Using Public Television's "Trillion Dollar Bet" As A Primer On Financial Risk

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ABSTRACT

In this special topics classroom discussion/ project, the financial management issues of systemic and model risks are examined, the Efficient Markets Hypothesis is analyzed, and the emerging field of Behavioral Finance is introduced. This interactive approach of having students respond to a list of instructor-prepared discussion issues/questions during the showing of the video is a great break from courses that are straight-lecture in orientation. The potential to require a follow-up assignment where students act as market participants in a virtual financial market on www.pbs.org adds to the interactive nature of the project.

INTRODUCTION

Learning the basics of financial risk is essential for all Business students, especially for those that choose to pursue careers in financial management. The relevance of the topic of financial risk is also due, in part, to its relationship to the large number of corporate scandals in capital markets occurring over the past several years. Long Term Capital Management, Barings, Ltd., and Enron are all firms that experienced bankruptcy or near-collapse due to their mismanagement of financial risk. The timely issues of accounting transparency, corporate governance, and ethics play a large role in these scandals and help illustrate the breadth of the problem. These financial scandals have implications for corporate managers and policymakers, present and future, so business students need to learn about the measurement, and management of, risk taking in capital markets.

Finance professors seek to teach how risk is measured, then managed in financial markets. The calculation of risk allows a manager to make more accurate risk versus return tradeoffs that are the essence of their decision-making. While basic risk measurement tools (statistical measures, CAPM, APT) are often covered in the Principles of Finance course, more sophisticated tools are covered in advanced courses such as Financial Markets, Investments, and Finance Theory. Specifically, the Black/Scholes Option Pricing Model (OPM) is one of most sophisticated, yet widely used, risk measurement tools covered in advanced courses today. Since both undergrad and MBA students often struggle to understand option pricing, it is helpful for professors to develop a more interactive approach to teaching the topic.

One way that the authors have found successful in getting students involved in learning about the measurement and management of financial risk is the use of a one-hour public television special (PBS) on NOVA (a science series on PBS). "Trillion Dollar Bet" is a discussion with two Nobel Prize-winning economists whose mathematical models to predict risk brought them both worldwide acclaim and then disgrace. The video traces the history of the formation of the Black/Scholes Option Pricing Model (OPM) and discusses its use in the operation of financial market hedge funds. It is case study, of sorts, of risk measurement in financial markets and a great example of what happens when the measurement models fail. The case of the Long Term Capital Management (LTCM) scandal of the late 1990s is profiled with interviews with several principles of LTCM. Zvi Bodie, Paul Sammuelson, Myron Scholes, and Robert Merton all discuss the development of the OPM and its practical application in financial markets worldwide, especially in the operation of capital market hedge funds (See Appendix A for a summary of the contents of the video).

This paper will provide guidelines and suggestions for using the video of the NOVA special during your classroom coverage of option pricing. Teaching notes are provided for professors interested in using the one-hour television special as an interactive student project/in-class case study and discussion and includes a reading list of background articles that may be assigned as preparatory reading for students. The paper is organized as follows: First, a discussion of the risk/return tradeoff and efficient markets hypothesis, second, an explanation of the concepts of systemic and model risks in financial markets, third, a discussion of the role of the financial transparency and corporate ethics in recent capital market scandals, and lastly, complete teaching notes for the 1-2 hour class session.

THE RISK RETURN TRADEOFF AND FINANCIAL MARKET EFFICIENCY

The video shows (see summary in Appendix A) that traders in financial markets must constantly weigh risk versus reward in making purchase and sale decisions. The focus of Trillion Dollar Bet is the activities traders undertake in the assessment of risk and how they often seek ways to minimize these risks using financial derivatives. It has long been argued that the use of derivatives is one of the driving forces of efficient pricing in these markets.

The general notion of weak-form market efficiency (see Fama, 1965 and Grossman, 1980) is that past price patterns are not exploitable in current markets since all relevant information is already reflected in today's financial market prices. However, many market participants, especially traders, often believe there are price patterns to exploit in order to earn returns more than commensurate with risks taken. It is important for students to learn that the finance theories that we teach them in financial management courses are not always relevant to traders' decisions. It is also instructive for students to debate wide range of relative efficiency in various capital markets. A specific discussion of the Efficient Markets Hypothesis as it relates to portfolio strategies of hedge funds is a good introduction to the LTCM collapse.

We like to discuss the role of derivatives from both a hedger's, and a speculator's perspectives so that students understand specifically how option contracts are used and why the valuation of these contracts helps traders in making decisions. A review of the seminal works in option pricing helps students see the "beauty" of the theoretical construct (Black and Scholes, 1973; Merton, 1973; and Smith, 1976). As mentioned in the "Teaching Notes" section of the paper, students can also review the basics of the OPM on the www.pbs.org/stockmarket.

SYSTEMIC AND MODEL RISKS IN CAPITAL MARKETS

Two specific types of risk in financial markets that are relevant to the video's coverage of the LTCM scandal are the concepts of *systemic* and *model* risks. Systemic risk relates to the risk of collapse of the financial system as a whole. This is why the "too big to fail" doctrine exists in the U.S. banking system. That is, financial regulators will attempt to rescue a large financial services firm that experiences severe financial difficulties which threaten the financial system. This is what happened when LTCM 's extensive use of leverage led to Federal Reserve concerns that other financial markets and institutions were in danger if LTCM collapsed. The GAO office report ("Long Term Capital Management: Regulators Need to Focus Greater Attention on Systematic Risk", 1999) summarizes,

"LTCM was able to establish leveraged trading positions of a size that posed systemic risk, primarily because the banks, and securities, and futures firms that were its creditors and counterparties failed to enforce their own risk management standards".

If systemic risk was the result of the LTCM scandal, model risk was the cause. As Derman (1996) summarizes, "When you build a valuation model of any type, you are implicitly assuming that the objects of your concern are *causally related* to each other, and that the relationship is *stable,* at least for the time that you intend to apply the model". In this way, model risk could be due to the use of an incorrect model or the incorrect use of the correct model (aka, *managerial* risk), the natural limits of the approximation scheme, or due to the use of historical data that are not a good estimate of future value. In reference to a model's natural limits, Alan Greenspan (1998) remarked during the LTCM crisis, "How much dependence should be placed on financial modeling, which, for all its

sophistication, can get too far ahead of human judgment?" [1] The newfound interest in *Behavioral* Finance relates also to the limits of mathematical financial models. Here, model risk can occur when investor behavior, which is not a factor in financial valuation models, has implications for market prices.

THE ROLE OF FINANCIAL TRANSPARENCY IN RECENT CAPITAL MARKET SCANDALS

The relative lack of corporate financial disclosure and accounting transparency played a role in the financial scandals surrounding Barings, Ltd., LTCM, and Enron. The collapse of each of three was borne in their financial risk taking in derivative markets, and much of this risk exposure was not disclosed to the stakeholders of these firms. Recent regulation such as the Sarbanes-Oxley Act of 2002 was passed in an effort to reform corporate financial reporting and restore confidence in the U.S. capital markets (Homer, 2003). This act is now leading to vast changes in the corporate governance of American corporations.

One of the reasons why established financial models may have been used so frequently by investors and corporate managers is that their risk taking was masked by the lack of adequate financial disclosure. This disclosure would help ensure accountability for risky financial market positions taken by the major players in the derivatives markets. But, disclosure of financial data is a matter of degree. Stiglitz (2002) asserts that with perfect information – an assumption by many economic/financial models- these scandals may have never occurred. This is because with perfect information, shareholders would have likely punished corporate officers for taking undue risks.

TEACHING NOTES FOR USING TRILLION DOLLAR BET TO TEACH STUDENTS ABOUT FINANCIAL RISK

To keep the flow of the class moving and limit interruptions, we cover four main foci for student discussion, beginning with Focus 1 before the start of the video and ending with Focus 4 after the conclusion of the showing. This leaves only two occasions to stop the tape for discussion breaks. The discussion questions under each foci are referenced to a specific segment of the video (segments are outlined in Appendix A). There are many methodologies to using the questions and the video in the classroom. For example, some professors may prefer to not stop the video at all during the showing and use the questions only as pre- or post-showing discussion points. We prefer stopping the film at breakpoints to talk about the contents, but do limit those breaks to just two as mentioned above. For classes that are longer in duration than the normal 75-90 minute block, allowing students to access the virtual market on the public television web site and make several trades to experience financial market participation first-hand adds to the experience.

The video covers four major themes that are each covered in the video, all of which relate directly to topics taught in a variety of Finance courses.

Focus 1: The Basics Of Financial Risk And The Efficient Markets Hypothesis

Discussion Questions: [1] What are derivatives? Why are they called derivatives? Give two examples of derivatives and explain why each qualifies as a derivative. (The website for "Gambling on Derivatives", www.ex.ac.uk/, contains information on derivative terminology and related information on financial scandals). [2] Swaps, currency futures, and commodity futures have all been used to manage investment risk. Describe each of the above. [3] Give an example of how risk in equity markets may be eliminated by hedging using futures contracts.

Time: Before the start of the video

Student Interactive Component: Have students examine a trader's lexicon on www.pbs.org/wbgh/nova/stockmarket.

[1] See http://mt.sopris.net/mpc/finance/ltcm.html for a good collection of summaries of news articles and quotations about the LTCM scandal.

Focus 2: The Option Pricing Model

Discussion Questions: [1] Describe options in equity markets and their relationship to insurance policies. How could an option be used to control risk in financial markets? [2] Describe each of the determinants of an option's value and how each may affect the option's price: stock price, strike price, volatility of the underlying asset, maturity date, and risk free interest rate. [3] Describe the basic notion of dynamic hedging as explained in the video (the use of opposite positions, equities and options, for example, on a continuous time path). [4] Describe why eliminating the risk variable by dynamic hedging expedited the development of the option pricing model by Black and Scholes.

Time: After the conclusion of part V in Appendix A

Student Interactive Component: Go to www.pbs.org/wbgh/nova/stockmarket and See the Black /Scholes mathematical model for pricing options. The formula can be discussed in conjunction with Question [2] above.

Focus 3: LTCM Case Study: A Discussion Of Model And Systemic Risks With Hedge Funds

Discussion Questions:

CORE FINANCIAL ISSUES - [1] Define both *Systemic* and *Model* risks in financial markets and tell how each of these two risks relates to the LTCM scandal. [2] Define "Managerial" risk in as it applies to derivatives markets. How does this issue apply to the downward spiral of LTCM? [3] Discuss the following quote from the tape in the context: "The act of predicting equity prices makes equity prices less predictable." [4] John Meriwether of LTCM, in response to whether he believed in Efficient Markets, replied, "I make them efficient" (Warde, 1998). What do you think he meant by that response?[2]

RELATED ISSUES - [5] Are there ethical issues related to the LTCM collapse? If so, what is the most important one? [6] Should financial risk taking such as that taken by LTCM managers be curtailed (i.e., regulated) by the U.S. Government? [7] How should financial risk taking be handled by the corporate boards and governing bodies of firms using derivatives? [8] What do you think is the major lesson learned regarding the "rocket science" approach taken by LTCM to investing in financial markets?

Time: After the conclusion of Part VI in Appendix A

Focus 4: Behavioral Finance

Discussion Questions: [1] According to the video, can human judgment, intuition, and business savvy be replaced by mathematical models in financial markets? [2] What was the most important assumption in the dynamic hedging model of Black. Scholes, and Miller? How did the financial turmoil of the early 1990s around the world affect this assumption? (Normal behavior of markets and returns to historic trends were expected). [3] Is human behavior conducive to mathematical modeling?

Time: After the conclusion of the video (after Part VII in Appendix A)

Interactive Student Project: Go to www.pbs.org/wbgh/nova/stockmarket and have students play a virtual market. Students can engage in both stock and options transactions.

[2] A LTCM case study by Shirreff states: "Meriwether was renowned a relative value trader. Relative value means (in theory) taking little outright market risk, since a long position in one instrument is offset by a short position in a similar instrument or its derivative. It means betting on small price differences which are likely to converge over time as the arbitrage is spotted by the rest of the market and eroded."

SUMMARY AND CONCLUSIONS

In this special topics classroom discussion/ project, the financial management issues of *systemic* and *model* risks are examined, the Efficient Markets Hypothesis is analyzed, and the emerging field of Behavioral Finance is introduced. This interactive approach of having students respond to a list of instructor-prepared discussion issues/questions during the showing of the video is a great break from courses that are straight-lecture in orientation. The potential to require a follow-up assignment where students act as market participants in a virtual financial market on www.pbs.org adds to the interactive nature of the project.

This Session teaches two "hot" topics that students are reading about in the popular and academic press: financial market risk and corporate governance. We have found that the student discussions also bring a much richer understanding and appreciation of option pricing, a perennial "tough read". The session has been successfully used in both graduate and advanced undergraduate courses. The overall reason why we feel this project session is so valuable is that it gives students a good sense of how and why wholesale practical application of academic theories is sometimes perilous. It shows the limitations of some applications of established financial management theories, a topic that many professors rarely emphasize.

Copies of the video of the special presentation can be purchased from public television for twenty dollars at www.wbgh.org/shop.

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APPENDIX A: OUTLINE OF THE VIDEO'S CONTENTS

1. Introduction: an overview of financial markets, the Chicago Mercantile Exchange, and the life of traders on the Exchange that are trying to beat the market. Most traders say that their assessment of risk relates to "gut" instincts rather than mathematical models.
2. Turning Finance into a science (hence, the NOVA series relevance): Although market practitioners usually scoff at mathematical theories developed by academicians, OPM showed the potential to forever change the way traders trade in financial markets. Zvi Bodie discusses the difficulty of predicting market prices for market participants. Also, Merton Miller discusses the application of mathematical theories in analyzing financial markets.
3. Paul Sammuelson discusses price randomness and the creation of the idea of a stock option by a French scientist that was studying a mathematical model of market fluctuations. However, the problem of placing a value on an option remained for decades until several American economists began trying to solve the option valuation problem in the 1960s.
4. Myron Scholes discusses his work with Fischer Black in the late 1960s to develop a model that would consider all the major factors that contributed to the risk/price of an option contract. Black and Scholes found that "dynamic hedging" could be used to eliminate the uncertainty of stock price movements (i.e., increases and decreases in a stock's price could be cancelled out and could now be accounted for).
5. Robert Merton discusses his use of continuous time mathematics to further refine the work of Black and Scholes after studying the work of a Japanese mathematician. The resultant reformulation of the Black/Scholes early option pricing work led to the 1977 OPM as we know it today. The Black/Scholes Option Pricing Model was a breakthrough in the study of risk versus return in the stock market since risk was previously considered to be uncontrollable and unanalyzable. The video then discuses the current use of derivatives in financial transactions and the birth of an entire derivatives industry. This industry was borne as traders began to make money in financial transactions that use the models developed by academicians.
6. The formulation of LTCM: In 1994, a "dream team" of financial scientists (two of which are profiled in the video) and investment banking "superstars" formed a hedge fund to apply the theoretical work of the option pricing model creators. Catering to wealthy investors with $10M, 3-year, minimums, LTCM raised $30B to invest using dynamic hedging portfolio management strategies. After their first three years of spectacular returns (1994: +20%; 1995: +43%; 1996: +41%; 1997: +17%), a change in the market dynamics due to the Asian Financial Crisis in 1997 led to losses for LTCM by 1998. The losses eventually led to a Federal Reserve bailout orchestrated by Alan Greespan (who discusses the crisis in this segment of the video) and his top lieutenants. LTCM was closed in 1999.
7. Implications for investor in efficient markets: In this summary, there are several points made that are a great compliment to a professor's teaching of financial market theories. Specifically, market efficiency is often a matter of degree. The successful use of option pricing models by LTCM led to copycat investing techniques and strategies by other market participants. This left the hedge fund less able to exploit pricing discrepancies/inefficiencies that their models identify. In the end, "it is people that drive financial markets, rather than mathematical theory". In other words, in markets there will always be room for judgment, meaning that a theory of human behavior is needed for robust financial models.