

Title: TRANSACTION COSTS, TRADE THROUGHS AND RISKLESS PRINCIPAL TRADING IN CORPORATE BOND MARKETS

Speaker: LARRY HARRIS
University of Southern California

Importance: Why this matters:

Because they are hidden in netted transaction prices, the cost of trading fixed income securities has historically been quite opaque. Recent advances in availability of trade and quote prices allowed Harris to identify riskless principal trades (RPTs). He demonstrated that dealers who arrange RPTs effectively act as brokers, while charging clients amounts more consistent with riskier dealer trades.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Harris compared the data on 3 million TRACE trades with about 464 million NBBO quotes from various electronic trading venues.

He was able to pair buy trades with sell trades within 2 seconds to identify those trades which were likely crossed through a dealer. He estimates the average customer roundtrip transaction cost at 125bp, equivalent to four month's interest on a 4% bond, also equivalent to a 50¢ spread on a \$40 stock!

Innovation: Are there new techniques of interest in the data or approach to the problem?

Harris has assembled a rich database capable of addressing transactional issues on corporate and municipal bonds.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Opacity in transaction costs has resulted in excessive costs, particularly to smaller investors who do not have the leverage, access or experience to query multiple dealers.
2. Most investors cannot effectively offer liquidity in these dealer markets. Institutional arrangements effectively prevent most retail customers from benefiting from innovative trading technologies.
3. Bond markets would benefit greatly from having a National Best Bid and Offer facility. Experience in equities is that order handling rule innovations have vastly improved those markets. Investors would benefit from lower costs; dealers would benefit from rising volume; and higher liquidity would make bonds more valuable, thus benefiting issuers.

Audience rating: 4.89

Title: **ON THE ROLE OF FINANCIAL INNOVATION AND QUANTITATIVE FINANCE IN FINANCIAL STABILITY AND ECONOMIC GROWTH: 50 YEARS OF THE PAST INTO THE IMPENDING FUTURE**

Speaker: **ROBERT C. MERTON**
MIT Sloan School of Management

Importance: Why this matters:

Merton provided us a history of the use of quantitative finance (financial engineering). He used the history to provide a context for ongoing research. Importantly, he argued that quantitative finance is alive and well, and contributes to economic growth. And, ongoing innovations will allow it to continue to contribute.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Professor Merton began his talk by providing a brief history of quantitative finance, beginning with Bachelier's continuous time finance at the start of the last century; to the 1950s when Markowitz and others introduced using mathematical solutions to address investment topics; to the 1960s when data was incorporated to the analysis. He then went on to demonstrate the importance of our industry. His first case study was about how the city of Leipzig was able to use swaps and other derivatives to produce a long-term fixed price for natural gas, without having to construct an expensive pipeline. Other examples included the benefits of global diversification relative to investing only in the home market, and using swaps to achieve diversification when it would not be possible by direct investment.

Innovation: Are there new techniques of interest in the data or approach to the problem?

He reminded us of the value and importance of our existing tools and techniques to address important problems, and enhance economic welfare.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. A well-functioning financial system is essential for sustainable growth and development, and financial innovation drives improvement of the financial system.
2. Derivative markets and quantitative finance tools are fundamental to a modern well-functioning financial system. They provide efficient implementation of the three methods of managing risk: diversification, hedging and insurance.
3. Intelligent regulation needs to realize the benefits of financial innovation while managing its risk.

Audience rating: 4.59

Title: SIZE MATTERS, IF YOU CONTROL YOUR JUNK

Speaker: TOBIAS MOSKOWITZ
University of Chicago, Booth School of Business

Importance: Why this matters:

One of the favorite anomalies prior to the 1980's was the "small stocks outperform in January" (and similar variants.) In the '80's and the '90's, the effect disappeared, and "resurrected" somewhat in the 21st century. Moskowitz's work shows that the size effect did not disappear and resurrect if one incorporates a measure of quality into the estimating equations.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Another study applying the CRISP data, applied the Fama/French small-minus-big factor and inserted various measures of quality based on profitability, growth, safety and payout. He defines quality as "characteristics that, all-else-equal, an investor should be willing to pay a higher price for: stocks that are safe, profitable, growing and well managed."

The goal was to investigate such historical observations about the rise and fall of size effect, the strange January effect, the illiquidity effect and the weakness in international analyses.

Innovation: Are there new techniques of interest in the data or approach to the problem?

A fairly standard approach of time series analysis of cross-sectional data, applying minor variations of Gordon's growth model.

Insights: 1-2-3, what are the three most important things the speaker offered?

Moskowitz concludes that when controlling for quality AND incorporating a size measure, the size premium is:

1. Stable through time and robust out of sample;
2. Not concentrated in "extreme" stocks
3. More consistent across seasons and markets
4. Robust to non-price based measures of size
5. Not captured by an illiquidity premium
6. More consistent internationally

Bottom line, it was the low-volatility, high quality stocks that drove the high average returns.

Audience rating: 3.89

Title: **LOW RISK ANOMALIES**

Speaker: **PAUL SCHNEIDER, University Of Lugano & Swiss Finance Institute**
CHRISTIAN WAGNER, Copenhagen Business School
JOSEF ZECHNER, CEPR and ECGI, WU Vienna

Importance: Why this matters:

Professor Schneider argued that the traditional CAPM is mis-specified, and that skewness needs to be added. If he is correct, all of our approaches that are based on the standard CAPM need to be adjusted. Incorporation of skewness would also provide an explanation for the low volatility anomalies.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

He investigated many of the volatility-related anomalies by testing them with and without incorporating skewness into the studies. Using a simulation based on a cross-section stocks from 1996 to 2014, he replicated Betting Against Beta, Idiosyncratic Volatility, Ex-Ante Variance and Distress studies, with and without a skewness factor. He obtained the skew from the options market.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Introducing skewness into investigations of anomalies changes many findings. Importantly, average returns increase with risk.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Low risk "anomalies" do not necessarily pose asset pricing puzzles. Including skewness explains many of the volatility-related anomalies, including: high versus low beta, CAPM idiosyncratic volatility, 3-factor Fama-French idiosyncratic volatility, and low volatility.
2. Because they ignore the effect of skewness on stock prices, CAPM betas are prone to overestimating risk. Skew adjusted betas tend to be lower than unadjusted.
3. The model can be extended to the distress puzzle in fixed income credit markets.

Audience rating: 3.80

Title: A NEW LOOK AT LIQUIDITY

Speaker: ROBERT ENGLE
Stern School of Business & Director of Volatility Institute

Importance: Why this matters:

All investment ideas and strategies need to be implemented through trading. Since trading costs almost always leak both assets and tactical information to trading intermediaries, a deep understanding of the trading mechanisms can provide opportunities for performance enhancement.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Engle analyzed institutional trade data from the Ancerno (Abel Noser) databases in an attempt to create a better explanation of the cost of trading from 1999 through 2013.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Engle builds separate models for liquidity suppliers and liquidity demand orders.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Trading cost estimates are vastly improved by considering the market environment in which the trade was made. A rising market will make buying strategies that spread execution over the day (VWAP) will be more expensive for buyers (demanders), while sellers (suppliers) will benefit by accommodating the more anxious buyers.
2. A trader executing such a strategy of hiding larger trades by dividing them into less observable small pieces will closely match the VWAP for that security for that day. Whether this can be considered "best execution" has been seriously debated for many years.

Audience rating: 2.84

Title: THE MYTH OF THE CREDIT SPREAD PUZZLE

Speaker: STEPHEN SCHAEFER
London Business School

Importance: Why this matters:

The credit spread puzzle is that many studies using Merton-type structural models of credit spreads find spreads that are lower than actual spreads, particularly for investment grade bonds. By using a longer history they are able to resolve the puzzle. They find the model is able to capture the level and the time series variation of investment grade credit spreads.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

They calibrated their structural model using default rates from the 1970 to 2001 and the 1920 to 2001 period. By calibrating the model to higher default rate observed over the longer period (e.g. post 1920 rather than post 1970), the model spreads are generally in line with observed spreads.

Repeating the analysis using individual bonds, they find the model fits empirical data reasonably well for investment grade bonds of medium to long maturity. The model does not fit shorter time or speculative grade bonds very well.

Innovation: Are there new techniques of interest in the data or approach to the problem?

The authors used simulations to estimate default rates, and demonstrated that the distribution is likely to be highly skewed. As a result, any single draw is more likely to be closer to the mode than the mean, producing a downward bias estimate of the underlying default rate.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Do not calibrate Merton Models to observed default rates over a shorter period. One needs to use post 1920 data to produce model spreads that are in line with observed. Observed defaults are just one draw from a larger distribution.
2. Default probabilities may be higher than we think.
3. The model also is able to fit the time series of spreads.
4. The model underpredicts spreads for high yield bonds. Probably due to not incorporating a premium for illiquidity.

Audience rating: 3.67

Title: **DAVID AND GOLIATH:
WHO WINS THE GAME OF QUANTITATIVE INVESTING?**

Speaker: **JOHN C. BOGLE
Vanguard Group**

Importance: Jack Bogle gave the banquet keynote speech. To no one's surprise, he gave a spirited talk on the virtues of indexing. Here are some slightly modified key quotes from his presentation. A copy of the full presentation is available under Spring 2016 Seminar on the Q-Group website.

The David approach to investing, is “buy a diversified portfolio of stocks operated at rock-bottom costs, and hold it forever.” The index fund relies on simple arithmetic, a mathematical tautology that could be calculated by a second grader: *gross return in the stock market, minus the frictional costs of investing, equals the net return that is shared by all investors as a group.* Taking the lion's share of those costs out of the equation is the key to successful long-term investing.

In contrast, many Goliaths of academia and quantitative investing believe the contrary: the application of multiple complex equations—the language of science and technology, of engineering and mathematics, developed with computers processing Big Data, and trading stocks at the speed of light—make you far stronger and more powerful than are we indexing Davids. The question posed in my title is essentially, “who wins?”—the *arithmetic* quants or the *algorithmic* quants.

Arithmetic Quants and Algorithmic Quants

The pool of assets managed by the algorithmic quants is run by (largely!) brilliant managers, many with Ph.Ds, and most with a complex quantitative approach that uses multiple equations. They assume extra-market risks and typically demand—and receive— very high compensation for their work. At the other extreme, of course, are the Vanguard index funds. They have no manager in the conventional sense. Their math is arithmetic, not calculus. They assume only market risk, neither more nor less, and they charge fees that are too small to be believed.

The story of the index fund begins with Vanguard. I recruited the Street's four largest retail brokers, led by Dean Witter. They expected to raise \$150 million in the initial offering. Wrong! The underwriting was a flop: \$11.3 million. The underwriters suggested that we accept the failure and send the investors their money back. But I wouldn't hear of it. After all, the world's first index mutual fund could now begin. And on August 31, 1976, it did. But its subsequent reception was, well, underwhelming. It was called “Bogle's Folly,” and a poster reading, “Help stamp out index funds. Index funds are un-American” was circulated around Wall Street. A pointed question, “Would you be satisfied with an average brain surgeon?” Worse, the first index fund's acceptance by the public was close to zero. During the first five years, it drew total new capital of a mere \$17 million from investors. Nearly a decade elapsed until the second index fund was formed (in 1984 by Wells Fargo) and it took until the mid-1990s before index funds began to gain traction with investors.

The EMH (the efficient market hypothesis) is also part of the algorithmic canon. But while markets are *usually* highly efficient (on both a macro and a micro basis), they experience periodic aberrations that are often unpredictable and extreme. On the other hand, my own arithmetic model relies solely on

the *Cost Matters Hypothesis* (CMH): investors as a group earn the stock market's return *less* the *frictional costs of investing*. This fact is insurmountable, and prevails under *all* circumstances

I was part of the *Pragmatic School* of indexing, with just two principles: (1) gross market returns minus cost equals net market return, and (2) the investment returns earned by fund managers lag the returns of the S&P 500 with remarkable consistency. I was inspired by Paul Samuelson, the consummate algorithmic quantifier, who turned to pragmatic arithmetic in his 1974 JPM paper. In that seminal article, he demanded “brute evidence” that proved that fund managers could consistently beat the market. To this day, none has been forthcoming.

Passive Indexing and Active Management Today

Today, about one-half of all ETF shares is held by banks and other financial institutions that trade them with a fury. The other half is held by individuals, in part by investors who tend to hold them because of their convenience, flexibility, and lower expense ratios than active funds, but, likely in larger part, by those who have a short-term focus and have confidence that they can out-trade their fellow speculators.

In my experience, as assets of a particular fund or style or class grow and competition for performance increases, declining relative returns are normal and to be expected. More and more brilliant, energetic, STEM-educated individuals enter the field, seeking to prove themselves and earn such extraordinary compensation. Then, in theory at least, price discovery becomes more challenging; spreads between stock prices and intrinsic value narrow; and strategies that have won in the past become more popular and draw increasing assets. Result: factor returns ultimately revert to the mean.

For what it's worth, index funds also have momentum in the marketplace. Investors are seeing the light. Since 2007, \$1.5 trillion of net cash flow has *poured into* equity index funds, while \$500 billion has *poured out* of active funds. With the Department of Labor's forthcoming fiduciary duty standard that requires brokers and investment advisers for retirement plan investors to put first the interests of their clients, that momentum will surely accelerate.

Strategic beta funds—essentially designed to provide excess returns over the S&P 500 by focusing on factor strategies—are all too likely to lapse, and ultimately fail to fulfill their promise. Finally, simple arithmetic is the king—the optimal way to capture for investors their fair share of whatever returns the nation's corporations (and the world's) can generate with the dividend yields and earnings growth reflected in the prices of their stocks. Yes, there may be a few investment strategies that will provide better returns for investors, but the number of strategies that will provide worse returns is infinite.

Title: QUANTIFYING BEHAVIORAL FINANCE

Speaker: ROBERT J. SHILLER
Yale University

Importance: Why this matters:

Shiller's work is based on a belief that it is highly desirable and possible to work behavioral phenomena into the framework of quantitative models of financial behavior.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Shiller has been searching for information on the effects of belief systems, and trying to relate how those beliefs lead to economic behavior. His data go back as far as the late 1800's. As an example, Shiller surveys individual and institutional investors for their opinion on such questions as "are stocks the best investment?" and relates those aggregated opinions to economic variables such as stock market indexes.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Shiller's theory of speculative bubbles is that these bubbles are driven initially by an unusual confluence of an array of precipitating factors. Many of these factors are *stories*, often human interest stories (narrative basis for human thinking.) Bubbles reach epidemic proportions with amplification (feedback) mechanisms. He searches for evidence of biases such as wishful thinking, selective attention, and other behavioral biases.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Newspapers hype events, particularly negative events, functioning as storytellers. People react quickly and viscerally to these signals; much more strongly if the news is on the front page rather than on the back pages.
2. Investors vastly over-estimate the probability of catastrophic events such as market crashes. They also overestimate the effects on investment prospects of unrelated events such as distant earthquakes. Negativity breeds negativity.
3. Behavioral finance has many opportunities for quantitative research, and is certainly just as relevant.

Audience rating: 3.90

Title: MISPRICING FACTORS

Speaker: ROBERT F. STAMBAUGH
Wharton School, University of Pennsylvania

Importance: Why this matters:

Many factor-based and active quant strategies use multiple characteristics to select stocks and/or construct portfolios. Clustering has the potential to combine correlated factors in an intuitive and robust manner.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Stambaugh demonstrated how to use clustering as a technique for combining stock characteristics (linked to return anomalies) into factors. He used the method to combine the 11 characteristics he used in his earlier papers into two factors. He then tested the combination of them plus a market and a size factor against the standard Fama-French three factor and five factor models. Using multiple metrics, Stambaugh's model did a superior job of "explaining" the anomalies. (I.e. including the two factors constructed using the clustering technique eliminated the significance of the anomalies based on the individual characteristics, while most were still significant using F-F.) His four factor model was also superior to F-F in explaining a longer list of 73 anomalies. His model also did a better job of explaining the F-F factors, than the F-F model did in explaining his factors.

Innovation: Are there new techniques of interest in the data or approach to the problem?

The first innovation was to first calculate residual returns, and then to clustering to combine the characteristics into factors.

The second innovation was to construct the SMB (small minus big) factor using only the stocks that were not in the extreme factor portfolio. That keeps the stocks' factor exposures from biasing the size portfolios.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Clustering permits identification of factors constructed from multiple characteristics in a way that principle components would not.
2. Creating the SMB factor using only stocks that did not have significant exposure to the other factors "improved" its performance.
3. Even without any explicit "value" characteristics, the model did a better job of explaining the anomalies observed in prior studies.

Audience rating: 3.35

Title: **SPECTRAL PORTFOLIO THEORY**
The Role of Frequency in Investing

Speaker: **ANDREW LO**
MIT Sloan School of Management

Importance: Why this matters:

Spectral analysis has potential for helping investors to model time series that include higher and lower frequency components. The technique can be used to ensure that signals are aligned with the time horizon of the return they are trying to forecast. If successful, it could result in superior forecasts.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Lo used several examples to illustrate that many time series are composed of components with different cyclical frequencies. The first example compared 1-day to 2-day mean stock return reversion strategies. He went on to illustrate how US GDP growth and the stock market can be decomposed into low and high-frequency components. He then showed how signals with a frequency that align with the returns produce superior results than signals that are misaligned.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Lo showed how spectral analysis techniques can be used to model return dynamics across multiple time horizons which the frequency component is explicitly captured. Using discrete Fourier transform, traditional time-series measures can be decomposed into the sum of frequency-specific subcomponents, each having distinct variance, alpha, beta and correlations. By identifying the frequencies that are responsible for a strategy's expected returns and volatility, investors have an additional dimension with which to manage portfolios' the risk/reward characteristics.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Using spectral portfolio theory may help to model return series that have oscillations at multiple time frequencies.
2. It is important to align the frequency of the signals with the frequency of investing. Signals with frequencies that are aligned with returns produce superior results than signals that are misaligned.
3. A wide range of investment strategies are likely to have both low and high frequency components.

Audience rating: 4.49

Title: CAN FINANCIAL ENGINEERING CURE CANCER?

Speaker: ANDREW LO
MIT Sloan School of Management

Importance: Why this matters:

1. Drug research is incredibly expensive, and each project has a low probability of success. By using financial engineering, we can help investors diversify the risk of individual studies, and potentially increase the amount we invest in drug research.
2. Some modern drugs are very expensive. We may be able to increase their availability if we view them as investments in longer lives, and create securities that allow the investment to be paid over time, rather than at the time of treatment.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

Professor Lo revisited a presentation he gave to Q several years ago. He shows that by creating a bond that funds a large number (150) of drug development projects, each with low probability of success (5%), it would be possible to construct an instrument that has very attractive risk-return characteristics. He went on to discuss how to fund some of the new, but very expensive, drugs. If rather than looking only at the high cost of the treatments, we view the cost of the drugs as an investment in saving lives, and create mortgage-like securities to fund that investment.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Creating a bond that diversifies the risk of individual drug research projects.
Creating a security that allows expensive drug treatments to be paid over time.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. We can use financial engineering to address them problem of high-cost, low probability of success drug research
2. We should view expensive drug treatments as investments, and develop techniques to allow the cost of the investment to be paid over time.

Audience rating: 4.49

Title: **LOOKING TO THE FUTURE**

Panelists: **ANDREW LO, ROBERT MERTON, STEVEN ROSS & JEREMY SIEGEL**

Moderator: **MARTIN L. LEIBOWITZ**, Morgan Stanley

Andy Lo: The regulatory environment for the financial industry is filled with animosity and frictions. This is not good for the industry, and, more importantly, the prosperity of the economy.

Technological advances in other fields, especially in data science and big data techniques, will be applied to finance.

Financial structures will be applied to solve humanity's biggest challenges.

Bob Merton: The industry needs to address issues of trust and inherent opacity; we have difficulty providing advice in a framework which is readily accessible to those in need of our services. We need to move toward goal-based investing: set a goal (funded retirement) and apply dynamic strategies to achieving that goal.

We need to develop more global solutions based on finance principles, including developing securities that replicate dynamic strategies.

Steve Ross: We need to make the social case for the value of finance. Since 2008 we've been cast in the role of the villain. Micro finance has been tainted by the confusion of macro-economic policy.

Jeremy Siegel: Jeremy focused on expected returns over the next decade. Based on historical rates, it appears that stocks are slightly overvalued, but bonds are really overvalued. Why? An aging population of baby boomers experiencing greater longevity worldwide is demanding safety and fleeing from higher volatility investments. Compounding the problem is the low growth of the world economy.

Discussion questions:

How do we address the issue of funding retirement? Unfortunately, we can't combine longevity with early retirement and maintain a high standard of living. We need to save more but explaining that need and the solutions are not being done well. We can address the problem through a portfolio that converts to an annuity at an appropriate time. Also, we need better explanations of deferred compensation programs. We need to better explain the virtues of liquefying the primary asset of housing through reverse mortgages. These can be addressed, but explaining them is not easy. Which is why managing finances for a single person is much more difficult than managing a billion-dollar mutual fund. The problem is communications: would it be better to describe goals in terms of sustainable income rather than asset values?

Why is finance viewed so negatively? We are viewed by the government and most of the populace as a source of problems, not solutions. Until we can gain more credibility, we cannot hope to make progress in solving these very real problems. For example, index funds are very credible and very transparent, because what they do and how they do it are easily explained. Recent television commercials about “orange money” head in the right direction.

Audience rating: 4.53

Title: TESTING STRATEGIES BASED ON MULTIPLE SIGNALS

Speaker: ROBERT NOVY-MARX
University of Rochester

Importance: Why this matters:

The statistical significance of multi-signal strategies cannot be evaluated using conventional tests. All backtests are biased to some extent. Importantly, when backtesting combinations of signals the bias will increase. Picking the best subset of several signals, and optimizing signal weights further increase the bias.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

The paper analyzes t-statistic distributions for multi-signal strategies, both empirically and theoretically, to determine appropriate critical values. Combining the best k out of n candidate signals yields biases similar to those obtained using the single best of n^k candidate signals.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Novy-Marx provided a metric to find the critical T-statistic (information ratio) based on the total number of signals tested, and the number of signals used in the final combined signal.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. T-statistics should be adjusted for bias. Combining signals diversifies tracking error, but the statistics will be biased if the signals are selected ex-post. The bias is larger in a long-short context.
2. Constructing a model based on the best 3 out of 20 signals is equivalent to picking the best 1 out of 1780, and the best 1 out of 2770 if the signals are weighted.
3. All backtests have some bias. Nothing is truly ex-ante. We all look at the same data, and read the same research.
4. Smart beta approaches using multiple indicators suffer from the same overfitting and selection biases as active strategies using "alpha" signals.

Audience rating: 4.38

Title: SOME NOTES ON FIXED INCOME

Speaker: STEPHEN A. ROSS,
Massachusetts Institute of Technology

Importance: Why this matters:

This model is presented as an alternative to the Cox, Ingersol Ross (CIR) and Heath, Jarrow, Morton (JM) models. It provides testable implications, and has the potential to better describe the behavior of interest rates.

Investigation: "Speaker analyzed XXX data to address the questions yyy, zzz, etc."

The model is a simple stationary model of the fixed income market and uses it to provide simplified proofs of some old results and obtain some new ones. It uses Ross' Recovery Theorem to derive the unobserved probability distribution of fixed income returns. In the model, the stochastic discount factor (pricing kernel) is the return on a hypothetical "long bond" (30 – 50+ years). In addition, the model provides some new results on the character of yield curves.

At this point the model has not been tested using empirical data, but Ross thinks it has great potential for developing interesting and useful conclusions.

Innovation: Are there new techniques of interest in the data or approach to the problem?

Certainly original thinking but provides little empirical information in its current state.

Insights: 1-2-3, what are the three most important things the speaker offered?

1. Ross prefers this approach to the standard continuous time CIR model. The model provides testable implications for the fixed income markets. Importantly, their "long bond" is a useful construct. It simplifies many existing results, and points to some new ones.
2. The yield on 30-year Treasuries is not a good surrogate for the unobserved "long bond".
3. Ross points out that interest rates were around 5% in Babylonia and are close to that value 5000 years later. Suggesting there is some long-term stability in interest rates. That is consistent with his model, not necessarily in the others.

Audience rating: 3.91