

**Organizations' Control of Their Market Actors: Managing the Risk of Government
Bond Traders****

By

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Abstract

Risk management is an issue of great concern for financial institutions especially following the many scandals of the 1990s. Investment houses dealing with volatile financial markets such as foreign exchange or government bonds find it difficult to maintain "proper" levels of risk taking. On the one hand they encourage their traders to take risks but they also promote risk aversion since maintaining their reputation as careful and solid investors is considered to be their most important asset.

The firm's traders operate as market actors whose decisions in the market affect the firm while at the same time they are being affected by the controls and incentives the firm uses. This paper develops a framework that examines the reciprocal relations between the traders and their supervisors and analyzes the effects of reference points on the traders' risk taking. Qualitative data based on interviews and observations as well as quantitative data on real purchase and sell decisions made by government bond traders of a large investment bank are used to test the hypotheses. The results show that risk management is a reciprocal process, that avoiding losses is more important than gains, that daily profits and losses affect subsequent risk taking and that in the fourth quarter traders engage in strategic behavior that may be detrimental to the profitability of the firm. Implications for risk management are discussed.

Introduction

The dramatic increase in fixed-income activities during the 1980s has changed the financial industry, which found itself starring in books and movies of what eventually was termed the decade of greed (Lewis, 1989). Several of the instruments that were initially developed as means of risk management and hedging against risk turned out to be instruments for profit making as well. These presented both opportunities and threats to financial institutions and the issue of risk control and risk management became very salient (Crouhy, Galai, and Mark, 2001).

The problem of control has worried the financial industry, which has periodically come up with different ways of attempting to control risk, including developing financial measures that help analyze, monitor, and manage risks. One such measure is the “value at risk” measure (e.g., Jorion, 1997), which provides a statistical definition of the amount of liquid assets a financial institution needs to have in order to hedge against potential risks. While the regulation of risk in commercial banks using such measures has been successful, the downfall of one of the most admired hedge funds, Long Term Capital Management (LTCM) led to growing concerns suggesting that financial institutions should look also at a variety of other sources of financial risk, including operational risk and risk attributed to the human factor.

The human factor has been one of the more difficult risk elements to control. Abolafia (1996: 18) quotes a trader who said, “You trade for your own account” (1996: 18). This quote points at the problematic aspects of risk control. Since traders are described as being motivated by greed and working in a loose organizational framework, how can their firm exert control over them? A number of firms have suffered from lack of control over their traders in several incidents that have been described as scandals or fiascoes. Perhaps the most famous is the story of Nick Leeson, who took very risky positions on Japanese futures, which eventually led to the demise of the 250-year-old-Barings Bank, but Leeson’s case was not unique. A major cause of the downfall of Salomon brothers in the early 1990s was lack of sufficient controls. Major problems due to inappropriate controls of traders occurred in the 1990s in Kidder, the Daiwa Bank, Sumitomo Bank, BCCI, and in 2002 in the Irish Bank, to name a few.

One aspect that makes controlling risk-taking in financial institutions increasingly difficult is the speed with which financial transactions are executed these days. The advent of information technology has led to the escalation of both the volume of trade and the speed of trading. Zaheer and Zaheer (1997) examined patterns of information seeking by traders in trading rooms worldwide using data on one day's interactions by currency traders on the Reuter's dealing system. They found that "alertness," which they defined as superior patterns of information seeking in the network and speed of response is associated with greater influence in the market. When transactions become so fast and when humans are involved in executing such transactions, both naïve errors and opportunistic behavior should be attended to. Studying the ways traders operate may provide some insight into the characteristics of the behavior of such market actors and what can be done both to help them succeed and to control undesirable behavior. Thus far, however, research on traders has not provided a detailed enough analysis of how they manage risk so as to understand how the organizations that employ them can control that risk. One such control mechanism is the incentive organizations provide traders with when they are successful and the penalties they levy on them when they fail. The present study addresses these issues.

Traders are professionals who work as market actors in representing organizations such as investment banks, hedge funds, and other financial institutions. The finance literature has examined the behavior of traders through the lens of aggregate market prices but has not devoted much attention to studies of the actual behavior of traders or market makers. Only a few such studies were conducted with a focus on traders' behavior and characteristics. Canoles et al. (1998) used a survey to examine the behavior of speculators in commodity futures markets. Based on the responses of some 73 individuals who traded through the services of brokers in Alabama, they concluded that while these speculators win more frequently than they lose, they are net losers in dollar terms. For the individuals they studied, winning (rather than losing) on a particular trade was more important than the amount of the win or loss. Silber (1984) examined the behavior of scalpers in futures exchanges and demonstrated that the time horizon under which such scalpers work is very short. Heisler (1994) studied the behavior of traders in the futures markets and found that they were much more concerned with losses than with gains.

Glick (1957), in a study of the behavior of futures traders in the Chicago board of Trade, used an anthropological approach to examine information flows and network formation among traders. His extensive study documented the social structure of the market where traders exchange information to get a better sense of the uncertainty facing them. Zaloom (2003) examined the ways traders make sense of price changes. Since those numbers change almost continuously, traders often talk to each other to understand or create a meaning for such instantaneously price movements.

Risk Taking and Control in Organizations

Organizational theorists classify controls into three categories: market, bureaucratic, and clan control (Eisenhardt, 1985; Ouchi, 1980). Market controls can affect the behavior of organizational members in financial institutions directly or indirectly through shareholders evaluation of their performance. For instance, CEOs whose performance leads to a drastic decline in their firms' market value may be asked by shareholders to resign. Bureaucratic control is achieved by the rules an organization sets to regulate the activities of its members. Clan control leaves organizational control of its members to the organizational participants themselves. In the financial industry, a partnership is an example of such a mechanism. In the years preceding the initial public offering of Goldman Sachs shares, its partners held most of their capital in the firm and thus kept a close eye on each other to prevent anyone from taking reckless risks. The larger the corporation, the less it can rely on clan control and the more difficult it is to trace market manifestations to faulty or malicious risk taking or decision making by the firm's managers. The saga of such organizations as Enron shows that even when signals about the deterioration of the company were around for some time, the eventual and devastating (financial) market response was delayed.

Risk management should be examined from a wide perspective, considering issues in the behavioral and social sciences, not only from technical financial accounting aspects. As the example of corporations like Enron show, relying on financial and accounting measures as a panacea without considering the nature of the human operator may not suffice. In the case of the risk management in financial institutions, studying both the behavioral and the organizational aspects of risk taking and risk control may provide a

better understanding traders' behavior. To that end, both cognitive and incentive aspects of traders' work should be examined. McNamara and Bromiley (1997) studied risk assessment by bank managers in making decisions on commercial lending. They found that those assessments were biased by both cognitive and organizational variables. When these two sources of bias contradicted each other, they found that the organizational factors, primarily in the form of organizational incentives, play a stronger role than the cognitive factors. Risk assessment is therefore more susceptible to organizational factors than judgmental biases. This finding suggests that the most salient characteristic of risk in organizational settings is its consequences in terms of success and failure. Furthermore, what generally distinguishes success from failure is the achievement of a certain benchmark; performance above which is considered as success whereby performance below it is defined as failure. The ways performance benchmarks are set in organizations are therefore of importance in attempting to understand how the potential consequences of success and failure affect risk taking.

The controlling aspect of performance targets is a central feature of the behavioral theory of the firm. Cyert and March (1963) proposed that organizations set aspirations based on their own past performance and the performance of other reference firms and modeled aspiration formation as a linear combination of both these variables. There are variations, however, in how firms combine their past performance, their rivals' performance, and general economic conditions in setting future goals. Bromiley (1991) modeled risk taking by organizations as a function of past return on assets and aspirations for return on assets. Miller and Chen (2004) studied risk taking by successful and poorly performing firms and examined the effects of proximity to bankruptcy using a sample of manufacturing firms. In an empirical study of the radio broadcasting industry, Greve (1998) posited that both historical and social aspiration levels affect organizational risk taking. He demonstrated that organizations take into consideration their past performance as well as the performance of rival firms in setting performance targets. The above studies used aggregate data on samples of firms to make inferences about the reference levels that firms use to set aspiration levels. However, these studies did not examine empirically the target setting process at the firm level of analysis. To get a sense of it one may need to examine the processes that occur inside firms. Once those processes are

described, their effect on traders' risk taking behavior, through the eventual delineation of success and failure, can be examined.

Target Setting and Risk Management

Risk that traders are allowed to take is usually set through monetary limits on outstanding positions as well as setting certain rules and limits on trades, but these rules and limits can vary across an organization and can be a subject to negotiation. The idea that target setting in a company is an outcome of a negotiation between different parties is a central theme in the behavioral theory of the firm (Cyert and March, 1963). Due to domain specialization in the nature of work, general rules and incentive schemes need to be adjusted for different market actors. For example, sales targets for traveling salespersons working for the same company are often adjusted to reflect the specific conditions in different regions. Similarly, lending limits may differ among branches of large commercial banks. A manager of a large commercial bank's branch in Manhattan is authorized to approve higher loans than a counterpart who is managing another branch of the same bank in a remote area of Brooklyn. Their sales goals may also be different, taking into account the number of potential clients, the accessibility of their business to clients, and so forth. These variations and risk management rules open the possibility for input into the process by market actors. When the task environment is the same for different market actors, rules can be reinforced in a unified way and all goals can be similar, but variations in the task environment make such a policy hard to implement. When there is heterogeneity in task contexts, market actors have an opportunity to modify the goals and the risk management rules as they apply to them. Consequently, even if the official goals of the firm do not change, the operational goals regarding the activities of the market actors may be modified in practice. Garud and Van De Ven (1992) showed how operational goals at the 3M Corporation were negotiated and renegotiated over time. A similar negotiation process is evident in Davis and Useem's (2002) description of corporate governance as a matrix in which the relations among shareholders, board members, and top managers determine the eventual goals that the company pursues. But when market actors have input into setting goals, risk management becomes more problematic.

While market actors' annual goals are set by management, monitoring the daily performance that reflects those goals as they are handed down to smaller units is more difficult. How would a supervisor evaluate the equal average performance of two traders, one of whom makes a big profit on one day followed by a big loss on the next and another who suffers a small loss followed by a small gain? It often turns out that high variation is not appreciated much in financial institutions where high variations can lead to losses.

An additional element that complicates risk management is the fact that market actors are usually more knowledgeable than their supervisors about the characteristics of their environment. The fiascos of Joseph Jett at Kidder and Nick Leeson at the Barings Bank were made possible, in part, by the fact that their superiors did not know enough about certain aspects and the inner working of the trading domain of these traders. The situation is one of asymmetrical information, that is, market actors who have unique knowledge about their domain may come back to their supervisors and change the targets that were set for them by arguing that the environment is different from what it was when the original goals were set. The dynamic nature of the environment in which traders work, coupled with the asymmetrical information about immediate changes in their domain of activity allow them to have an input into the process of performance monitoring and evaluation. In investment banking firms, annual goals are set separately for different departments. More than that, firms are concerned with being profitable and avoiding being losers. Therefore, departmental and individual profit and loss figures get recorded and tracked continuously so that the firm is not put at jeopardy due to careless trading. Thus, limits on trading parameters are set primarily with regard to the maximum loss traders can post in a day. However, the volatility of government bonds prices is so high at times that huge losses can occur at the very end of a day, even for experienced traders. Applying a penalty to a trader who exceeded the amount of "allowed" loss on one day but made more gains (in absolute dollars) on the preceding day is a bit awkward, especially if the trader is an experienced professional who can provide a good excuse for the negative deviation from his or her expected performance. Since incentives are awarded on an annual basis, applying a strict penalty policy (i.e., firing or suspending) based on daily

performance deviations is not practiced unless losses are very high. Thus in practice, traders have inputs into the target setting process. This should not be taken as an argument that superiors don't have means of controlling the traders. Obviously, behavior that leads to very serious losses is punished but given the limitations discussed above, superiors are resorting to setting and enforcing rules of behavior rather than focusing solely on the measurement of daily performance.

Hypothesis 1. Organizations operating in volatile financial environments are likely to emphasize rule following rather than base risk management solely on performance measurement.

Risk taking toward the end of the year

The time of annual performance evaluation in organizations does not necessarily reflect a need for evaluation due to the performance of the firm at large. For instance, a firm can make an investment in October in a certain year and expect profit from this investment in six months. Yet, annual reports for shareholders are usually due at the end of the calendar year. Many managers engage in what is known as “window dressing” activities (Lakonishok et al., 1991) so that annual reports would make stakeholders happy. DeGeorge, Patel, and Zeckhauser (1999) argued that corporations have strong incentives to manage their earnings so that they exceed three thresholds: they are expected to report profits, sustain recent performance, and meet analysts' expectations. They tested their model on earnings of over 5000 firms for the period 1974-1996 and concluded that while all three thresholds are important, the profit threshold is the dominant one. Assuring that performance exceeds such a threshold is innocuous at times but can involve actions that detract from the firm's real business activity at other times.

The behavior of organizational market actors is similar; when the end of the year with its anticipated bonus decisions is approaching, they engage in strategic behavior. Such behavior means that if market actors reached profit levels, they behave cautiously when the evaluation time is near. In contrast, if their position shows losses, they may take risks in an attempt to reach the positive domain that would make them eligible for a bonus. Taking such risks may also lead those market actors to greater losses.

Hypothesis 2. As the end of the year approaches, market actors whose portfolio shows profits shun risks while those portfolios show losses are more inclined to take risk so as to increase the chances of getting a bonus.

The Effects of Success and Failure on Risk Taking

Studies of professional managers in financial institutions show that incentives have an effect on risk taking. Chevalier and Ellison (1997) discussed the conflict between mutual fund investors and mutual fund managers that arises because investors would like the firm to maximize risk-adjusted fund returns, while fund managers want to increase the fund's value and so have an incentive to increase the inflow of investment money. Such increased inflow creates an incentive for them to increase or decrease the riskiness of the fund as a function of the fund's year-to-date return. In addition to the salience of profitable performance, the downside portion of the performance distribution also affects organizational market actors, that is, the implications of failing to reach positive levels of performance. Bonuses are paid as a function of performance and may go up in a non-linear manner where very high performance may be compensated on a higher rate. However, if performance falls far below into the losses domain, some organizational market actors may be dismissed. A statement by a vice president of a large commercial bank illustrates this point. When asked if there are arrangements in his organization that penalize for risk taking, he responded by saying, "There are no penalties, except if you take risk and you guess wrong. . . you might get fired." (Shapira, 1995: 57).

Classical theories of risky choice make the assumption that individuals make choices so as to maximize their utility. The idea that a reference point affects individual choice under risk was introduced by Markowitz (1952) and in Kahneman and Tversky's (1979) prospect theory. Bowman (1982) and Fiegenbaum (1990) were among the first management researchers to argue that the reference point proposed in prospect theory affects firms' strategic decisions. Prospect theory assumes that the status quo provides a natural reference point, but other reference points such as an aspiration level may also play such a role. March and Shapira (1987) observed that managers use two reference points when they think of risk. One point is an aspiration for performance; the other, a point signifying survival. Managers are more inclined to take risks when they are faced

with failure to meet goals than when those are achieved. Executives also tend to take riskier actions when their own positions or jobs are threatened than when they are secure. Nonetheless, most managers feel that survival should not be risked, and most would not take risks that could jeopardize the survival of the firm. They also realize, however, that if a competitor threatens the market position of the firm, they have to take one of two risks: adopting new risky strategies or not surviving if they take no action.

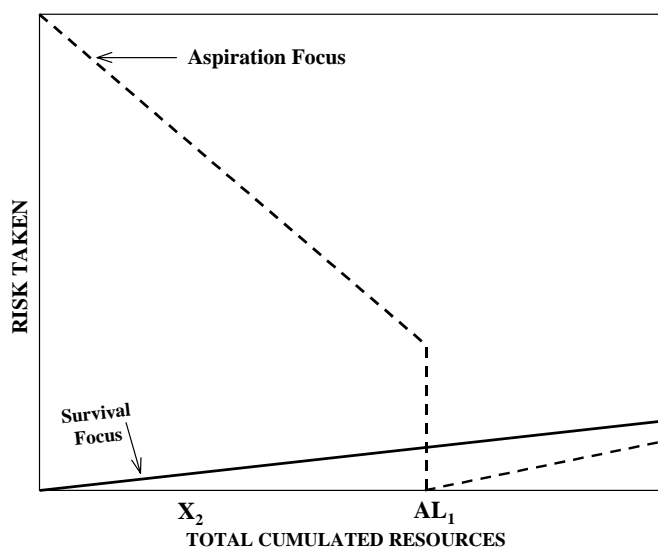


Figure 1. Risk as a function of cumulated resources for a fixed attention focus.

March and Shapira (1992) developed random walk models of risk taking in which the decision maker considers two reference points: an aspiration level for resources that adapts to experience and a fixed survival point where resources are depleted. Risk taking is essentially a realization of a series of independent draws from a normal performance distribution of possible outcomes. The distribution is assumed to have a fixed mean and a variance that changes in time. Each realization ends with either success or failure that changes the risk taker's resources. The decision maker selects the bet size at every step and risk taking is controlled by two simple rules: The first rule suggests that when resources are above the focal reference point bet size is set so that in case of failure

resources would not fall below the focal reference point. The second rule applies when resources are below the aspiration point on which the decision maker is focusing. In this case, the bet size is set so that in the case of success, resources will surpass the aspiration level. Risk-taking is sensitive therefore to (1) the risk taker's resources relative to the survival and aspiration level and (2) whether the risk taker's focus is on the survival reference point or on the aspiration level reference point.

Two basic risk functions are plotted in Figure 1. They show risk taking directly as the standard deviation of the performance distribution and are not utility functions. The function starting from the origin, which is marked by the solid line, assumes the risk taker focuses on survival, which is assumed to be fixed. Risk taking increases monotonically with resources. The second function depicts risk taking while focusing on the aspiration level, which can change. Thus, there is a family of such functions for different aspiration levels. The two functions described in Figure 1 are specific functions reflecting particular parameter values and should be viewed as representing a class of models (see March and Shapira, 1992).

The question of how much risk will a decision maker take once she has suffered a big loss is not simple. A possible implication of prospect theory is a risk seeking response because the decision maker is in the domain of losses. However, Kahneman and Tversky (1979) cautioned that responses to large negative deviations from the reference point might be more complex and may lead to different responses. An alternative implication can be derived from the threat-rigidity framework (Staw, Sandelands and Dutton, 1981) suggesting that following a big loss, decision makers might respond in a risk averse manner. March and Shapira's model integrates these two perspectives by suggesting that the decision maker's focus affects the choice. It may depend not only on whether the prior outcome is considered as a reasonable or as a very large loss but also on which of two benchmarks, "success" or "survival," emerges as the relevant reference point for the next decision.

Performance and its consequences are very salient in organizations. In particular, life in organizations is marked by the rewards and penalties that people receive and by those that they expect to receive. A financial analyst who attested to the strength of the relations between performance rewards and penalties commented, "Being the only analyst to recommend a certain stock, if you're right it singles you out as a star. If you are wrong, it

won't be forgotten" (Shapira, 1995: 56). Managerial risk taking is affected not only by the outcomes of decisions but also by the ramifications of these outcomes and decisions. Examination of the setting and changes of aspiration levels in organizations is therefore embedded in the particular context in which risks are taken and decisions are made. The higher a decision maker is above her aspiration level the larger bet sizes she can take. The lower she is below it the larger bet size she will take when focusing on it and attempting to get above it.

Hypothesis 3. The further away from the aspiration target the performance of traders is the more risk traders take while focusing on this point.

A major aspect of prospect theory's value function as well as the model depicted in Figure 1 is the asymmetry between gains and losses. The pain inflicted by losses is higher than the pleasure derived from a similar amount of gain. This asymmetry has been demonstrated in many studies, including studies on financial investment. Traders are professional investors whom one may expect to be immune to such feelings. Even though professional investors were shown to be more rational than amateur investors the above asymmetry enabled Shefrin & Statman (1985) to detect the disposition effect, which is the tendency to hold on to losing stocks longer than winning stocks. The disposition effect characterizes the behavior of professional investors as well (cf., Shapira & Venezia, 2001). These findings suggest that both traders and their superiors are more sensitive to losses than they are to gains.

Hypothesis 4a. Negative deviations from performance aspirations lead to more risk taking by traders who focus on reaching that point than traders whose performance exceed their aspiration points.

Traders who focus on their aspiration level tend therefore to take larger bets when they fall below it. However, very large losses can lead to different consequences; losing a lot of money can lead to negative consequences such as dismissals. The ideas of the threat-rigidity (Staw et. al. 1981) and a focus on survival suggest that response in such a case may

be different. Traders who lose a lot of money may switch their attention focus from the aspiration point to survival and drastically reduce their risk taking.

Hypothesis 4b. Extreme negative deviations from performance aspirations lead traders to focus on survival and to take small risks.

Risk Taking in Government Bond Trading: A Field Study

The government bond trading market is an appropriate context in which to examine the ways in which incentives and controls affect risk taking among traders. Although financial textbooks (e.g., Sharpe, Alexander, and Bailey, 1999) analyzed the major variables underlying the valuation of bonds, only scant attention has been given in previous research to analysis of the behavior of traders or market makers. Yet specialists at the New York Stock Exchange, scalpers in futures markets, and government bond traders use their judgment in arriving at decisions. Conceivably, if markets are efficient, such judgments may be inconsequential, as those who have faulty judgment may be "eliminated." This may not fully characterize the situation in the trading profession. Traders in such firms operate in very dynamic, high-risk environments. Sometimes they work under real time pressure similar to the short decision time horizons described by Silber (1984) in his analysis of scalpers' behavior. Holding positions for a long time on a certain security may be detrimental, as shown in 1987, when a mortgage backed securities trader held a position for a long time without disclosing it to his superiors. The brokerage firm claimed that the position led to a loss of a few hundred million dollars (Stevenson, 1995).

Top management of such financial institutions aim at maximizing profits and minimizing risks. The management of risk requires striking a delicate balance between risky and conservative actions. Understanding the model underlying traders' behavior may allow their superiors to control excessive risk as well as encourage prudent risk taking. Since incentives and penalties play a major role in guiding the behavior of employees in such institutions, this study examines the ways in which they affect traders' risk-taking.

Methods

Research Site and Study Design

The study was conducted in one of the 10 largest investment-banking firms on Wall Street in the spring of 1990 and lasted for some 8 months with repeated visits and interviews over the next two years. The firm is active in all forms of financial services, including equity, fixed income, and foreign currency trading. This study focused on the behavior of government bond traders. The data were collected in three forms: observations, interviews, and analyses of actual trading records. The study was conducted in three phases. In the initial phase a site visit and interviews with key officials were held. In the main study, observations were conducted and trading records were collected. In the post study stage, three additional site visits and interviews were held with traders and managers as well as interviews with traders and supervisors in other similar firms. These post study interviews continued for many years.

The U.S. Treasury Market

The U.S. government bond market is a gigantic over the counter market consisting of networks of independent dealers. U.S. treasuries are auctioned to some 40 primary dealers who later sell them to large institutions and to large broker-dealer firms. The latter resell the securities to smaller institutional investors and to the public. The secondary market for U.S. treasuries is active after the close of the market, although about 95 percent of the trading occurs during New York trading hours, approximately from 7:30 AM to 5:00 PM (Fleming and Remolona, 1999). Although summary indexes, like the Dow Jones Industrials index for stocks, are not easily available, Fleming and Remolona (1999) report that in 1994 dealers traded an average of \$125 billion per day, \$67 billion with customers and the rest with other dealers. The size of the market is huge and is surpassed only by the volume of trade in foreign currency. About 90 percent of the trading is done through an inter-dealer-broker market, which means that trading is done via networks organized by the different brokers.

Dealers firms trade the government bonds by using these networks. At the time of this study, six major brokers had organized this trading activity in an over-the-counter market. Every brokerage firm provides the dealers and other large customers with proprietary electronic screens that display information on the securities they are dealing with. Direct phone lines between the brokers and the dealers are used to conduct the actual trading. This decentralized network of brokers and dealers allows the buyers and sellers of any security to remain anonymous, their identity being known only to the broker who arranges the deal. Once a deal has been arranged over the phone, cash to cover the cost of a purchase is transferred the next day to the broker, who then transfers it over to the seller.

Research in finance on fixed-income securities has increased dramatically in recent years, although research on the microstructure of the fixed income arena is much smaller than the comparable literature on equities. Umlauf (1991) argued that there is an information asymmetry between primary and secondary dealers because the latter are permitted to trade with only a subset of brokers. Fleming and Remolona (1999) examined the response of the spread of public information on prices of bonds in the secondary market and proposed and tested a two-stage model. In the first and relatively brief stage, public information, usually in the form of macroeconomic news, leads to an increasing gap in the bid-ask spreads and a decrease in the trading volume.

Trading volume surges, while price volatility and the widened bid-ask spreads persist in a prolonged second stage that follows a little later, allowing the market to absorb the information before those indices go back to their normal levels. Longstaff (2002) found a large liquidity premium associated with Treasury bonds when he compared them with bonds issued by U.S. government agencies, which are effectively guaranteed by the U.S. government. While theoretically the price gap that he found (up to 15% of the value of the Treasury bond) seems very high, Longstaff (2002) concluded that it is an indicator of the value consumers put on the liquidity associated with the standard Treasury bonds (rather than those of government agencies).

Data Sources

Observations. To get acquainted with the nature of work of the traders I went to the trading floor to observe their behavior. In the initial stage I made some observations and

interviewed the more senior managers. During the data collection stage I visited to the trading floor 6 times and stayed there for about three hours each time. These traders are seated in a large trading floor where other traders, who trade municipal and corporate bonds, also have offices. They use computer terminals on which information is displayed. Traders observe the prices of bonds they specialize in (specialization is determined by maturity dates of the bonds) and respond to requests by salespersons (representing clients) seated in another section of the same large room. Traders can also execute buy and sell decisions using funds allocated to them by the firm. Traders who trade solely for the firm are called proprietary traders. In the firm where this research was conducted and in the industry at large, traders are compensated by a base salary plus an annual bonus that depends on their performance. Annual performance appraisal is carried in early January for performance in the previous calendar year, and the ensuing coveted bonuses are paid in February. In the year preceding the study, a sales agent seated just one row behind the traders, got a bonus close to \$2 million and a couple of the traders got bonuses close to \$1 million each.

Interviews. I held repeated interviews with 10 traders, the head of the Government Bonds trading desk, the head of the Zero Coupons desk, the head of the Corporate Bonds trading desk, the Executive Vice President for Risk for the entire company and 4 senior vice presidents in the financial services group. Each interview lasted from half an hour to an hour. The interviews were held during working hours and interviews with the traders were held in a small conference room near the government bonds desk. Interviews were interrupted occasionally when the traders were called by their assistants who observed their monitors during the interviews. Interviews with managers were conducted in their offices. In conducting the interviews I asked the interviewees to describe their work and then to define risk and risk taking. Subsequent questions asked about the relation between risk and control, the relations between success, failure and risk and the effects of incentives and penalties on risk taking. In addition I asked the traders about the degrees of freedom they had in trading and asked their supervisors about the control measures they employ and the effectiveness of these actions.

Repeated interviews were held with a few traders and managers during the three years following the first interviews stage. In these interviews I inquired again about the way they defined risk. I also asked about changing conditions in the market since the advent of electronic communication and information flow led to decreasing margins of profitability. I also asked again about the way incentives and penalties affected their behavior.

In the post study stage I interviewed a few traders and managers and I also interviewed traders and managers of government bonds trading desks who worked in other firms, to get a sense of the generalizability of the findings to the industry at large.

Transaction Data. The data represent the entire trading and transaction records of some 20 government bonds traders, over a period of three and a half months, from late June to mid October in 1990. All in all, the data include about 400,000 transaction records. The data for each transaction comprise the details of the particular security, the time of trade, the price at the time of transaction, the face value of the position, the dollar value of the position the trader had, and the profit and loss (P&L) of the trader from the transaction. On their computer screens, traders are provided with information on the positions of the different bonds they hold. They can easily see whether they have made a profit or a loss on the security they hold or sold short. Prices get updated whenever a buy or sell decision is executed. In addition, traders can update their positions any time they wish. When traders update a position following a recent trade done by others on the same security, the updating is recorded as a transaction record.

Traders start each day with a display showing their opening positions, namely, the closing values of the prior trading day. Changes in the values of these positions, such as buy or sell decisions (by them or others) are recorded and a profit or loss figure is calculated following each transaction. Due to the possibility of high losses, traders are required to provide their supervisor with a printout of their positions at the end of the trading day. In addition to information about their own holdings, traders enjoy a variety of other information on display such as information from the New York Stock Exchange, currency markets and futures and options markets in Chicago. Some traders observe information on as many as eight computer screens simultaneously. Summary statistics for equity markets in terms of the prices and volume of trading are provided by such indices as

the Dow-Jones Index or the S&P 500 index. No volume of trading figures are provided for daily trading of government bonds, but several companies provide their aggregate price index, one such index that of has acquired reputation as a leading indicator of the government bonds market is the Lehman Bond Index.

Analyses

Descriptive Aspects of Traders' Work

At the time the data were collected in the study there are about 250 to 300 Government Bonds traded on the market, and traders specialize in trading different bonds based on their maturity dates. In this firm, trading bonds was divided into four time ranges: 0-2 years bills, 2-5 year notes, 5-10 year notes and 10-30 years bonds. Within each specialty grouping traders could hold a portfolio of fifty or sixty securities, but most of them did not hold more than 30 at the time of the study.

The bond traders are provided with all the data they need in real time. The feedback they get from their own decisions is instantaneous. The availability of these data, coupled with other analyses carried out in their firm implies that they should be familiar with the normative theories of finance. Indeed, in the interviews they described the knowledge required for being successful traders and most said that they have good knowledge of and education in both economics and finance; however given that they traded government bonds, knowledge of macroeconomics was especially valued. Given their knowledge in finance, they spoke about risk in terms of volatility, rather than only as downside risk. They noted however, that given the structure of their compensation, the risk in their job was more of a downside risk. They also voiced firm ideas about the correlation between risk and return. On the other hand, since they work with data, which are virtually continuous in time, and since their profit and loss figures were recorded at the end of each day and each trader's personal P&L was set to zero every morning, the latter served as a natural reference point, which affected their trading decisions.

The working day at the Government Bonds Trading Desk starts with a meeting early in the morning where they conduct a general analysis of the market and then set a general strategy for the day. Each trader has limits on the amount of money he can hold in securities that he buys (called long positions) as well as obligations he makes (i.e., selling

short). At the end of the trading day each trader has to report on his outstanding positions (both long and short) to the Head of the desk.

Controls and Risk Management

The firm trades government bonds to make profits. It is clear to management that since price volatility is very high in this type of trading, losses can occur. The task of the head of the government bonds trading desk is to maximize profits and to prevent losses that loom large in the eyes of top management. He executes his task by encouraging the traders, through their incentives, to take prudent risks on the one hand and by monitoring their behavior on the other. It is clear that monitoring the traders in a continuous manner is impossible and counterproductive. Therefore, the head of the government bonds trading desk and the executive vice president for risk management require that traders submit their positions at the end of each trading day. These managers are also on the look for performance deviations, primarily with regard to big losses.

The report of every trader consists of their raw positions in terms of the face value of each of their positions and the monetary value of each of these positions. The head of the desk and the executive vice president for risk management go over the reports and examine the exposure of long positions, short positions, the gross exposure by adding it up and the net exposure by subtracting the short positions from the long. They also adjust all positions for the time dimension by calculating duration-weighted exposures and by transforming all positions to a common measure, which can be the 10-year notes. However, all these are variations on the major theme, which is the basic exposure determined by the positions the traders hold.

Setting Risk Limits on Traders. In practice, the management of risk consists primarily of setting exposure limits on the traders, that is, limiting the total amount of the long and short positions they can take. The head of the desk also said that most of the time traders are staying with their positions instead of buying and selling and he has to encourage them to be active. However, he set limits on the amount of the dollar amount of the positions they can have. These limits are set according to a few criteria the first of which is the product the trader is dealing with. For instance, there is more volatility and

risk the further away the maturity date is. The second criterion is the experience the trader has and the third criterion is the trader's track record in terms of his success and failure.

The set limits reflect the fact that the firm that was highly leveraged at the time. Consequently the AAA rating the firm had at the time was the most important concern of top management. As the head of the desk put it: "Top management is very conservative; they are concerned with losses much more than they care about winning, this is a tough asymmetry to deal with." Given the concerns of top management, he attended first of all to preventing losses. While he described himself as employing a flexible control policy, he set the maximum amount of loss per trader to \$25,000 per day. This was the first red flag. The second red flag was a loss of \$50,000 and in such a case more explanations were needed, not only at the desk level but also at a higher level. If such a loss occurred he, as the head of the desk had to explain it to management. However, despite these two "flags" he said that he used different thresholds before he intervenes. "Those thresholds may be flexible unless of course there is a substantial loss. I usually let the traders explain what they do. A large loss is something else and I spend a good deal of time to find out if the loss occurred out of negligence, poor judgment or careless risk taking. The consequences are in line with the cause and going out of limits with no initial approval or good justification may lead to dismissal."

In addition to monitoring losses he monitors the age of the positions the traders hold. While "insurance" is often done by hedging positions, another "insurance" aspect in this market is its liquidity. If you hold a security that appears to be on the decline, you can usually sell it. If a position on a security has not changed in a long time it may indicate a difficulty of selling it. Thus, the head of the desk scrutinizes routinely positions that have not changed over a long period of time. In particular, if a trader is holding on to a position for 30 days he quizzes him at length about it. If a trader holds a position for 60 days he requires that the trader write a full page describing his rationale for holding the particular security so long. "This usually does it," he commented, "most traders don't have the patience to write a full page and they end up selling the security."

Qualitative Analyses

Risk Control by Monitoring Performance and by Rule Enforcement. The head of the desk emphasized the importance of following the limits and the rules of trading set for each trader. “I am not averse to risk taking” he said, “but I am averse to surprises.” The trading limits are very important since if they are not kept, management can lose control. In an interview held a year after the transaction data in this study were collected, he provided the following story to illustrate the importance of trading limits. “On the Friday following Thanksgiving Day, financial markets are open but the volume of activity is usually low. On that Friday, I went out of town. Around 2 p.m. I got a call from a trader who sold short a large amount of 10 year notes that morning hoping to buy such notes at a lower price later in the day. Yet, the market was thin and he couldn’t do it successfully. He called me to ask for my advice and to acknowledge getting out of his trading limits in doing that deal. I told him to do nothing, but immediately thereafter called my deputy and told him to hedge the position against a potential loss. The next Monday, when the trader came in I fired him on the spot. I did so not because of the potential loss, although I was worried about it, but because I couldn’t afford to let that trader continue working once he broke the trading limit by a large amount without asking for permission.”

The above action was not used frequently but it underscores the importance of rules. It was a loud rule violation by a trader who went out of bounds. Of course, it is not certain what would have happened had the trader been successful in liquidating his position and not calling the head of the desk that day. How many such unreported incidents happen throughout a trading day is unclear.

Traders acquire specific knowledge on the domain of their activity and their superiors often lack much of their knowledge. The Executive Vice President for Risk Management in the company said: “You cannot conduct risk management in a technical manner. Traders always know better the specific procedures and tricks they engage in.” Thus, he makes a habit to spend time with them on a daily basis. He regularly comes to talk to

them at lunch, and often has drinks with them in a bar after work. Personal relations with the traders are an important way to find out more reliably how they are working and learn about the good ideas and the tricks they use. He finds information about positions they mis-marked to hide their losses, and mistakes they did in trading. Risk management according to him is different than cutting the risk. In his words: “What you do is not blow the whistle but alert the person, if a good trader like Jack takes a daily loss of more than \$25,000 this is still fine. If some inexperienced trader get out of their bounds, it is a more serious issue.”

The traders echoed the ideas voiced by their supervisors. Several traders had positions with losses over \$25,000 during different days but they attempted to and recovered most of them. Still on about 9% of the days of the period when the data in this study were collected there was at least one trader with a loss exceeding \$25,000 at the end of the day. The trader who is considered to be the best lost one day \$170,000, and in his interview said that one day during the year prior to the date when the interview was conducted he actually lost \$400,000 in one day but he added, “they took it well.”

Monitoring behavior according to rules is therefore an important aspect of risk control. However, in practice rules are not enforced automatically, except if the deviation from a rule is extreme. In most cases the firm uses monitoring and questioning and this allows the traders to have an input into setting performance goals. This is due to the fact that there is tremendous uncertainty and ambiguity in the market. Due to the ambiguity negative daily performance deviations may be interpreted at times in different ways. Traders can be very good at coming up with explanations for their bad outcomes. In addition, they can engage in behavior so as to game the system by mis-marking their positions. For example, a trader who is long on a particular security that he bought in the morning but whose price has dropped significantly below the purchase price during the last hour of trading can mark this position with the price that prevailed before the big drop. By mis-marking this position, his account will not show a loss at the end of the day. He can hope that the price will rebound back in the next morning so that the “temporary” loss will not be noticed. Of course if he marked his position properly and the price did bounce back the next day his cumulative P&L would be the same, however, if he hid the temporary loss by mis-marking his position, he would have spared the scrutiny and

questions of the head of the desk. Since risk managers are trying to prevent large losses they search for rule violation because they believe it can lead to large losses. Recall that the head of the desk commented that he was averse to surprises. He also added: “Surprises almost always lead to big losses.”

Finally, in commenting on situations at the end of the year when annual bonuses decisions are made, the Head of the desk also added that “Those traders can be quite good at arguing with you about their performance during the year especially when they did not according to expectations. They can sway you to consider all kind of issues as to why they did not reach the goal, and since the goal is a range of expected profits rather than one number, at times they can succeed in their arguments.” Having said that the Head of the desk pointed again at the importance of rule following as a major tool of risk management. “My major concern is on avoiding losses and making sure that the traders follow the rule and produce no surprises. Haggling over bonuses is less of a problem especially if we made profits.”

Risk Taking in the Fourth Quarter. Annual performance evaluation in the firm is conducted in early January and covers the prior calendar year. The evaluations have immediate consequences in terms of the remuneration of traders. Those who were successful are almost certain to get a bonus in line with their performance. Those who failed are not going to get a bonus and those who failed significantly may even be fired. These anticipated consequences affect the way traders take risks in the last quarter and primarily in the month of December. In the interviews I held with the traders they acknowledged their tendency to avoid making big buys (or short sells) in that period if their cumulative P&L is positive. As one trader put is: “If I am ahead, that is, if my P&L is positive in the month of December, especially toward the end of the month, I attempt to play it low, that is, reduce my exposure. Why should I risk my bonus when I am ahead?” In response to my question of what happens when the head of the desk inquires about the drop in his activity he said: “I can always find some appropriate explanation regarding market risk and so on.” But, he added: “The head of the desk knows that he can’t push me much.” Another trader recalled the frenzy activity of one of his colleagues who accumulated losses in early December a few years earlier: “This guy traded like crazy, he

didn't leave his desk for a minute even when we all went out to lunch, he stayed at his desk and continued to trade." Eventually, this trader ended up with big losses and was dismissed from his job.

Other traders added that they start being more cognizant of their year to date performance in the third quarter. One of them said: "At the beginning of October I scrutinize my positions to figure out if I am doing well. In a sense it is the last period that I can act aggressively if I am ahead. Later that month I plan to get rid of positions that pose too much risk. I'd say that I start to be cautious sometimes in late October and more so in November and for sure in December." He added that if he is behind in October and even in November he will trade aggressively so as to try to improve his P&L. "If I am in the red in December I may be very aggressive." Another trader added "I am usually more aggressive in October than in December."

The head of the desk confirmed that traders behave strategically in the fourth quarter and particularly in December. He said: "I have to run around and encourage them to trade, most of the time they stay with their positions." While low exposure at the end of the day suggests that risk is under control, it may also mean that profit opportunities might have been ignored." He also said: "If traders are stuck with those positions most of the day, we have no chance of making money." At the same time he was very concerned about those traders who accumulated losses and agreed with the above statement that such guys may display frenzy activity: "In the month of December I am often on my toes pushing the good traders and worrying about the bad ones. My monitoring activities are at their peek. I understand the traders who don't want to jeopardize their anticipated bonus, but it doesn't make sense for the firm; we have to make money year round."

There appears to be some tension between the importance and salience of the traders' cumulative performance and their most recent performance. Bonuses are determined by annual performance yet, as one trader said: "True, but they will remember my most recent losses." While it is reasonable to assume that the cumulative performance is the more important element in performance evaluation, trader's overemphasis of the importance of their recent performance guides their actual risk taking behavior. A statement by the best trader on the desk helps underscore this issue. He said: "You are only as good as your last trade."

Quantitative analyses: The effects of Profits and Losses on subsequent Risk Taking

Profit and loss. The daily performance of the traders is measured by the profit and loss (P&L) figure at the end of the day. Traders' performance get tracked and recorded at the end of each day and in the morning of the next day their initial P&L gets set to zero.

Aspiration point. The definition of the aspiration point is important for separating success from failure. While bonus decisions are made based on annual performance the above discussion shows how salient daily performance was both to the traders and to their managers. The practice of setting the P&L to zero at the end of every day eventually defines the day as the frame of reference for performance measurement. The worry about losing money on a daily basis affected traders' behavior. As most have said in the interviews the goal that is driving them on a daily basis is to make profits and not losses. The more the profits the better and even though it was clear that the annual coveted bonus is evaluated by cumulative performance; the daily focus was on not losing money. Such short horizons for performance have been observed in analyses of investor behavior (Benartzi and Thaler , 1999). The aspiration point was set to zero in the following analyses.

Risk exposure. Daily risk taking is measured by the average monetary value of the securities the trader held on day $(t+1)$. The average holdings takes into account the buy and sell decisions the trader has made throughout the day as well as the securities he held from the prior day without buying or selling. The major aspect that defines risk for the company is the net exposure the trader had. It doesn't matter whether the trader had long or short positions on the securities. At the end of the day these amounts were added to obtain a measure of the gross exposure of each trader.

There are different ways to gage the exposure as a measure of risk. For example, one can look at the exposure at the end of the day. However, traders often engage in "window dressing" at the end of the day by mis-marking their positions. Some may reduce their exposure at the end of the day before going home so as not to worry whether the market (in Tokyo and London) will turn against them when they are not at work. It has been shown in

that day traders tend to close their accounts each day, and that traders in futures markets tend to close their contracts at the end of the trading day so as to go home with no worries. The average daily monetary value of the trader's positions appears to be a better indicator of risk taking because it describes the trader's risk taking activities throughout the day and is affected to a smaller degree by the end of the day strategies. The daily monetary values of the outstanding positions of each trader were averaged and the data reported in the analyses below is based on 880 trader days.

Control Variable: Lehman Bond Index. The bond market is affected by macro economic trends, which are in part an outcome of several political and social events. These events affect the entire market. To control for these effects I used the Lehman Brothers Index. The index is recognized as the broadest measure of the US investment bond market.

Profits, Losses and Subsequent Risk Taking

Means and standard deviations of the main variables are presented in table 1.

Table 1

Descriptive Statistics: Daily amounts per Trader (in dollars)		
Variable	Mean	S.D.
Average monetary value of securities	24,924,746	15,562,865
P&L	10,531	88,731
Positive P&L	31,822	44,130
Negative P&L	-28,425	45,898
Small losses (upper 3 quartiles of negative P&L)	-9,740	9,165
Large losses (lower quartile of negative P&L)	-84,239	89,482

Test of Hypothesis 3. To test the effect of P&L on the subsequent day's risk taking, regressions of the average risk exposure on day $(t+1)$ were run on the P&L of day t . All the regressions reported in the following analyses were run as panel data with fixed effects. This procedure controls for individual traders' characteristics that affect their risk taking but was not observed. This is achieved by including a trader-specific dummy variable, or fixed effects, in the analyses. In addition, due to the fact that profit and loss were recorded on a daily basis and since the goal of traders was to avoid ending with daily losses, zero losses (and profits) were taken as the aspiration level in the following analyses.

According to Hypothesis 3 deviations from the aspiration level lead to higher risk exposure on the next day. This is true for both positive and negative deviations. Thus, risk exposure on day $(t+1)$ was regressed on the absolute P&L of day t . The regression took the following form:

$$(H3^*) \text{ Risk Exposure}_{(t+1)} = \alpha + \beta |P\&L_{(t)}|$$

The regression resulted in an (absolute) coefficient for P&L that is significantly different from zero in support of hypothesis 3 (See column 1 in Table 2).

Test of Hypothesis 4a. The interviews with the traders provided strong evidence that they perceived the importance of negative and positive performance deviations differently. The model suggests that focusing on aspiration leads to different risk taking than focusing on survival. An initial test of Hypothesis 4a was carried by regressing risk exposure on the prior day's P&L which was divided into positive and negative in the following way:

$$PP\&L = \begin{cases} PP\&L = P\&L & \text{if } P\&L > 0 \\ PP\&L = 0 & \text{otherwise} \end{cases}$$

$$NP\&L = \begin{cases} NP\&L = P\&L & \text{if } P\&L \leq 0 \\ NP\&L = 0 & \text{otherwise} \end{cases}$$

Where PP&L is positive P&L, and NP&L is negative P&L. The resulting regression took the following form:

$$(H4a^*) \text{ Risk Exposure}_{(t+1)} = \alpha + \beta_1 \text{PP\&L}_{(t)} + \beta_2 | \text{NP\&L}_{(t)} |$$

The results are presented in the second column of Table 2.

Table 2

Variable	Model		
	(1)	(2)	(3)
Absolute P&L/1000 (N=880)	.372*** (.055)	-	-
Positive P&L/1000 (N=569)	-	.674*** (.089)	-
Negative P&L/1000 (N=311)		.079 (.092)	-
Positive P&L/1000 (N=569)	-	-	.896*** (.091)
Small losses (upper 3 quartiles of negative P&L, N=233)/1000	-	-	5.499*** (.423)
Large losses (lower quartile of negative P&L, N=78)/1000	-	-	.083 (.087)
Leham Index/10 ⁵	1.583* (.801)	1.908* (.971)	1.927* (.983)
Constant/10 ⁶	7.572 (6.140)	3.110 (6.132)	2.193 (5.571)
No. of Observations	880	880	880
R ²	.189	.201	.205
F test for inclusion of fixed effects	9.07***	9.63***	9.22***

* $p < .05$, ** $p < .01$, *** $p < .0001$

The coefficients (in their absolute value) of the regression of model 2 were compared and the coefficient for positive P&L was significantly higher than the negative P&L coefficient ($t=6.95$, $d.f.=878$, $p<.001$). The latter was not significantly different from zero. This stands in contrast to hypothesis 4a that stated that more risk is taken following losses rather than profits. However, being in the negative domain is more complex than being in the positive domain. A possible explanation that emerged from the interviews is that large losses lead to different risk taking than small losses. The model suggests that decision makers focus on the reference point to which they are closer, thus small losses are likely to make the traders focus on the aspiration level while large losses may lead to focusing on survival. While there is no way to measure what reference point a trader was focusing on before making a buy or a sell decision, the interviews indicate that large losses lead to caution, namely reduced risk taking.

Test of Hypothesis 4b. Recall that the traders distinguished between losses and large losses as governing their behavior. To examine the effects of large vs. small losses, negative P&L was split at the 25 percentile of the negative domain. That is, the lowest quartile of losses was defined as large losses while the upper 75% of the losses range was defined as smaller losses. Risk exposure was then regressed on the following three variables (in addition to the control variables): (1) Positive P&L (defined as above). (2) Large losses defined by multiplying the relevant P&L by 1 if it belongs to this domain (i.e., the lowest 25% of the negative P&L domain) and zero otherwise (that is, any P&L value that is in the upper 75% of the loss domain or positive P&L was coded as zero). (3) Small losses were defined by multiplying the relevant P&L by 1 if it was a part of this domain (that is losses in the upper three quartiles of the loss domain) and zero otherwise (i.e., large losses as defined above or positive P&L). The variables in the regression were defined as follows:

Positive P&L (PP&L) was defined as:

$$PP\&L = \begin{cases} P\&L & \text{if } P\&L > 0 \\ 0 & \text{otherwise} \end{cases}$$

Small losses P&L (NP&LS) was defined as:

$$NP\&LS = \begin{cases} NP\&LS = P\&L & \text{if } (1^{\text{st}} \text{ quartile } NP\&L) < P\&L \leq 0 \\ NP\&LS = 0 & \text{Otherwise} \end{cases}$$

Large losses P&L (NP&LL) was defined as:

$$NP\&LL = \begin{cases} NP\&LL = P\&L & \text{if } P\&L < (1^{\text{st}} \text{ quartile } NP\&L) \\ NP\&LL = 0 & \text{Otherwise} \end{cases}$$

The resulting regression took the following form:

$$(H4b^*) \text{ Risk Exposure}_{(t+1)} = \alpha + \beta_1 PP\&L_{(t)} + \beta_2 | NP\&LS_{(t)} | + \beta_3 | NP\&LL_{(t)} |$$

The results of the regression are shown in the model 3 column of Table 2. The picture that emerges from this regression indicates that behavior in the negative P&L domain is not homogeneous; small losses lead to increased risk taking that is higher than risk taking in the positive P&L domain ($t=-19.06$, $d.f.=800$, $p<.0001$), while large losses lead to very cautious behavior. Indeed the coefficient of the large losses variable is not significantly different than zero. The results of the third model help explain the non-significant coefficient of the regression for the negative P&L in Model 2. It is possible that the large losses drove down risk exposure and dominated the effect of the small losses.

Discussion

Risk management is a great concern for financial institutions fueled mainly by the trading scandals of the 1990s many of which were attributed to rogue traders. The more recent accounting scandals attributed to faulty and biased reporting procedures complicates the problem even further. Faith in the professionalism and ethics of financial institutions on Wall Street has significantly deteriorated. At the same time competition became fiercer due to advancements in information technology that make profit margins

much smaller. The rapid information flow and the speed in which transactions are executed in financial markets make it more difficult to correct for naïve errors and opportunistic behavior of traders. Newly developed risk measures such as the value of risk provide early warning signs but cannot guarantee proper risk control. Finance scholars started to look into organizational aspects such as operational risk in an attempt to get a better handle on controlling risk (Crouhy et. al. 1999). Sociologists turned into conducting anthropological studies of trading to get an understanding of the ways interpersonal networks within markets (cf. Zaloom, 2003) Management researchers have examined the ways traders seek information patterns and how the speed with which those are detected lead to more influence in global financial markets (Zaheer and Zaheer, 1997).

The research reported in this paper differs from most past studies in that it focuses on the firm level. It examines the behavior of a firm's traders who operate as its market actors when they interact with the market while at the same time being controlled by their firm. Through buy and sell decisions those market actors affect the firm and at the same time they are affected by it through the controls and incentives that the firm sets. Those market actors span the interface between the firm and the market and controlling these traders is a delicate task. On the one hand firms worry about the outcomes of careless risk taking but risks need to be taken to make profits. This delicate task is usually carried through a combination of controls and incentives. Setting limits on positions the traders can take deals with the former; the latter is managed through the bonuses awarded to successful performance. On the face of it these seem as simple and straight-forwarded practices. After all they are based on clear numbers; the position a trader has taken is recorded both at the firm and with the broker who handles the trade and the profit or loss associated with it is defined by the market price. In practice however the analyses reported in this paper show that profit and loss, which are the most important outcomes of traders' actions, could be interpreted in different ways as success or failure, depending on the benchmark that is selected.

The analyses point at a few findings. First, while controls are based primarily on position limits, continuous monitoring and interaction with the traders is deemed necessary for proper control. Through those interactions the executives in charge of risk

management learn from the traders. Risk control seems therefore more like a reciprocal process rather than just monitoring rule following.

Second, losses are more important than profits since losses could damage the firm's reputation and its AAA credit rating. In addition, top management doesn't like volatility in profits because it assumes that steadily rising profits are perceived better by potential clients even if low volatility may be associated with lower average profits. Attaining positive profits was found by Degoerge et. al. (1999) to be the most important goal managers have which lead them to manage their firms' earnings. An emphasis on positive profits with an extreme aversion to losses makes it difficult to encourage prudent risk taking by the traders. The dilemma faced by the executives in charges of risk management was echoed by the head of the desk who said: "traders are on the firing line." He also added that he and the executive vice president often approach top management to convince them to be more flexible about losses by allocating some funds as a sort of "insurance" against losses. They said that these efforts were not successful.

Third, there is tension between cumulative and daily performance. The theory of the firm states that firms should maximize their long-term value. In practice, firms need to measure daily risk exposure to guard against potential extreme losses. The worry about hidden old positions was after all the impetus for the new era of tight control of traders on Wall Street. In 1987 Howard Rubin, a mortgage back securities trader for Merrill Lynch has hidden a position for a long time and was accused by the firm of causing a 377 million dollars loss (Stevenson, 1995). It was this incident that made investment banks search frantically for information systems that would allow them to control their traders continuously. A consequence of the new controls mechanisms was the emergence of the day as an important time frame for performance evaluation by the firm and for the traders' evaluation of their own performance. The analyses show that daily performance significantly affected the traders' risk taking behavior.

Fourth, the time period close to the annual evaluation and bonus decisions proved important in affecting the traders' risk taking. Even though one can understand the inclination of traders who do well in the fourth quarter not to jeopardize their bonus, it makes no sense that a mundane organizational practice such as performance evaluation of individual employees should be a potential detriment to its profitability. It should be

noted that both traders and their supervisors behaved rationally given the incentive structure and top management risk attitudes. The problem resides in the relationships between traders and their supervisors, between the latter and top management and between top management and the board. It is a system wide issue where inputs from different levels should be considered in reshaping the incentive system in the firm at large.

Finally, could these problems be specific to the firm that was studied? While the study was conducted in one firm it encompassed an entire department and the findings appear to be generalizable to similar departments in other financial institutions. Obviously more data about trading should be collected to validate the potential generalizability; in the absence of such data the interviews conducted with traders and managers in other similar firms over the years provide support for it.

Implications for Risk Management

Risk management of market actors in volatile financial markets is a complex task. During the period of the study the government bonds trading desk had gross outstanding daily positions of some 500 million a day and close to a billion dollars on some of these days. The focus on daily performance and the worry about losses seems natural especially since profit margins have been shrinking all the time. In the years that passed since the data was collected I conducted interviews with traders in other firms and the problems analyzed in this paper seem to be the same. Controlling for opportunistic behavior by (some) traders will always be a genuine concern of management to grapple with. An arrangement that appears to solve part of the problem was adopted recently in some firms where the bonus is calculated in early January and handed out only in April. This “five quarter” bonus system is applicable in desks that trade options so as to guard against traders who make some questionable buy and sell decisions in late December that may prove to be very bad a few months later. Other firms play with the idea of paying bonuses based on performance through a different month, like October. Such solutions often emerge after a certain trader found a way to make shaky sells or purchases without the awareness of his supervisors. Risk managers in financial institutions are going to be one step behind the “innovations” of rogue traders. The worry about the potential horrendous

consequences of undetected actions such as the upheaval caused by Leeson and the demise of the Barings bank will push risk managers to employ tight controls in the foreseeable future.

Research on financial risk indicators and operational risk measures can help and so can good incentive systems; but they are not going to eliminate the problems described in this paper. Risk management is a larger issue than a technical problem. Controlling traders is a managerial task that is embedded in a particular context where market actors operate in a very dynamic and fluid system. It is the understanding of the reciprocal linkages between them and their managers that can provide better understanding of how controls should be set. It appears that bureaucratic and market forms of controls have limited effectiveness in such a system. If a variation on the notion of clan control is going to be effective then behavioral studies that attempt to understand the underlying bases of traders' behavior as well as anthropological studies of the networks within and between organizations and markets may further provide better ideas about this delicate control task. Such possibilities should be examined in future research.

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