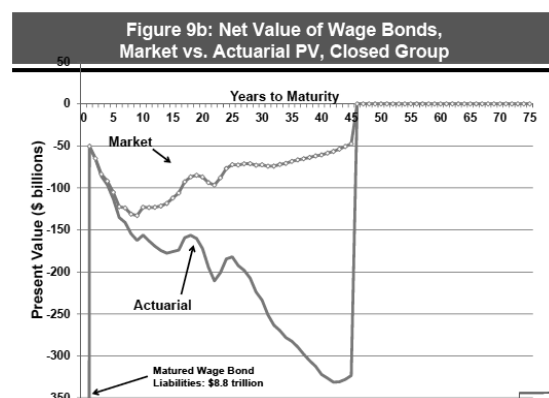
1. Low contemporaneous correlation between stock returns and wage growth.
2. Positive correlation between stock returns and future growth in wages.
3. Returns on “wage bond” (a security with payoffs tied to the future economy-wide-average wage at various horizons that is not equal to wage growth).
4. A correlation between “wage-bond” returns and consumption growth that increases with the horizon.

In this model the risk premium is always positive and the term structure of discount rates is upward sloping; the risk premium built into discount rates increases with the horizon and is more like a bond rate over short horizons and a stock return over longer horizons. Using three approaches (market, actuarial, and a one created using a factor analysis model), Zeldes estimates the discount rate over the long term. This results in three quite different discount rate estimates over time that can be seen below: Discount rate – risk-free rate (three approaches).



Using the new market discount rate paradigm, Zeldes solves for the prices and expected returns of various financial assets, including the wage bond. In addition, Zeldes says, he examines a reduced-form model with a link between wages and stock prices that generates the same term structure of risk premia as that for wage bonds. After calibrating these models, he computes the set of implied risk-adjusted discount rates.

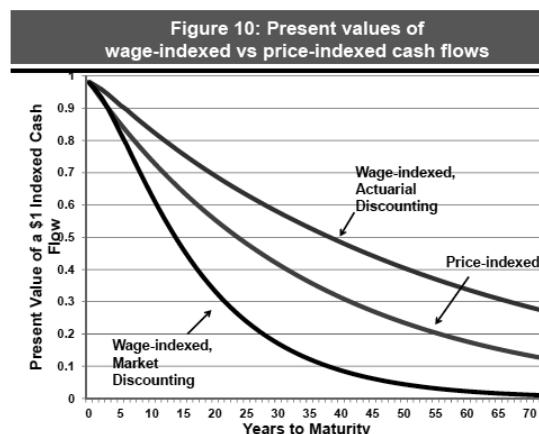
Once done, he uses these discount rates to re-compute the common measures of Social Security’s funding status [present value of future (outflows minus inflows) minus the value of the trust fund] depending upon whether future participants, future contributions and benefits are included. The actuarial shortfall ranges from \$18.3 to \$5.3 trillion. Using the market value approach, the risk-adjusted shortfall in Social Security is 18 - 68% less than indicated by the official statistics. The following chart shows the outcome for the market and actuarial present values for what Zeldes calls the closed group (the group that includes future contributions and benefits, but only for current participants).



Zeldes assesses the three policy changes that have been proposed to bring the Social Security system back into balance. His analysis includes many provocative,

colorful and useful charts that show the current situation and the possible changes outlined below:

1. Increasing payroll taxes, decreasing benefits, and indexing benefits to prices rather than wages. His assessment is that even though adjusting for risk reduces the present value shortfall, it actually would further increase the tax rate necessary to bring the system back into balance.
2. Decreasing benefits. He concludes that the risk adjustment would have an ambiguous effect on the magnitude of benefit cuts.
3. Indexing benefits to prices rather than wages. Linking benefits to prices instead of wages would increase the cost of Social Security benefits and thus increase the shortfall. The chart that follows shows the differences.



Zeldes summarizes the results of creating his simple model-based recipe for performing risk adjustment:

1. Large risk adjustments have very small short-run correlations between wage growth and stock returns.
2. Most imbalance measures are significantly smaller under the market value approach.
3. The cost gap between wage indexing and price indexing shrinks when using the risk adjustment: under some parameterizations wage indexing

becomes less expensive than price indexing.

As next steps Zeldes plans to:

1. Do additional research to enhance and calibrate macroeconomic models of wage risk.
2. Allow for an inflation risk premium.
3. Make empirical estimates of short-run and long-run wage risk and its correlation with stock prices.
4. Estimate magnitudes of policy changes necessary to restore balance to the system (tax increases, benefit cuts).

Encourage governments to adopt market-value approaches to measurement and policy evaluation.

3. Global Crises and Equity Market Contagion

Geert Bekaert, Leon G. Cooperman Professor of Finance and Economics, Columbia Business School and (NBER) presented, “Global Crises and Equity Market Contagion,” he coauthored with the following from the European Central Bank: Michael Ehrmann, Senior Adviser, Directorate General; Marcel Fratzscher, Head, International Policy Analysis Division; Arnaud Mehl, Principal Economist, Directorate General International.

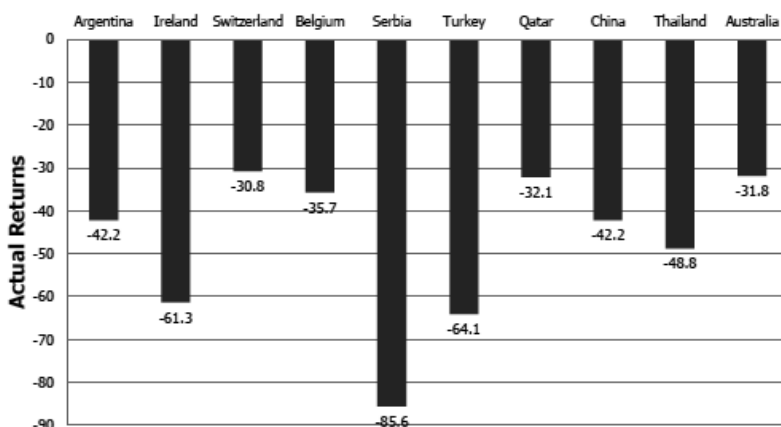
Bekaert begins with the following all too familiar story:

1. Return correlations increase in bad times.
2. Bad shocks easily transmit across countries.
3. Such shock spillovers result in excessive comovements between asset classes and countries such as

the “Tequila Crisis” (1994-95), “Asian Flu” (1998), and “Russian Virus” (1998). This often is called contagion.

While we may all agree that such a thing as contagion exists, Bekaert points out that there is no consensus on exactly what constitutes contagion or how it should be measured. In this presentation he revisits the debate on the presence, types and sources of contagion in what he calls an ideal lab: the Global Financial Crisis of 2007-09. Using the chart below, Bekaert reminds us of the depth of the Financial Crisis worldwide from 2007-09.

Global Crisis August 7, 2007 – March 15, 2009



He characterizes 3 popular hypotheses regarding contagion channels as:

1. Globalization/interdependence: economies integrated with U.S./global economies were hit hardest.
2. A wake up call: the crisis initially provided new (fundamental) information to investors which led to a generalized crisis.
3. Herd behavior: a contagion without discrimination that was unrelated to fundamentals.

To examine the three hypotheses, Bekaert first defines contagion as excess correlation: correlation over and above what one would expect from economic fundamentals. Using data from 2007-2009 he analyzes the

transmission of crises to country-industry using 55 country-specific equity portfolios. His model is an asset pricing framework with global and local factors designed to predict crisis returns by using explained increases in factor loadings as indicative of contagion.

$$r_i = \beta_i r_w + \varepsilon_i \quad \text{Then: } \rho_{i,w} = \beta_{i,w} \frac{\sigma_w}{\sigma_i}$$

↑ global risk
 ↑ country-specific risk

Since this single factor world (w) model does not explain comovements, he creates three factor adaptations using the following orthogonalized factors:

1. U.S. factor (R_t^U)
2. Global financial factor (R_t^G)
3. Domestic factor (R_t^D)

The domestic factor excludes the portfolio return under investigation.

His data is comprised of stock prices from 1995 to 2009 for 2000 firms, 55 countries, and 10 sectors from which he creates 415 value-weighted U.S. dollar portfolios. The crisis is identified as starting on either August 7, 2007 or September 15, 2008. Using this data he finds systematic and substantial contagion from domestic equity markets to individual domestic equity portfolios, the severity of which is inversely related to the quality of countries' economic fundamentals and policies. In addition, he reports that U.S. and global contagion were limited and domestic contagion was stronger. This is shown in the chart on the next page.

	Benchmark	
	coef	st. err.
Contagion		
γ_1^G	0.056 ***	0.013
γ_1^U	0.133 ***	0.015
γ_1^D	0.249 ***	0.016
Interdependence		
β_1^G	0.368 ***	0.012
β_1^U	0.397 ***	0.016
β_1^D	0.491 ***	0.014
Other		
η_1	-0.038	0.025

Finally, he finds that there was no contagion evident during other recent crises. The Financial Crisis during 2007-09, he says, stands alone.

The results were not related to globalization or herd behavior. Instead, Bekaert concluded that this Financial Crisis was a kind of “wake-up call” with markets and investors focusing substantially more on idiosyncratic, country-specific characteristics during the crisis. This segmented-world finding, he says, was unexpected since the sample was made up of the largest capitalization stocks in each market: stocks of companies that he would have expected to be global players. Looking at a number of different sectors he finds that the culprit in the crisis was the financial sector. He provides the chart below that shows three of his sectors.

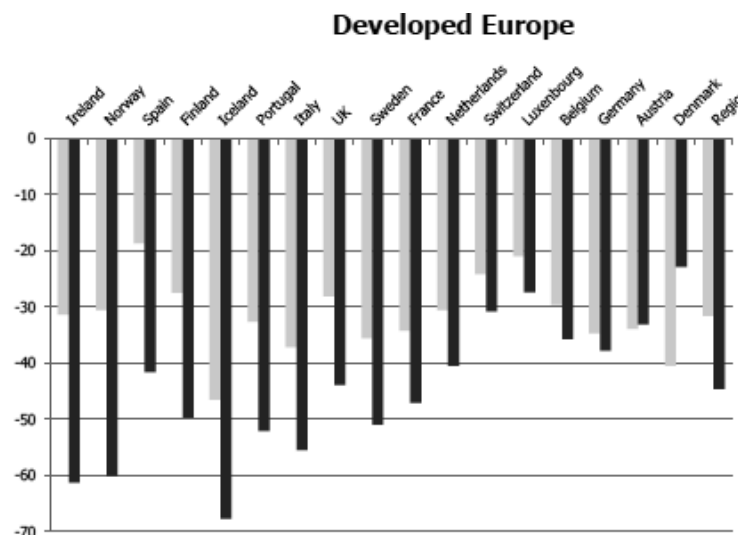
		Sector		
		Communications	Utilities	Financial
Contagion	γ^G	0.015	0.068	0.203***
	γ^U	-0.037	0.179***	0.106***
	γ^D	0.096	0.310***	0.194***
Interdependence	β^G	0.305***	0.286***	0.495***
	β^U	0.455***	0.236***	0.441***
	β^D	0.539***	0.394***	0.439***
Other	η	0.036	0.172***	-0.217***

Relatively unaffected

? defensive

Culprit sector

Bekaert points out that this was not an indiscriminate spread of the crisis but a “wake-up call” during which investors re-focused on country characteristics and punished markets with poor fundamentals. The chart below shows their predicted and actual returns for Europe.



Ironically, Bekaert concludes that domestic factors regained importance in determining equity market performance in the most global crisis of recent times. Furthermore, he concludes that it was banking policy (e.g. deposit and debt guarantees and capital injections) that helped decouple returns during the contagion. The world, he says, is still relatively segmented and domestic factors are critical.

4. Pension Funding and Investment Strategy Issues from Market Value Accounting

M. Barton Waring, Global Chief Investment Officer for Investment Strategy and Policy at Barclays Global Investors (retired) presented “Insights

About DB Pension Plans From Market Value Accounting.”

This presentation captures the spirit of some key portions of Waring’s recently published book, *Pension Finance: Putting the Risks and Costs of Defined Benefit Plans Back Under Your Control*. Waring says the book provides a “clean-sheet-of-paper” approach to pension accounting and actuarial science using market value accounting principles and discusses its implications (for contribution and expense risk, for affordable benefit levels, and for investment strategy and policy).

Waring says that in a good-hearted, but perhaps misguided effort to make good retirement benefits widely available, actuarial science failed to control risks and costs of defined benefit (DB) plans. This effort supported higher benefits than can be paid for with planned funding levels and biased contributions downward, thus back-loading obligations. To make the DB issues more difficult, a plethora of sufficiently complex actuarial methods forestall debate and convey no real information. Despite the complexity, Waring says that “if you manage the economics, the actuarial and accounting versions will follow.”

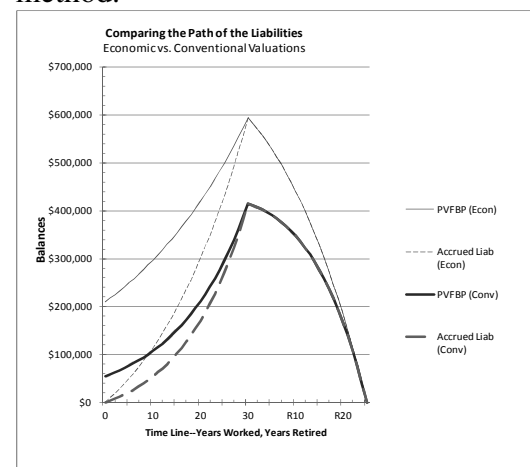
The central question is “What is the right discount rate?” While actuaries prefer the expected return on the pension asset portfolio, economists argue that the expected return on the liability-matching asset portfolio is the correct rate. To date, Waring notes, this argument has only been about measuring the liabilities rather than contributions, the subject upon which he focuses.

Of economic interest are three liabilities:

1. Full Economic Liability: Present value of benefits for all past, current, and future employees (less termination option on future accruals).

2. Present Value of Future Benefit Payments: For all past and current employees (less termination option), the payment schedule drives expenses and contributions.
3. Benefit Security Liability: The accrued liability representing the promised payments due and owed based on some choice of normal cost method. About this, he says he will have more to say later.

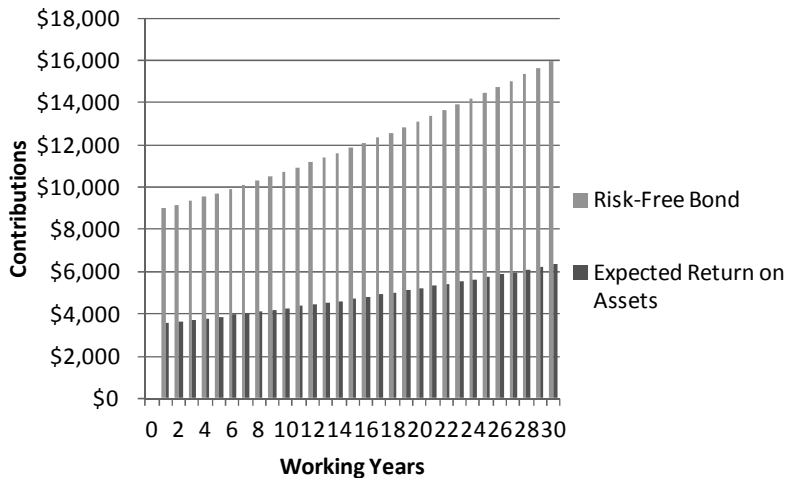
Warning then provides the following graph to show the results of using each method.



No matter what method is used, the benefit payments are the same and since the investment policy is constant, the returns will be constant. The fact is that the higher discount rate is just a cover for reducing the normal cost and contribution payments, he asserts. This leads him to ask the question “Why discount at the expected return on assets?” He says that the answer is that there are huge savings to the DB sponsor (or at least they appear to be huge) and the higher discount rate is just a cover for reducing the normal contribution payments.

A critical issue in the pension debate is the rate used to discount liabilities. Typically

the expected return on assets is used. As you can see from the chart below, the lower the rate the smaller the contribution and the larger the savings for the DB sponsor.

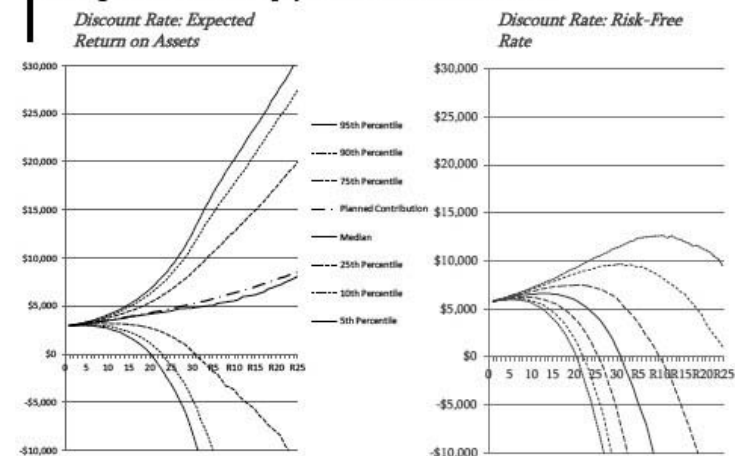


Warning says the problem is that investors do not get the expected return just because they are long term investors, while the assumed actuarial discount rate depends on it. He reminds us of the facts: the S&P 500 has only delivered a 0.55% per year compound average return for the years from 2000 to 2011. At the same time, the dollar grew to only \$1.07, less than 1%, far less than the result when using the actuarially expected 8% return assumption. A dollar would have grown to \$2.52. Thus the resulting assets in the pension plan are only worth 42% of what was expected. Waring says, “No wonder there is a pension crisis.” It will take a compound average return of 16% per year for the next 12 years to make up this shortfall and, in spite of many bad returns being offset with good returns, there is a 50% probability that the ending portfolio expected could vary from what is projected by a substantial amount.

Showing the outcome for the single employee example, holding benefit payments and investment returns constant, and discounting by the expected return on assets, results in

larger than planned contributions more than half the time (the leftmost chart). In contrast, the chart to the right shows that contributions seldom badly disappoint when the risk-free rate is used.

Surprises nearly disappear with risk-free rate Holding constant benefit payments, investment returns



Given the possible shortfalls in contributions that could occur, it is important to ask: When contributions are overdue, who will pay?

1. Contribution rules, with their long term amortizations and wide corridors, are not remotely likely to make up any resulting accrued liability deficits.
2. In a bankrupt plan, participants will ultimately bear the loss, recovering only a portion of each benefit dollar.

After being told for years that their benefits are secure, participants, Waring warns, should understand that good intentions and blind faith in the expected return assumption will not adequately fund a pension plan.

Waring points out that discounting with the expected return on assets is not cheaper but a way to set-up a slow motion bankruptcy. No one else in finance and banking, he says, uses the expected return on debtor assets to discount that debtor's future cash flow obligations except the government. “No One Else” and “No

Where Else” he says. “Why then”, asks Waring, “are pension actuaries, the GASB, and others supporting this harmful practice?”

5. Hurricane Outlook for the 21st Century

Hugh E. Willoughby, Research Professor, Department of Earth Sciences, Florida International University was the Monday evening dinner speaker. His topic was “Hurricane Outlook for the 21st Century.”

Willoughby defines hurricanes as a substantive concern due to their financial and human impact and says all we have to do to understand this is remember the effects of Hurricane Katrina in August 2005.

Hurricanes are heat engines that Willoughby compares to steam engines on a ship. The difference in energy (heat content) resulting from the warm temperatures at sea level and much colder temperatures at the top of the hurricane creates a crucial temperature differential within the storm. In the Atlantic, he points out, there is enough energy to make a Category 5 hurricane anytime during August and September, but sheer is a moderating influence. Sheer describes a change in wind speed or direction and in hurricanes is primarily vertical from the bottom to the top of the hurricane. It is the dominant limiting factor in the intensity of a hurricane.

Damage from hurricanes can be personally devastating (total economic damage is two times the insured damage) and this impacts many with homes and possessions on the East Coast of the U.S. He does note that is no visible upward trend in U.S. damage when the data is corrected for such things as increased populations and possessions in the U.S. coastal areas. However, tail forecasts from the distribution allow for \$16 billion in damages

per year with the possibility of up to \$1trillion per year. Furthermore, he points out, on a warmer globe it will be much easier for devastating hurricanes to develop.

This leads Willoughby to ask: How much of the apparent increase in hurricanes is due to incomplete observations from the past and how much is due to climate change? He says that over the last 1500 years the world has gone through an anthropogenic, human induced, change -- a neutral cycle. However, numerical models of this period have common problems in spite of the fact that they are the best guide we have. In looking at the data using many of the statistical tools with which those at Q are familiar, he is led to conclude that human induced, Anthropogenic Global Warming (APG), is not “a matter of belief but rather a persuasive argument.” Willoughby provides facts about the changes that have and are happening due to climate change (e.g. the world is now 40% warmer than during Thomas Jefferson’s time).

Willoughby turns to the numerical models used in hurricane analysis and prediction. He concludes that even as the number of hurricanes is likely to decline, the strongest hurricanes in the future will be stronger and have more and heavier rain than those in the past due to their increased water vapor content. The decline in number comes from increasing sheer and thermodynamics that will limit their size and intensity. According to Willoughby, there is yet another disturbing possibility. Models predict that the most destructive Atlantic hurricanes will form over the Cape Verde Islands. This means that the center of hurricane action will move over the Central Atlantic resulting in apparent bad news for New England

He ends his discussion with a warning: these changes will challenge humanity, especially farmers, as the threat to agriculture increases. APG “is not a conjecture but is a matter of evidence” and concludes that ignoring it may result in a “civil judgment but not jail time.”

6. What is Risk Neutral Volatility?

Stephen Figlewski, Professor of Finance, New York University Stern School of Business, presented “What is Risk Neutral Volatility?” This research was supported by a grant from the Q-Group.

Figlewski starts by saying that the market prices for risky assets depend on the market's assessment of the probability distribution (P) for its future payoff together with the market's risk aversion (Q). Neither Q nor P can be observed directly:

1. The form of the distribution itself is unknown, although extensive research suggests it has fatter tails and its shape changes over time.
2. The factors that go into the risk-adjustment process are unknown.
3. The risk premia for unspanned, unhedgeable factors are often treated simply as unknown constants to be estimated.
4. P and Q, when combined into the Risk Neutral Probability Density (RND), can be extracted from market prices for options.

Figlewski asks, “Should We Care?” about the RND. The answer is that indeed we should because RND measures how options are being priced. The Black Scholes (BS) model uses the principle of delta-hedging to price options. It is delta-hedging that market makers use to manage their risk. He reminds us that the BS model assumes a constant volatility log

normal diffusion, an approach that he says is too simple. It does not consider such things as tail behavior that may, and should, be critical for investors and market makers. Moreover, it is important to understand the multiple risk premia embedded in option prices since they are significant components of return.

Figlewski says there are two major problems in constructing a complete RND from a set of market option prices:

1. How to smooth and interpolate option prices to limit pricing noise and produce a smooth density.
2. How to extend the distribution to the tails beyond the range of traded strike prices.

He notes that unlike implied volatility, the RND is model free, and that is a big advantage. He develops the Breeden-Litzenberger technology to extract RNDs from daily S&P 500 index option prices and computes the standard deviations. He then explores whether, and by how much, the risk neutral volatility is influenced by a broad set of exogenous factors which are expected to be related to its empirical density and to the risk neutralization process. He notes that his main objective is not to build a formal model of option risk premia, but to establish a set of stylized facts with which any model must be consistent. There are, he notes, several broad questions to be addressed:

1. What return and volatility-related factors are most important to investors in forming the forecasts of the empirical probability density that are embedded in the RND?
2. Is the market primarily forward-looking or backward-looking in gauging volatility?
3. What are the relevant time horizons on which it focuses?

4. What factors influence the process of risk neutralization?
5. Do the answers to these questions differ for long-maturity vs. short-maturity options and do they do so over different time periods?

Figlewski points out that extracting the RND from options prices in practice is nontrivial and describes his process in detail. His explanatory variables are divided into three classes:

1. Volatility-related variables that do not require looking back over past data.
2. Volatility-related variables computed from past data over a horizon that must be specified.
3. Variables related to risk attitudes that may influence risk neutralization.

After describing the outcomes of his analysis in detail, he provides the following observations regarding key questions.

1. What return and volatility-related factors are most important to investors forming forecasts of the empirical probability density that are embedded in the RND? He says that simple correlations indicating the strength of the direct univariate relationships between explanatory variables and both RND and realized volatility were largely of the expected sign.
2. Is the market primarily forward-looking or backward-looking? What are the relevant time horizons on which it focuses?
 - a. Backward looking: The past trading range and some tail-related variables were statistically significant but not easy to interpret.
 - b. Forward looking:
 - i. One model, GARCH, had the best predictive

power over all horizons. RND volatility alone or combined with historical volatility was highly significant, but contributed nothing when combined with GARCH.

- ii. All three volatility measures appear to have the greatest marginal explanatory power for future volatility over the next 5 to 10 trading days, though only GARCH is significant.
- iii. The coefficient on historical volatility was uniformly negative and insignificant.
3. What factors go into the neutralization? Here Figlewski reports mixed results, however, yesterday's RND volatility minus that of the GARCH model as extremely powerful in the RND volatility equations.
4. What risk factors go into the neutralization? He includes such things as the:
 - a. Previous day volatility risk premium as measured by yesterday's RND volatility minus that of the GARCH model.
 - b. Strength in the Michigan Consumer Sentiment variable.
 - c. High P/E ratio for the stock market. The past error from a GARCH model is both in

- absolute value and to a lesser extent as a signed variable.
- d. Large past errors of either sign.
- e. Yield spread in the bond market.
- f. Day t trading range.
- g. S&P P/E ratio.
- h. Day t-1 RND volatility risk premium.

At the end of his presentation, Figlewski asked the participants for ideas on how to continue to develop the ideas from his ongoing research. There was a lively conversation. Those who did not hear the presentation will have to wait until the paper is completed to read it in its entirety.

7. Bubbling With Excitement: An Experiment

Terrance Odean, Rudd Family Foundation Professor of Finance, Haas School of Business, University of California, Berkeley presented, "Bubbling with Excitement: An Experiment," coauthored with his Haas School of Business, University of California, Berkeley colleagues: Eduardo B. Andrade, Associate Professor of Marketing, and Shengle Lin, Searle Foundation Fellow.

Odean starts with a little history lesson pointing out that behavioral research in economics began about 20 years ago after years of researching how people should act as a rational agent, as opposed to how people make decisions. He says that we have known for a long time that there are periods when the markets do not reflect rationality from "Tulip mania" of 1637, to the "Irrational Exuberance" of the late 1990s. These popular accounts of investment bubbles emphasize the role of emotions and the role of excitement as an accelerant. During these non-rational periods, aroused emotional states distort better

judgment and inflate an asset bubble until it ends in panic selling.

Experimental studies of asset pricing bubbles have focused on non-emotional factors such as liquidity, experience, transparency, novelty of the environment and speculation. Investors, however, can and do act on emotion and there are several theories about how that occurs (preferences; beliefs; overconfidence; limited attention; emotions). Bubbles themselves could result from people's undifferentiated sensation seeking and financial trading could represent an important source of physiological arousal. As such, any highly arousing incidental experience could produce a larger bubble relative to a non-arousing experience. Odean notes that he believes that pleasantness associated with the arousing experience (excitement) is critical for investors to inflate the bubble.

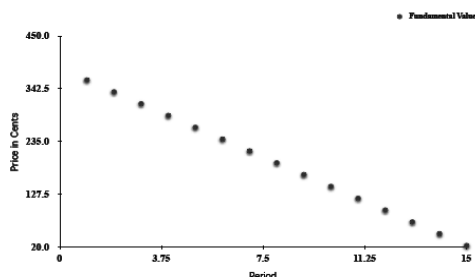
The positive affect is transmitted through changes in information processing that impacts preferences and influences beliefs and/or increases risk taking. A negative affect can decrease risk-taking. Odean and his colleagues create an experimental financial market designed to study the role of emotions in asset-pricing bubbles. In previous research by others this method has been used.

Odean creates an experimental market designed to manipulate participants' emotional states by showing one of a number of short videos at the beginning of each trading session. The videos are chosen to arouse excitement or fear and sadness. As a control, one of the videos provides a neutral, unemotional treatment. Creating a predisposition before the experiment is a commonly used procedure

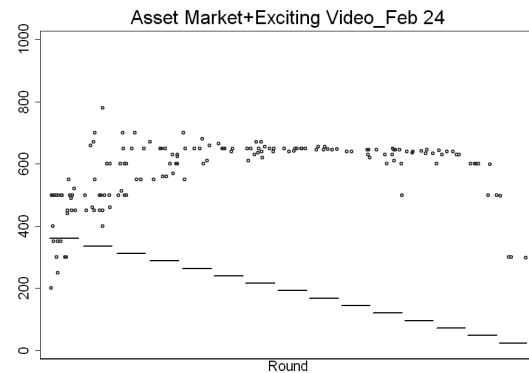
that is known to impact financial and economic decision-making.

Each of Odean's experimental markets is conducted over 15 periods . The subjects begin with several pieces of information: the starting position (a combination of cash and/or stocks) and potential dividend payments (the magnitude of which is uncertain and later revealed). The price and dividend pattern is designed to create the fundamental-value price pattern like that shown below. The subject sees this chart at each of the 15 rounds of buying and selling. Thus the fundamental value is not in question at any time during the trading.

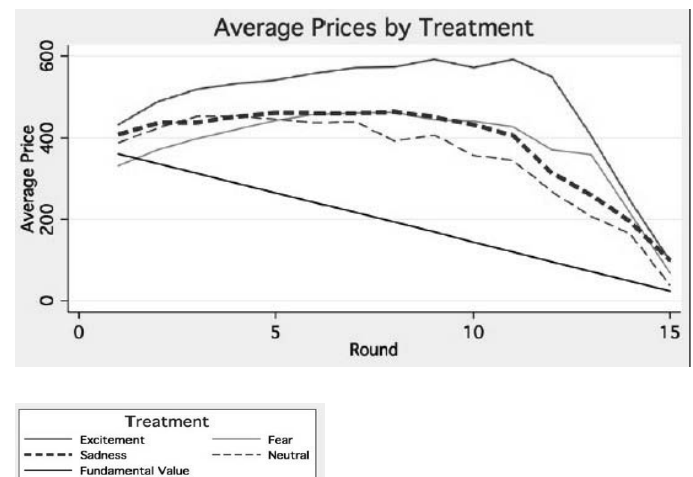
Fundamental Value Line



The subject then chooses to buy or sell at market rates that are reflections of the behavior of the other subjects in the simulation. The result from one of the “exciting-video” simulations is shown below. Clearly, during this simulation a bubble develops before prices finally crash at the end of the simulation. The simulation prices (the dots in the chart below) trump the fair value until near the end when prices drop rapidly toward the fair value (the dashed lines in the chart in the next column).



This experience is not only true for the “excited video” treatment. The following chart shows the average price of the stock being traded for each of the induced emotional states. While the results are different, only the results of the excitement state are significant.



On the basis of his research, Odean concludes that larger asset pricing bubbles develop in experimental markets run subsequent to showing the exciting videos and that differences in the magnitude and amplitude of the bubbles are both economic and statistically significant. Emotion, the factor studied by behavioral economists, appears to play a very large role in bubbles. During periods of heightened excitement, rational agents, if they exist, seem to deviate from rationality.

8. New Research in Behavioral Finance

Nicholas Barberis, Stephen & Camille Schramm Professor of Finance, Yale School of Management, presented “Testing Theories of Investor Behavior Using Neural Data,” he coauthored with Cary Frydman, PhD Candidate, Colin Camerer, Robert Kirby Professor of Behavioral Economics, Peter Bossaerts, William D. Hacker Professor of Economics and Management and Professor of Finance, and Antonio Rangel, Associate Professor of Economics, California Institute of Technology.

Barberis begins with the two major paradigms in finance:

1. The “rational agent” framework that posits sensible beliefs are updated properly when new information arrives and investors make sensible decisions in the face of risk.
2. Behavioral finance that asserts that some market participants are less than fully rational and hold less than fully rational beliefs and decision-making under risk.

For guidance on how people deviate from rationality, he draws on research in psychology about beliefs (e.g. overconfidence and representativeness) and the psychology of decision-making under risk (e.g. prospect theory and ambiguity aversion). As for testing, he says one can start with a psychological principle, derive and test the predictions or one can start with a puzzling fact propose and test a psychology-based hypothesis. He starts with a puzzling fact.

His puzzling fact is the “disposition effect” (individual investors have a greater propensity to sell stocks trading at a gain than to sell stocks trading at a loss). This effect has attracted considerable attention because it is

challenging to explain using simple rational models of trading behavior. Barberis looks to four models for an explanation: one traditional (representativeness) and three others that are behavioral (probability weighting, mutual fund flows, realization utility).

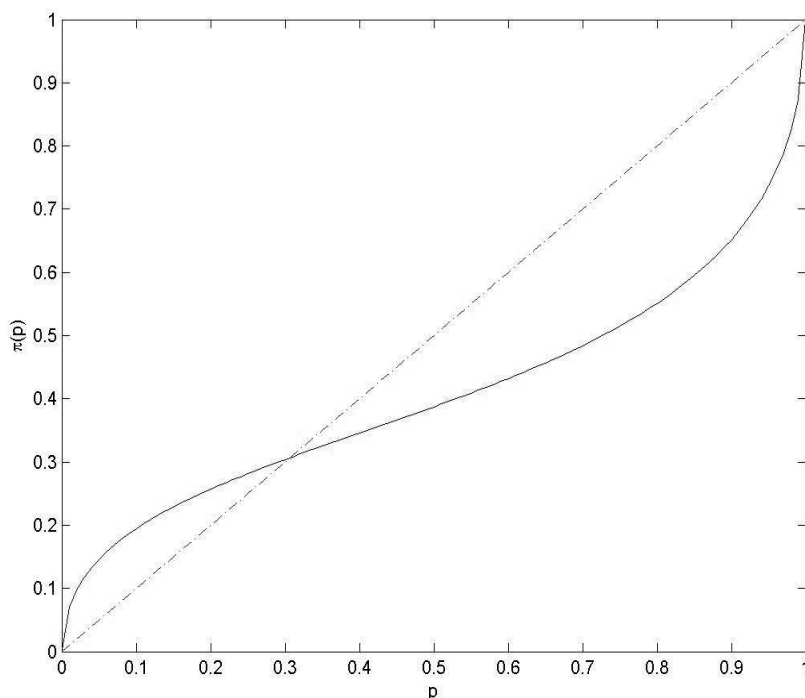
Representativeness posits that people draw overly strong inferences from small samples of data and it would predict long-run mean reversion in stock returns. He cites as a practical example of this theory, the “hot hand” effect in basketball (a player has a better chance of hitting a shot after a hit than after a miss). Widely held, this theory has not been proven using the evidence from professional basketball.

An alternative to representativeness theory is probability weighting. This theory postulates that the rational decision-maker should evaluate risk by:

1. Considering the different possible future outcomes.
2. Deciding how good or how bad each outcome will make him feel.
3. Weighting each outcome by its probability creating an “expected utility” framework.

Unfortunately this process may not be a good description of how people actually think about risk. Rather, he says, the brain may weigh probabilities in a nonlinear way by overweighting low probabilities and underweighting high probabilities. This assessment process may create an outcome more like that shown in the chart below. The dotted line represents rational choice and the solid line represents how individuals might act if using probability weighting. Probability weighting is an element of prospect theory and it is a model of how people incorporate loss aversion. This sort of idea, he says,

captures the odd fact that simultaneously people demand both lotteries and insurance.



Barberis notes that probability weighting predicts that a security's own skewness will be priced: positively skewed assets will be overpriced and will earn low average returns; negatively skewed assets will be underpriced and will earn high average returns. Thus, by taking a significant position in a positively skewed asset, an investor has a small chance of making a lot of money and, based on probability weighting, a small chance is highly valued.

He provides a number of examples of where this behavior has been identified. Stock options predicted to have more positively skewed returns have lower average returns. Stocks with high idiosyncratic volatility have low average returns while those that are positively skewed have the reverse. As for

explaining the disposition effect, a model of the stock market in which investors process risk according to prospect theory, seems to do better than does representativeness. Probability weighting plays a key role.

Barberis next turns to the mutual fund flows idea. This notion suggests that we can make sense of stock price movements by thinking about mutual fund flows. He points to three facts about these flows:

1. Mutual fund returns in the current period positively predict mutual fund flows in the next period.
2. Mutual fund flows are positively serially correlated.
3. When mutual funds receive new flows, fund managers allocate a substantial fraction of them to existing positions.

Understanding these facts leads to a new interpretation of a number of phenomena: momentum; the smart money effect; fund performance persistence.

Finally Barberis turns to the third theory: realization utility. This theory suggests that investors feel a burst of pleasure (pain) when they sell an asset at a gain (loss). It is this theory he tests. He sets up an experimental market where 28 Caltech students and employees trade stocks while their brain activity is monitored using an fMRI scanner (functional Magnetic Resonance Imaging).

For this experiment, there are three stocks. At each moment the stocks are in either a "good" state or a "bad" state. In a good

state, the stock goes up with a probability of 55% and in a bad state it goes down with a 45% probability. The subjects are not told the states of the three stocks but can try to infer them from the price updates they observe. Each subject starts with \$350 and can, at each decision point over the experiment, buy a share (if not currently owned) or sell shares if he does own them. The stock's price changes only when a price update is shown on the screen the subject sees. It is important to note that from a subject's perspective, each stock price is positively auto correlated.

Realization utility says that people experience a burst of pleasure that can be seen on a brain scan when they sell an asset at a gain. A specific area of the brain, the ventral striatum (vStr) is widely believed to encode "hedonic value," subjective feelings of pleasure. Thus, neural activity in the vStr should spike up around the moment where a subject issues a command to sell a stock at a gain as compared to when a subject continues to hold a stock with a similar embedded gain.

Barberis plots a time series of neural activity in the vStr when a subject issues a command to sell a stock at a gain. He then compares this activity to when the subject holds a stock with a gain. The results confirm his prediction -- realization utility is the culprit in the "disposition effect."

9. Toward Determining Systemic Importance

Mark Kritzman, President and CEO of Windham Capital Management, LLC, and Senior Lecturer, MIT Sloan School of Management, made the final presentation on Tuesday of the Spring 2012 Q-Group Meetings, entitled "Toward Determining Systemic Importance" coauthored with

William B. Kinlaw, Managing Director and Head of the Portfolio and Risk Management Group, State Street Associates and David Turkington, Vice President, State Street Global Markets.

Until the shock of the Global Financial Crisis, systematic risk (the extent to which movement of a broad market or economic factor imparts risk to a narrow entity such as an individual company or stock) had long been the focus of investors as they sought to design efficient portfolios and to avoid uncompensated risks. In the wake of the Global Financial Crisis, focus shifted to systemic risk (risk that results from a relatively narrow shock that propagates quickly and broadly throughout the financial system and the real economy) for good reason. The Global Financial Crisis made it clear that narrow events such as Lehman Brothers' default could cause the global stock market to crash, paralyze the financial system, and cast the world economy into a deep and long recession.

Systemic risk and measuring it is important to investors who need to assess the vulnerability of a portfolio to systemic shocks and who need to develop a defensive strategy. It is equally important to policy makers to ensure that policies target the right entities before a shock and effectively engage in preventive or corrective measures when circumstances warrant intervention. While important, Kritzman says, measuring systemic risk is difficult.

Attempts have been made to gauge the degree of systemic risk within the financial system and to identify the linkages across financial institutions and other key entities. This effort has been difficult for several reasons: securitization

obscures many connections among stakeholders; private transactions create opacity; deceptive accounting methods conceal financial dependencies. Moreover, the complexity and volume of derivatives contracts render it nearly impossible to disentangle the web of connections throughout the financial system. Lehman Brothers, for example, had more than 1.5 million derivatives contracts on its books when it defaulted.

Kritzman introduces his measure of systemic importance, the “absorption ratio.” The absorption ratio (AR) is measured as the fraction of the total variance of a set of asset returns explained, “absorbed”, by a fixed number of characteristic vectors (eigenvectors) (E). He says this ratio captures both an asset’s riskiness and its connectivity to other risky assets during periods of high systemic risk. When the absorption ratio is low, markets are more resilient to shocks and less likely to exhibit a system-wide response to bad news. Compact markets are more fragile.

For a market to sell off significantly, two conditions typically must prevail: the market must be fragile and it must receive a negative shock. Despite false positives Kritzman reports that the absorption ratio distinguishes relatively benign market conditions from dangerous ones and does so in advance. He

provides the following chart (the dark area is the AR and the line represents the S&P 500 from 1998 to 2012).

He extends the idea to a market timing strategy. Based on the systematic risk index, he creates a dynamic switching model and compares its performance to that of a static 50/50% allocation. His encouraging results are shown in the chart below.

Absorption ratio as a market timing signal*

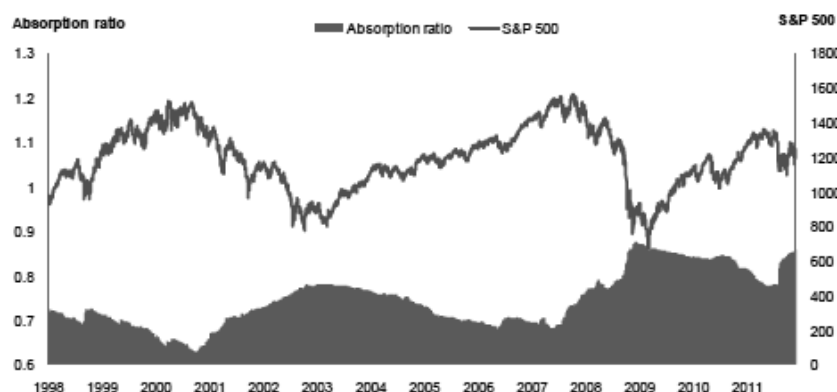
Trading rule		Performance (1/1/1998 through 11/30/2011)	
Systemic Risk Index	Stock/Bond Exposure		
$-1\sigma \leq \Delta \text{Index} \leq +1\sigma$	50 / 50		
$\Delta \text{Index} > +1\sigma$	0 / 100		
$\Delta \text{Index} < -1\sigma$	100 / 0		
		Dynamic	50/50
Return		9.15%	5.72%
Risk		11.30%	10.14%
Return/Risk		0.81	0.56
Max. Drawdown		12.83%	26.26%
Turnover		111%	n/a
Trades/year		2.2	n/a

Kritzman next turns to a discussion of extending the absorption ratio to determining systemic importance by constructing a measure of centrality that includes:

1. The asset’s vulnerability to failure.
2. A measure of how broadly and deeply an asset is connected to other assets in the system.
3. The riskiness of the other assets to which it is connected.

It is important to note that none of the measures is sufficient, but collectively they may offer the best observable indication of systemic importance.

The absorption ratio for U.S. equities*



To create a measure of centrality Kritzman multiplies the asset's weight (absolute value) in each eigenvector by the relative importance of the eigenvector (measured as the percentage of variation explained by that eigenvector divided by the sum of the percentage of variation explained by all of the eigenvectors that comprise the subset of those that are most important).

$$\mathbf{d}_t = (\mathbf{y}_t - \boldsymbol{\mu}) \boldsymbol{\Sigma}^{-1} (\mathbf{y}_t - \boldsymbol{\mu})'$$

Where:

d_t = vector distance from multivariate average

y_t = return series

$\boldsymbol{\mu}$ = mean vector of return series y_t

$\boldsymbol{\Sigma}$ = covariance matrix of return series y_t

Kritzman contrasts this specification to previous measures that use the principal eigenvector alone. In this centrality measure, the uses several eigenvectors in the numerator of the absorption ratio suggesting that most of the time several factors contribute importantly to market variance. He says the centrality score measures the degree to which a particular asset or industry drives market variance. To demonstrate how the measure works he ranks the systemic importance of industries (December 1997 - June 2011) and stocks (December 1992- June 2011) using U.S. stock market data

Top industries when standardized shift > 1	Average percent rank
Diversified Financial Services	95
Capital Markets	94
Software	92
Commercial Banks	91
Communications Equipment	90
Oil, Gas & Consumable Fuels	90
Computers & Peripherals	90
Real Estate Investment Trusts (REITs)	87
Pharmaceuticals	85
Industrial Conglomerates	85
Top U.S. financial stocks when std. shift > 1	Average percent rank
Citigroup	98
Bank of America	97
JP Morgan Chase	96
American International Group	96
Fannie Mae	93
Morgan Stanley	92
American Express	92
Merrill Lynch	91
Bank One (Acquired)	91
Goldman Sachs	89

Most of the list is what would be expected, however, Kritzman notes the absence of Lehman Brothers among the top 10. He explains that Lehman was not always systemically important, but became systemically important in the period leading up to the Financial Crisis and maintained relatively high centrality throughout the crisis right up to its collapse. He then ranks the systemic importance of global financial institutions as of October 2011, and urges that the results be heeded but interpreted with circumspection.

He notes that the centrality measure is not an indication of an entity's financial strength or weakness, nor is it a gauge of creditworthiness or a predictor of investment performance. Rather, it is a statistical representation of an entity's vulnerability to failure and connectivity to other risky entities and is derived solely from historical returns and by ignoring current fundamental information.

Kritzman concludes that his approach to measuring systemic importance relies solely on the behavior of asset prices thus giving it two virtues: it is simple and

easily updated; it captures risks and linkages that may not be otherwise observable. However, as a measure, it is limited because it fails to consider fundamental factors that may not be embedded in security prices.

10. Noise as Information for Illiquidity

Jiang Wang, Mizuho Financial Group Professor, MIT Sloan School of Management, CAFR and NBER, presented “Noise as Information for Illiquidity,” coauthored with Xing Hu, Assistant Professor, University of Hong Kong, and Jun Pan, Professor of Finance, MIT Sloan School of Management, CAFR and NBER.

If the Financial Crisis taught us anything, it is that liquidity is essential for markets. However, Wang says, it is only partially understood and there is no clarity about:

1. How to measure liquidity.
2. What determines liquidity.
3. Whether there is commonality in liquidity across markets.
4. How liquidity affects asset prices.

Wang says that noise in asset prices (pricing errors) reflects market illiquidity:

1. During normal times, an abundance of arbitrage capital forces prices close to fundamentals, smoothing out variations around the yield curve.
2. During times of crisis, a shortage of arbitrage capital allows prices to deviate from fundamentals. Thus, limited arbitrage capital allows more noise in yields.

For Wang, the amount of noise in yields provides a measure of illiquidity.

The basic premise in Wang’s work is that the abundance of arbitrage capital during normal times helps smooth out the Treasury yield

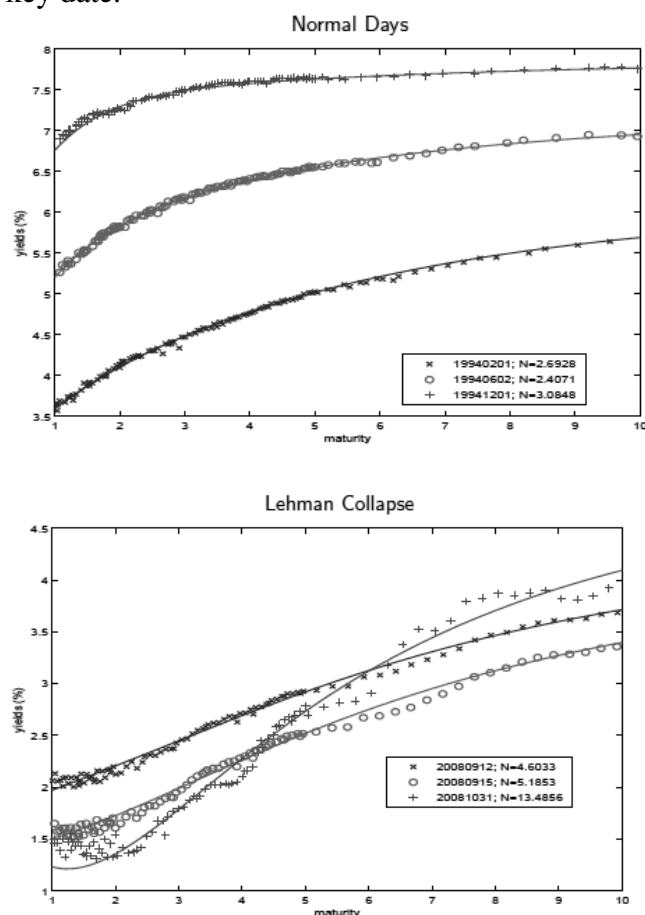
curve and keep the average dispersion low. During liquidity crises, however, the lack of arbitrage capital forces the proprietary trading desks and hedge funds to limit or even abandon their relative value trades, leaving the yields to move more freely and resulting in more yield curve noise. Wang argues that these abnormal noises in Treasury prices are a symptom of a market with a severe shortage of arbitrage capital. Furthermore, this is not unique to the Treasury market and can impact overall financial markets.

In this study he focuses on the U.S. Treasury market for two reasons. First, it is by far the most important asset market in the world and a shortage of liquidity in this market provides a strong signal about liquidity in the overall market. Second, the fundamental values of Treasuries are determined by a small number of interest rate factors easily captured empirically to create a more reliable measure of price deviations.

Using the CRSP daily Treasury database, he constructs a noise measure by backing out a smoothed zero-coupon yield curve (the yield curve used to price all available bonds on that day). He then aggregates the deviations across all bonds to create a measure of noise. Wang notes that in the fixed-income literature, deviations from a given pricing model are often referred to as noise.

Wang says the results are rather informative regarding the liquidity condition of the overall market. During normal times the noise is kept to an average of 3.94 basis points comparable to the average bid/ask yield spread of 2 basis points. Because of this he concludes that arbitrage capital is effective in keeping the deviations within an unattractive range

given transaction costs during normal times. However, during a crisis the noise measure spikes up much more prominently than the bid/ask spread, thus implying a misalignment in bond yields sufficiently large to attract relative value arbitrageurs. The following charts contrast the yield curve on normal days (the first chart) and during crisis periods (the second chart). The curves represent the key period and two time periods around the key date. Note the legend provides the dates and the yield curve deviations from those on the key date.



Clearly, the size of the noise measure spiked during the Financial Crisis. This is further shown on the event annotated chart in the next column.

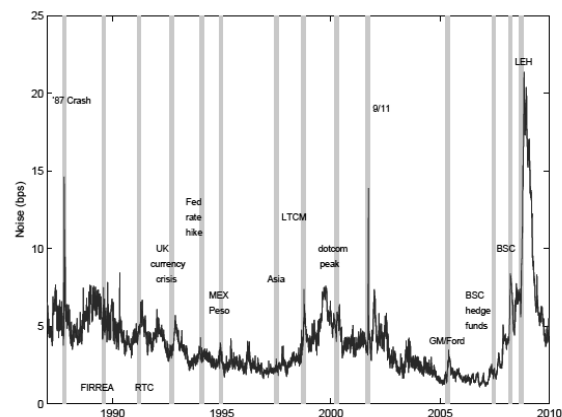


Figure 2: Daily time-series of the noise measure (in basis points).

Wang says that the sharp rise of the noise measure during crises of different origins and causes suggests that the noise measure may capture market-wide liquidity risk. He wonders if noise factor can explain asset returns. Specifically, he examines whether the returns on assets he deems sensitive to changes in market-wide liquidity (such as hedge funds and the currency carry trade) can be explained by his noise measure and finds that it explains cross-sectional variation in hedge fund returns and currency carry trade strategies. Liquidity is important.

11. Will My Risk Parity Strategy Outperform?

Lisa R. Goldberg, Executive Director of Analytic Initiatives at MSCI Barra and Adjunct Professor of Statistics, University of California, Berkeley presented the last paper of the 2012 Spring Q-Group Meetings, “Will My Risk Parity Strategy Outperform?” she coauthored with Robert M. Anderson, Director, Coleman Fung Risk Management Research Center and Professor of Economics and Mathematics, University of California, Berkeley and

Stephen W. Bianchi, doctoral candidate,
University of California, Berkeley.

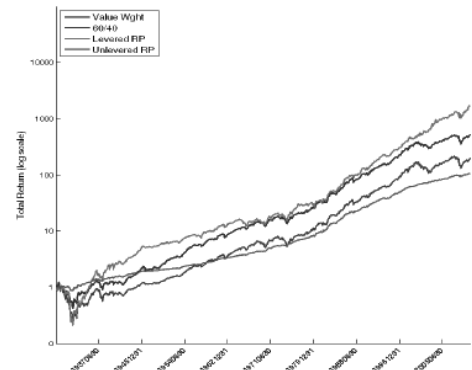
The question Goldberg tackles, as have many of her predecessors, is “Can We Beat the Market?” In this paper she looks specifically at whether the lower-beta-higher-return/higher-beta-lower-return anomaly, thought to be the result of investor constraints on leverage, can be exploited to achieve a realized Sharpe ratio that is higher than that of the value-weighted market portfolio with same volatility. She says that one of the major reasons for this work was the content of a paper by Frazzini and Pedersen given at Fall Q-Group meetings.

Goldberg starts with three general strategies typically used to beat the market:

1. Levered Risk Parity: Equal risk contributions from stocks and bonds levered to match the market volatility.
2. Unlevered Risk Parity: Equal risk contributions from stocks and bonds fully invested.
3. Fixed Asset Mix: A constant asset allocation, typically 60% Stocks/40% Bonds.

To assess whether levered risk parity outperforms the other strategies, Goldberg uses stock and bond data 1926-2010 to examine what would have happened. The performance of each of her four strategies, including one that is value weighted, is shown in the next column (the end points of the lines are shown in the order listed in the legend). Overall, levered risk parity outperforms.

Levered Risk Parity Outperformed 1926-2010 (Base Case)...



She then breaks the data into the following subsamples:

- Pre-1946 (1926-1945)
- Post-War (1946-1982)
- Bull Market (1983-2000)
- Dot-Com & Beyond (2001-2010)

Goldberg finds a time dependent difference: for the Post-War period the 60/40 portfolio is superior to all other strategies.

Critical to the success of the levered risk parity strategy is the cost of borrowing. She evaluates the strategy, first assuming a risk-free borrowing rate and then the Eurodollar rate, making sure to include trading costs. Taking costs into account the 60/40 constant asset allocation strategy outperforms leveraged risk parity for the entire period and all sub periods. The levered risk parity strategy premium is significant only when it is financed at the risk free rate and trading costs are neglected. Her results are shown in the chart on the next page.

The Premium is Significant Only if Levered Risk Parity is Financed at the Risk-free Rate and Trading Costs are Neglected

	Excess Return (basis points)	P-Value (T-Stat)	Alpha (basis points)	P-Value (T- Stat)
Financed at Risk-free rate	210	.03 (1.88)	181	.06 (1.62)
Financed at Eurodollar deposit rate	29	.40 (.26)	-2	.50 (-.02)
Financed at Eurodollar deposit rate and adjusted for trading costs	-51	.67 (-.46)	-81	.76 (-.73)

Goldberg concludes that on the basis of this research:

- While CAPM investors hold the market portfolio and lever or delever to adjust risk, practical considerations imply that leveraging a portfolio diminishes Sharpe Ratio.
- A weaker strategy may outperform a stronger one over periods of several decades, certainly beyond the investment horizon of most individuals and institutions like pension funds or endowments.
- Results of back tests depend on the test period and assumptions about transaction costs.

Finally she says, “When the experiments are done, we still have to decide what to believe.”
(Jonah Lehrer, *The Truth Wears Off*)



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