THE JOURNAL OF BEHAVIORAL FINANCE, 12: 29–40, 2011

ISSN: 1542-7560 print / 1542-7579 online
DOI: 10.1080/15427560.2011.555028

Prospect Theory and Risk-Seeking Behavior by Troubled Firms

Doron Kliger
University of Haifa

Iris Tsur
University of Haifa and The Technion[1]

We employ Prospect Theory (PT, Kahneman and Tversky [1979]) to explain the relationship between risk and return at the organization level. Our modeling approach addresses shortcomings in previous research approaches. We suggest an alternative approach for inferring the reference point, a key element of PT, and measuring risk, as well as a different representation of the risk-return association taking into consideration a timeline of the firm's state, its state dependent action, and consequences. Consistent with PT, results using COMPUSTAT data show that firms with returns above their reference levels take less risk than firms with returns below their reference levels.

Keywords: Prospect theory, Organization level, Reference point, Risk preferences, Strategic decision making

1. INTRODUCTION

Economic and financial research has been dealing with the risk-return tradeoff for decades, with Expected Utility Theory (EUT, Von Neumann and Morgenstern [1944]) as the main tool for analyzing decision making under risk. The conventional assumption of risk aversion, a basic premise of EUT, suggests a positive relationship between risk and return. Indeed, early empirical research at the organizational level supported this relationship. Nevertheless, while EUT explains many economic occurrences, a substantial body of evidence shows that decision makers systematically violate its basic tenets.

In 1979, Kahneman and Tversky presented a descriptive model of choice called Prospect Theory (PT, Kahneman and Tversky [1979]). Their model exhibits and explains some empirical results that violate EUT. In 1992, Tversky and Kahneman presented their Cumulative Prospect Theory (CPT, Tversky and Kahneman [1992]), extending PT to uncertain, as well as risky, prospects with any finite number of outcomes.

In the sequel, we focus on the properties of the value function advocated in PT and CPT. According to PT and CPT, decision making under risk or uncertainty can be viewed as a choice between prospects (gambles), where each prospect is assigned a certain value. The key elements describing the value function are: (a) The carriers of value are gains and losses, which are defined relative to a reference point or target level (e.g., Fishburn [1977], Fishburn and Kochenberger [1979], Laughhunn, Payne, and Crum [1980]) that serves as the zero point of the value scale to separate between gains and losses; and (b) The value function is concave for gains, convex for losses, being steeper for losses than for gains. This last condition is implied by the principle of loss aversion according to which losses loom larger than corresponding gains.

Though PT was developed to explain individual decision making, it was frequently employed on decision making at the organization level (e.g., Fiegenbaum and Thomas [1988], Chang and Thomas [1989], Fiegenbaum [1990], Miller and Bromiley [1990], Jegers [1991], Sinha [1994], Johnson [1994], Gooding et al. [1996], Lee [1997], Lehner [2000]). In particular, PT was used to explain organizational decision-makers' attitude toward risk, as reflected by the relationship between observed risk and return. This line of

[1]This research was carried out during Iris Tsur's Studies for MSc degree in Economics, in the joint program of The Technion and University of Haifa.

Address correspondence to Doron Kliger, Department of Economics, University of Haifa, Haifa 31905, Israel. E-mail: kliger@econ.haifa.ac.il

research has commonly focused on PT's propositions regarding the value function, based on the assumption that the value function has the most significant impact in determining decision-makers' attitude toward risk. The main research hypothesis was that decision makers in firms achieving returns above (below) their reference levels would exhibit risk aversion (seeking), reflected by a positive (negative) association between risk and return.

Previous studies estimated a firm's reference points and risk and return position based on the firm's time series of returns over the time period under study (usually 5–10 years). The underlying assumption in the approach taken by these studies was that a firm's behavior and situation are time invariant. In fact, the main criticism regarding this approach is that the use of the suggested measures may be appropriate only if the return distribution is constant over the studied time period. This criticism is especially noteworthy in the context of PT, as a firm's position relative to the reference level and, hence, its actions are state dependent. The main goal of the current research is providing an empirical setup designed to deal with this issue.

This research carries on the investigation of the relationship between risk and return using accounting measures, such as the return on equity (ROE) at the organizational level, based on PT propositions. Our research suggests an alternative representation of the reference point, which resolves the problems discussed above. We assess the relationship between risk and return, taking into consideration a timeline of a firm's state, its state-dependent action, and consequences. In a nutshell, we examine the influence of a firm's returns on its subsequent risk level, allowing thereby the firm's behavior to change over time.

The paper is organized as follows. In the second section, we review the developments in the related risk-return association literature. We review the main approach employed in previous research that implemented PT on organizational decision making, and describe the approach in our research and its major contributions. In the third section we elaborate on the logical sequence that led us to our main research hypothesis. In the fourth section we describe the database and empirical analysis, and in the final sections we present the obtained results and conclusions.

2. LITERATURE REVIEW

In the past few decades, research in business administration has devoted considerable attention to the relationship between risk and return. Most of the early literature dealing with risky choice behavior was developed under EUT assumptions. As discussed earlier, the combination of EUT and risk aversion predicts a positive relationship between risk and return. Indeed, earlier empirical research at the organizational level using accounting based measures, has reported a positive relationship between organizational risk and return, both at firm, as well as at the industry level (e.g., Conrad and Plotkin [1968], Fisher and Hall [1969], Coonter and Holland [1970], Hurdle [1974], Neumann, Bobel, and Haid [1979]).[1] As opposed to these studies, Bowman [1980] found a negative association between risk and return, in a study covering 85 industries (1,572 firms) over a period of nine years (1968–1976). Bowman referred to his result as a "paradox" since it ran counter to the by-then established empirical regularity of positive relationship between risk and return. He attributed it to two major possible factors. First, good managers may, simultaneously, increase returns and reduce risk. Second, managers may be risk seekers in some situations.

Bowman's observation of a negative risk-return relationship was detected in many subsequent studies. One research branch has tried to employ Bowman's first explanation for the phenomenon, namely, the possibility that a good firm management may achieve higher return and lower risk simultaneously, either by analyzing a firm's diversification strategy (e.g., Bettis and Hall [1982], Bettis and Mahajan [1985], Amit and Livnat [1988]), market power (e.g., Cool, Dierickx, and Jemison [1989]), or the effect of previous risk on the return (e.g., Miller and Bromiley [1990]). Another branch of research was based on Bowman's second explanation, that is, managers' two-fold attitude toward risk, mainly using PT (Kahneman and Tversky [1979]) and the behavioral theory of the firm (Cyert and March [1963], Singh [1986], Bromiley [1991], Miller and Leiblein [1996]). Our research belongs to the latter approach.

The PT explanation of the observed risk-return relationship was based on the s-shape property of the value function. The logical sequence yielding the research hypotheses is best described by Miller and Bromiley [1990]. They assume that every company has a target performance level that corresponds to its industry's mean performance, and that a pool of projects exists from which managers choose the projects they will undertake. The projects are evaluated on the basis of expected risk and return each would add to the company's overall position. Managers examine the risk-return position of their corporation under the assumption that the company will take on one of the projects and thus make a choice with respect to overall corporate risk and return. They explain that according to prospect theory, a firm with performance above the average for its industry should be risk averse and only willing to accept an increase in income stream risk if an investment opportunity offers high expected returns. The better the performance of a firm, the less willing it is to take an additional risk in order to increase its expected returns. Thus, when a high-performing firm does assume risk, it is a risk that promises high returns. Under prospect theory's assumptions, low-performing firms will forego expected returns to increase variance in returns, and the rate at which they make the trade-off increases as performance declines. The choice of high-variance projects increases the probability of obtaining a target level performance for below target firms. Thus, the lower a firm's performance, the more likely it is to choose a risky project with low expected return over a less risky project with higher expected returns.

Several studies (e.g., Fiegenbaum and Thomas [1988], Chang and Thomas [1989], Fiegenbaum [1990], Jegers [1991], Sinha [1994], Gooding et al. [1996], Lehner [2000]) found support to PT, that is, that firms below (above) the reference point exhibited a negative (positive) relationship between risk and return. Other studies found only partial support to PT by observing a negative relationship between risk and return for low performers (Bowman [1982, 1984], Johnson [1994], Lee [1997]) or no support at all (Miller and Bromiley [1990]).[2] The following section reviews the main approach employed in the indicated previous studies and describes the approach of our research and its major contributions.

2.1. Determination of the Reference Point

An important stage in implementing PT at the organizational level is defining the reference point. Kahneman and Tversky [1979] indicated that there is no general rule for deciding on such a definition. Nevertheless, they mentioned that the location of the reference point, and the consequent coding of outcomes as gains or losses, may be affected by the aspiration level of the decision maker. Most researchers who examined the risk-return association under PT assumed a common reference point at the industry level, usually measured by the industry median or mean of returns (Fiegenbaum and Thomas [1988], Fiegenbaum [1990], Miller and Bromiley [1990], Jegers [1991], Sinha [1994], Johnson [1994]).

This measure implicitly assumes that firms within the industry evaluate their performance relatively to each other. Fiegenbaum and Thomas [1988] and Fiegenbaum [1990] justified this selection by citing studies (Lev [1969], Frecka and Lee [1983]) finding that firms periodically adjust their performance and financial ratios to their industry means. Fiegenbaum [1990] reinforced this selection by pointing out articles and reports about firms' performance also take in consideration industrial performance. A more focused and updated support for the validity of industry benchmarks as reference level proxies may be found in Lehner [2000].

The vast majority of the cited above studies have measured the industry median (or mean) of returns by calculating this measure *over* the *time period* under study. This approach is appropriate, however, only if the expected return is constant over the period (Wiseman and Bromiley [1991], Lehner [2000]). Another shortcoming of this approach is the latent assumption that firms know the current industrial performance, although it is fully revealed only in the subsequent period. In other words, there is an implicit assumption that firms base their future risk attitude on a target level before it is realized.

Our research approach considers these two arguments and suggests an alternative determination for the firms' reference point. First, we calculate the reference point *annually* based on the industrial performance, and, second, we employ it only to a firm's decisions in the subsequent period. Our approach is common in financial statement analysis (e.g., Lev [1969], Frecka and Lee [1983]), in which firms' target returns are usually determined based on historical industrial performance.

A majority of the studies modeled the hypothesized relationship between risk and return according to PT by a linear relationship between risk and return, which was estimated separately for above and below the reference point (e.g., Fiegenbaum and Thomas [1988], Miller and Bromiley [1990], Fiegenbaum [1990], Jegers [1991], Sinha [1994]). Others have implemented a model that allows a curvilinear relationship (Chang and Thomas [1989], Gooding et al. [1996]). Our approach describes the relationship between risk and return using a weaker functional form while introducing the time dimension into the analysis. We elaborate on the selected functional form in the sequel.

3. SETUP AND TESTABLE HYPOTHESES

We track the following sequence: Firms evaluate their year t-1 returns relatively to the returns of the other firms in their industry and particularly relative to their reference point, which is determined as the industry median return at t-1. At the beginning of year t, each firm has to decide on its subsequent risk level, given its industry position (below or above the reference point). In accordance with the assumption above, a firm's risk level is measured as the distance between its realized return and the industry's median return at year t.

We hypothesize that firms with returns above (below) their reference point would take lower (higher) levels of risk, which will be expressed by a smaller (larger) return distance. The intuition under this hypothesis is that a higher risk offers firms the chance to achieve a larger positive return at the price of a larger negative return. Thus, firms that achieved a return below their reference point at t-1 are expected to take higher risk levels since, by doing so, they increase their chances to change their position from below to above the reference point. Formally, the research hypothesis is:

> Hypothesis: A negative association exists between firms' return positions within the industry (i.e., being below or above the industry median return at year t-1) and their subsequent risk level, measured by the distance between the firms' returns and the industry median return at year t.

4. DATA AND EMPIRICAL ANALYSIS

4.1. Data

The data were collected from Standard and Poor's COMPUSTAT database for the period 1987–2001.[3] This is a longer time span than used by the majority of the related literature and therefore represents a wider range of economic and environmental conditions. The sample was restricted as follows. Only firms with at least 10 years of data and belonging to industries that had at least 20 firm-year observations were included. As a filter, 3% of the total observations with the most extreme values were removed from the sample preliminarily to implement the restrictions. Nevertheless, regressions performed without filtering (reported as an Appendix) show qualitatively similar results. COMPUSTAT's four-digit industrial classification system was used for identifying the industry groups. This is a finer classification than the two-digit industrial classification used in several previous studies, for example, Bowman [1980], Fiegenbaum and Thomas [1988], Wiseman and Bromiley [1991], and Lehner [2000]. The total sample covers 41 industries and 2,068 firms. Tables 1 and 2 present the sample's descriptive statistics by industry and year.

4.2. Measures

The reference point for firm i in industry j in year t, $\text{Ref}_{i,j,t}$, calculated for each year separately, is the median of the firm's

TABLE 1
Sample's Descriptive Statistics by Industry

Ind No.	Ind. SIC	Industry Name	Firm-year Obs.	Equity (MM$) Min	Max	Avg.	Std Dev.	ROE (Decimal Representation) Min	Max	Avg.	Std Dev.
1	1311	CRUDE PETROLEUM & NATURAL GS	131.2	0.0	16, 335.0	356.8	1, 344.2	−2.89	2.68	0.05	0.39
2	4911	ELECTRIC SERVICES	118.4	8.5	12, 689.0	1, 604.6	1, 918.5	−2.60	1.60	0.12	0.14
3	6798	REAL ESTATE INVESTMENT TRUST	87.8	0.3	3, 427.0	194.8	340.8	−2.32	2.14	0.06	0.23
4	6021	NATIONAL COMMERCIAL BANKS	85.8	1.4	63, 453.0	1, 926.4	5, 035.5	−1.10	2.28	0.12	0.13
5	7372	PREPACKAGED SOFTWARE	84.5	0.1	47, 289.0	312.6	2, 070.5	−2.84	1.95	0.06	0.51
6	2834	PHARMACEUTICAL PREPARATIONS	83.6	0.1	24, 233.0	1, 070.7	2, 485.0	−2.98	2.53	0.09	0.51
7	4813	PHONE COMM EX RADIOTELEPHONE	75.1	1.9	103, 198.0	4, 122.4	8, 777.4	−2.17	2.00	0.13	0.24
8	4931	ELECTRIC & OTHER SERV COMB	63.9	13.4	8, 897.0	1, 325.1	1, 536.6	−1.74	0.42	0.11	0.12
9	5812	EATING PLACES	61.3	0.2	9, 639.1	206.3	898.8	−2.94	2.35	0.03	0.38
10	1040	GOLD AND SILVER ORES	51.1	0.2	4, 154.0	201.6	468.7	−2.92	1.40	0.18	0.45
11	3845	ELECTROMEDICAL APPARATUS	50.8	0.1	5, 509.5	91.8	339.6	−2.54	0.77	0.14	0.46
12	3674	SEMICONDUCTOR,RELATED DEVICE	50.4	0.3	37, 322.0	648.4	2, 781.8	−2.49	2.35	0.02	0.35
13	6331	FIRE, MARINE, CASUALTY INS	49.6	0.1	17, 451.0	1, 244.1	2, 324.2	−2.97	1.14	0.09	0.23
14	6022	STATE COMMERCIAL BANKS	47.1	2.5	10, 745.0	899.0	1, 579.3	−2.32	0.36	0.13	0.12
15	3663	RADIO, TV BROADCAST, COMM EQ	45.8	0.3	18, 612.0	532.6	1, 877.9	−2.13	1.58	0.01	0.34
16	7373	CMP INTEGRATED SYS DESIGN	45.7	0.1	4, 043.1	102.4	367.2	−2.83	2.91	0.06	0.47
17	4924	NATURAL GAS DISTRIBUTION	45.3	5.4	1, 612.1	273.0	288.7	−0.21	0.74	0.12	0.05
18	6211	SECURITY BROKERS & DEALERS	37.3	0.3	20, 402.0	886.0	2, 458.9	−2.31	0.97	0.11	0.23
19	2911	PETROLEUM REFINING	33.5	3.7	74, 346.0	7, 549.1	11, 476.2	−1.69	1.87	0.08	0.21
20	2836	BIOLOGICAL PDS,EX DIAGNSTICS	31.4	0.1	5, 217.2	177.6	481.9	−2.81	0.56	0.37	0.58
21	3661	TELE & TELEGRAPH APPARATUS	31.1	0.3	28, 760.0	559.5	2, 174.9	−2.83	0.76	0.05	0.44
22	2835	IN VITRO, IN VIVO DIAGNOSTICS	30.1	0.2	549.8	35.0	61.8	−2.87	1.05	0.28	0.53
23	7370	CMP PROGRAMMING, DATA PROCESS	30.0	0.3	42, 832.0	1, 135.7	5, 199.1	−2.58	1.67	0.13	0.58
24	3841	SURGICAL, MED INSTR, APPARATUS	29.6	0.2	4, 034.0	240.8	665.1	−2.82	1.66	0.05	0.45
25	1531	OPERATIVE BUILDERS	28.9	1.3	2, 276.7	240.6	321.7	−2.78	2.90	0.04	0.44
26	3312	STEEL WORKS & BLAST FURNACES	27.3	6.6	7, 997.2	780.8	1, 594.6	−2.17	2.48	0.03	0.33
27	3842	ORTHO, PROSTH, SURG APPL, SUPLY	27.1	0.1	1, 240.2	140.6	252.0	−2.56	0.87	0.01	0.38
28	3714	MOTOR VEHICLE PART, ACCESSORY	26.7	0.3	4, 208.0	534.1	826.6	−2.56	1.94	0.06	0.32
29	5411	GROCERY STORES	26.5	4.0	5, 915.0	660.6	931.7	−1.46	0.90	0.09	0.18
30	3576	COMPUTER COMMUNICATION EQUIP	25.5	0.3	27, 120.0	296.0	2, 072.9	−2.98	0.97	0.14	0.60
31	3679	ELECTRONIC COMPONENTS, NEC	24.3	0.1	5, 316.0	177.9	704.3	−2.10	2.23	0.00	0.34
32	8711	ENGINEERING SERVICES	24.0	0.4	425.4	50.3	83.2	−1.83	1.76	0.04	0.28
33	3559	SPECIAL INDUSTRY MACHY, NEC	23.9	0.5	7, 606.7	245.8	714.0	−2.02	1.25	0.00	0.37
34	3577	COMPUTER PERIPHERAL EQ, NEC	23.4	0.7	11, 784.3	551.4	1, 789.5	−2.09	0.99	0.09	0.42
35	3825	ELEC MEAS & TEST INSTRUMENTS	23.2	0.2	1, 764.4	97.8	214.3	−2.41	0.99	0.01	0.29
36	4213	TRUCKING, EXCEPT LOCAL	22.6	0.1	735.2	118.1	141.5	−2.02	1.90	0.09	0.24
37	7990	MISC AMUSEMENT & REC SERVICE	22.0	0.3	2, 510.7	194.2	363.6	−2.89	2.01	0.05	0.46
38	4923	NATURAL GAS TRANSMIS & DISTR	21.9	4.2	3, 000.0	594.6	624.7	−0.69	0.48	0.09	0.10
39	6311	LIFE INSURANCE	21.7	3.6	52, 150.0	2, 328.9	5, 214.2	−0.48	0.50	0.11	0.10
40	6141	PERSONAL CREDIT INSTITUTIONS	21.6	1.3	31, 560.0	2, 358.7	4, 539.8	−1.92	1.84	0.11	0.28
41	3823	INDUSTRIAL MEASUREMENT INSTR	20.1	0.3	2, 228.6	91.2	230.4	−1.62	1.35	0.06	0.27

The table presents the sample's descriptive statistics by industry. The presented data includes the number of firms in each one of the 41 examined industries, and some descriptive statistics (minimum, maximum, average and standard deviation) about the equity and the ROE of the firms in each industry.

TABLE 2
Sample's Descriptive Statistics by Year

Year	No. Firms	Equity (MM$)				ROE (Decimal Representation)			
		Min	Max	Avg.	Std Dev.	Min	Max	Avg.	Std Dev.
1987	1,552	0.1	38,263	659.5	2,300.7	−2.98	2.35	0.05	0.33
1988	1,668	0.1	39,509	656.5	2,257.0	−2.89	2.01	0.05	0.35
1989	1,750	0.1	38,509	654.6	2,209.1	−2.87	2.48	0.03	0.34
1990	1,834	0.1	42,832	688.2	2,391.2	−2.65	2.91	0.02	0.37
1991	1,929	0.1	37,006	696.2	2,400.0	−2.82	1.88	0.01	0.36
1992	2,021	0.0	39,124	689.6	2,296.4	−2.53	2.90	0.02	0.34
1993	2,029	0.1	48,253	733.1	2,377.2	−2.86	2.15	0.01	0.34
1994	2,033	0.2	56,184	777.9	2,575.3	−2.80	1.03	0.00	0.36
1995	2,038	0.1	49,020	841.5	2,651.8	−2.87	2.53	0.01	0.36
1996	2,041	0.2	43,542	931.5	2,825.7	−2.98	1.94	0.02	0.34
1997	1,925	0.1	43,660	1042.2	3,027.0	−2.84	2.03	0.00	0.36
1998	1,788	0.2	48,849	1204.2	3,808.3	−2.89	2.14	0.03	0.43
1999	1,672	0.2	78,927	1417.6	4,843.2	−2.97	1.96	0.00	0.39
2000	1,538	0.2	103,198	1715.2	6,144.6	−2.94	2.68	0.01	0.45
2001	1,344	0.2	74,346	1855.1	6,220.7	−2.92	0.77	0.06	0.45

The table presents the sample's descriptive statistics by year. The presented data includes the number of firms in each year from 1987 to 2001, and some descriptive statistics (minimum, maximum, average and standard deviation) about the equity and the ROE of firms for each year.

industry return in the previous year, that is,

$$\text{Ref}_{i,j,t} = \text{MED}_{j,t-1} \tag{1}$$

where $\text{MED}_{j,t-1}$ is the median ROE of industry j at year t-1. In this way, the reference point is being adjusted annually to the last known industry return median.

Many studies have used a mean-variance approach for analyzing the risk-return association. As indicated earlier, using this approach is appropriate only when the returns' distribution is constant over the studied time period. Return was usually measured as the mean ROE or return on assets (ROA) in a time period (usually 5–10 years). Risk was measured as the return's variance (or standard deviation) around the same time period. In contrast, in our research the return and risk measures are calculated in each year separately. This allows the distribution of returns change over time, a property which is essential for accommodating PT-based actions.

Formally, let $\text{ROE}_{i,j,t}$ be the ROE of firm i in industry j at year t(ROE is calculated as net income at time t divided by the time-t common equity). Risk is measured separately for each firm in each year by the absolute difference between the firm's return and its industry's contemporaneous median return:

$$\text{Risk}_{i,j,t} = |\text{ROE}_{i,j,t} - \text{MED}_{j,t}| \tag{2}$$

As in previous research, we also define risk as a measure of return dispersion. Nevertheless, in our research, it reflects the dispersion of the firm's *annual* return around the *industry's* contemporaneous median return (as opposed to around the *firm's* mean return in *the studied time period*). This definition enables the firm to control the effects of exogenous factors that affect the whole industry but are not controlled by the firm. For simplicity, we assume that all firms in a given industry are influenced by these factors in a similar way. In addition, as opposed to previous research which measured risk by the *ex-post* or actual variance (or standard deviation) of a firm's return (Fiegenbaum and Thomas [1988], Chang and Thomas [1989], Miller and Bromiley [1990], Fiegenbaum [1990], Jegers [1991], Sinha [1994], Johnson [1994], Gooding et al. [1996]), we examine the influence of the firm's return in a given year on its selected risk level for the subsequent year. Hence, in this research, risk is measured *ex-ante*, given the industry's median return. Table 3 presents descriptive statistics of the research variables.

4.3. Empirical Analysis

To test the main research hypothesis, an empirical framework is formulated, describing the relationship between the firm's return position in the industry and its consequent risk level. The firm's return position is represented by a state variable

TABLE 3
Descriptive Statistics of Research Variables

Measure	No. Firms	Min	Max	Average	Median	Std. Dev.
$\text{ROE}_{i,j,t}$	27,162	−2.983	2.907	0.010	0.102	0.369
$\text{Risk}_{i,j,t}$	27,162	0.000	3.095	0.168	0.062	0.318
$\text{Ref}_{i,j,t}$	25,818	−0.523	0.220	0.080	0.094	0.076

The table provides descriptive statistics of the research variables. $\text{ROE}_{i,j,t}$ is return on equity of firm i in industry j at year t, $\text{Risk}_{i,j,t}$ is the absolute difference between the firm's return and its industry's median return at year t and $\text{Ref}_{i,j,t}$ is the reference point of firm i in industry j at year t which is defined as median ROE of industry j at year t-1. For each measure the presented descriptive statistics are: number of observations, minimum and maximum value, average, median and the standard deviation.

defining whether the firm achieved a return that is above or below the reference level. The basic model for testing the research hypothesis is represented by the following equation:

$$\text{Risk}_{i,j,t} = \alpha + \beta \times I\_\text{gain}_{i,j,t} + e_{i,j,t} \quad (3)$$

where $\text{I\_gain}_{i,j,t} = \text{I}[\text{ROE}_{i,j,t-1} > \text{Ref}_{i,j,t}]$; I[.] is an indicator function returning the value 1 whenever the stated condition is true (and zero otherwise), and, $e_{i,j,t}$ is an error term. The effect of the state variable (firm's return position in the industry) on the firm's risk is represented by the coefficient β. According to the main hypothesis, the sign of β should be negative, that is, high (above the reference point) return firms are expected to take a lower level of risk than low (below the reference point) return firms.

Equation 3 is estimated by the Ordinary-Least-Squares method in three configurations: (a) pooled regression; (b) separate regressions for the 15 largest industries (measured by number of firm-year observations); and (c) separate annual cross-sectional regressions for each of the years 1988–2001 (i.e., 14 regressions). Control variables are appended to eliminate time-, industry-, and firm-specific effects. The first configuration is controlled for industry affiliation and year, the second for firm identity and year, and the third for industry affiliation. Note that one-year lagged data are required for the regression, as state variables. This requirement caused a relatively small reduction in the number of analyzed observations from 27,162 to 24,797 (a reduction of 8.7%).

4.3.1. Firms' "Rate of Success" Distribution

As a preliminary stage to the regression analysis, the distribution of the firms' "rate of success" was examined. We defined a firm's rate of success by the number of times its ROE was above the industry median, divided by the number of years the firm's ROE was reported.

Figure 1 exhibits the distribution of the firms' rate of success and the number (and percent) of firms included in each one of the rate ranges. Interestingly, among the most "successful" firms, only 126 firms (6% of the total sample) were always above their industry median, and among the most "unsuccessful" firms only 150 firms (7% of the total firms sample) were always below their industry median.

4.3.2. Pooled Regression

The pooled regression model includes dummy variables controlling for industry- and time-specific effects. The regression is performed in four variations, including subsets of the control variables (indicated as Model i, i=1, ... ,4):

$$\text{Risk}_{i,j,t} = \alpha + \beta \times \text{I\_gain}_{i,j,t} + \sum_k \gamma_k + I\_\text{ind}_{i,k,t} + \sum_l \delta_l \times I\_\text{year}_{i,j,t} + e_{i,j,t}$$

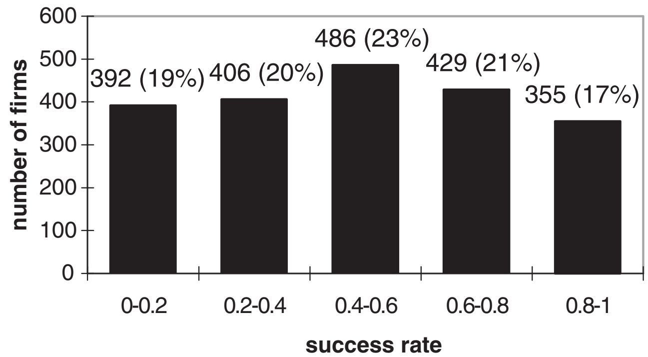

FIGURE 1 Firm's rate of success distribution.
Exhibits the distribution of the firms' "rate of success", which is defined for each firm as the number of times its ROE was above the industry median, divided by the number of years the firm's ROE was reported. The x-axis provides five "rate of success" ranges (from 0% to 100%, in decimal representation). The y-axis exhibits the number (and percent, in parentheses) of firms included in each range.

$$i = 1, \ldots, n_j;\ j = 1, \ldots, 41;\ t = 1988, \ldots, 2001;$$
$$k = 1, \ldots, 40; \quad l = 1988, \ldots, 2000 \quad (4)$$

where n_j is the number of firms in industry j, $\text{I\_ind}_{i,k,t} = \text{I}[k = j]$, and $\text{I\_year}_{i,j,l} = \text{I}[l = t]$.

4.3.3. Industry Regressions

The industry regressions include dummy variables capturing the influence of time- and firm-specific factors. A separate regression is performed for each one of the 15 largest industries, covering more than half of the firms included in the whole sample.

$$\text{Risk}_{i,j,t} = \alpha_j + \beta_j \times I\_\text{gain}_{i,j,t} + \sum_m \lambda_{j,m} \times I\_\text{firm}_{m,j,t} + \sum_l \delta_{j,l} \times I\_\text{year}_{i,j,l} + e_{i,j,t} \quad \text{for } j = 1, \ldots, 15$$
$$i = 1, \ldots, n_j; \quad t = 1988, \ldots, 2001;$$
$$l = 1998, \ldots, 2000; \quad m = 1, \ldots, n_j - 1 \quad (5)$$

where n_j is the number of firms in industry j, $\text{I\_firm}_{m,j,t} = \text{I}[m = i]$, and $\text{I\_year}_{i,k,l} = \text{I}[l = t]$.

4.3.4. Cross-sectional Regressions

To further examine the robustness of the regression results, a separate cross-sectional regression is performed for each year, from 1988 to 2001, including dummy variables controlling for industry specific effects.

$$\text{Risk}_{i,j,t} = \alpha + \beta \times I_{\text{gain}_{i,j,t}} + \sum_k \gamma_k \times I_{ind_{i,k,t}} + e_{i,j,t}$$
$$\text{for } t = 1988, \ldots, 2001 \quad (i.e, \quad 14 \text{ regressions})$$
$$i = 1, \ldots, n_j; \quad j = 1, \ldots, 41; \quad k = 1, \ldots, 40 \quad (6)$$

TABLE 4
Risk-Return Association for Pooled Regression Analysis

	Pooled Regression			
Coefficient	Model 1	Model 2	Model 3	Model 4
$\hat{\alpha}$	0.2097***	0.1948***	0.2529***	0.2364***
$\hat{\beta}$	−0.0992***	−0.1003***	−0.0995***	−0.1006***
Industry controls	No	Yes	No	Yes
Time controls	No	No	Yes	Yes
Adj R^2	2.73%	12.10%	3.09%	12.38%

Note. (2,068 firms; $n = 24{,}797$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table provides the results of the pooled regression analysis, using four different subsets of the control variables – for industries and for years. $\hat{\alpha}$ and $\hat{\beta}$ represent the pooled regression coefficients, were $\hat{\alpha}$ represent the intersect and $\hat{\beta}$ represents the association between the firm's return position and its subsequent risk level.

where n_j is the number of firms in industry j, $\text{I\_ind}_{i,k,t} = \text{I}[k=j]$, and $\text{I\_year}_{i,j,l} = \text{I}[l=t]$.

5. RESULTS

5.1. Pooled Regression Analysis

Table 4 describes the results of the pooled regression analysis, using four different subsets of the control variables. The results show a significant negative association between the firms' return positions and their risk levels.[4] The estimated coefficient, $\hat{\beta}$, is negative and similar in all four models. The results corroborate our main research hypothesis that firms with a return above (below) the reference point take less (more) risk.

5.2. Industry Regression Analysis

In the second specification, the regression coefficients were estimated separately for each of the 15 largest industries. Table 5 describes the estimation results. The results show that for 14 out of the 15 (93%) industries the estimated coefficients, $\hat{\beta}$, are negative, 11 of them are statistically significant at the 10% significance level. The results are consistent with the results of the pooled regression analysis, and reinforce the existence of a negative relationship between risk and firms' return positions.

5.3. Cross-sectional Regression Analysis

Table 6 presents the mean values, standard deviation, and minimum and maximum values of the estimated coefficients of the annual cross-sectional regressions, separately estimated for each year from 1988 to 2001. The rightmost column of the Table presents, for comparison, the results of the pooled regression (Model 2).

The means of the estimated coefficients are very close to the estimates obtained in the pooled regression model. In particular, the mean value of $\hat{\beta}$ in the annual cross-sectional regressions (−0.1029) is similar to the estimated $\hat{\beta}$ in the pooled regression model (−0.1003). A more specific examination of the annual cross-sectional regression results show that $\hat{\beta}$ is negative and significant at the 1% significant level for each of the annual cross-sectional regressions. These results are consistent with the pooled regression analysis and

TABLE 5
Risk-Return Association for Industry Regression Analysis

	SIC No.	Industry Name	$\hat{\alpha}$	$\hat{\beta}$	No. Firms	Avg. Obs.
1	1311	CRUDE PETROLEUM & NATURAL GS	0.38***	−0.07***	151	127.7
2	4911	ELECTRIC SERVICES	0.03	−0.02**	125	117.6
3	6798	REAL ESTATE INVESTMENT TRUST	0.06	−0.02	99	86.4
4	6021	NATIONAL COMMERCIAL BANKS	0.07***	−0.01	97	84.9
5	7372	PREPACKAGED SOFTWARE	0.72***	−0.06**	103	81.1
6	2834	PHARMACEUTICAL PREPARATIONS	0.03	−0.06*	98	80.0
7	4813	PHONE COMM EX RADIOTELEPHONE	0.18***	0.02	84	74.5
8	4931	ELECTRIC & OTHER SERV COMB	0.04	−0.02**	67	63.6
9	5812	EATING PLACES	0.15	−0.10***	72	59.8
10	1040	GOLD AND SILVER ORES	0.36***	−0.06	59	49.6
11	3845	ELECTROMEDICAL APPARATUS	0.20**	−0.12***	61	48.6
12	3674	SEMICONDUCTOR,RELATED DEVICE	0.17**	−0.08***	56	49.4
13	6331	FIRE, MARINE, CASUALTY INS	0.28***	−0.05**	57	48.9
14	6022	STATE COMMERCIAL BANKS	0.09**	−0.02**	53	46.6
15	3663	RADIO,TV BROADCAST, COMM EQ	0.49***	−0.07***	52	44.9
	Total				1, 234	

Note. ($^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table provides the estimation results of the industry regression analysis. The estimates of the regression coefficients, the number of firms, and the average firm-year observations of each one of the 15 largest industries are presented in this table.

TABLE 6
Risk-Return Association for Annual Cross-Sectional Regression Analysis

	Annual Cross-sectional Regressions				
Coefficient/ Measure	Mean	Standard Deviation	Minimum	Maximum	Pooled Regression
$\hat{\alpha}$	0.1962	0.0317	0.1242	0.2440	0.1948***
$\hat{\beta}$	−0.1029	0.0261	−0.1602	−0.0715	−0.1003***

Note. (2,068 firms; $n = 24{,}797$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table presents statistical properties (mean, standard deviation, minimum and maximum) of the annual cross-sectional regression estimates. The rightmost column presents, for comparison, the pooled regression results.

corroborate the negative relationship between the firms' return positions and their risk levels.

5.4. Robustness Analysis

The sample consists of firms which were always above or below their industry median. In order to examine the robustness of the risk-return association to the exclusion of such "extreme" firms, an additional analysis on a filtered sample is performed. The filtered sample includes only firms that had a success rate between 20% and 80%, yielding a total 1,321 firms. The regression results are presented in Tables 7, 8, and 9.

The results of the various regression analyses using the filtered sample resemble the results obtained with the full sample. For the pooled regression analysis (Table 7), the significant negative association between firm's return position in the industry and the firm's subsequent risk level remains stable (although is slightly decreased) in all four models. For the industry regression analysis (Table 8), the results show that 14 of the 15 (93%) estimated coefficients are negative, 12 statistically significant at the 10% significance level. For the annual cross-sectional regression analysis (Table 9), the mean of the estimated coefficients remains close in the values to the estimated coefficients of the pooled regression model, which are negative and significant.

TABLE 7
Risk-Return Association Pooled Regression Analysis – Filtered Sample

	Pooled Regression – Filtered Sample			
Coefficient	Model 1	Model 2	Model 3	Model 4
$\hat{\alpha}$	0.1733***	0.2131***	0.2274***	0.2674***
$\hat{\beta}$	−0.0671***	−0.0662***	−0.0672***	−0.0663***
Industry controls	No	Yes	No	Yes
Time controls	No	No	Yes	Yes
Adj R^2	1.42%	8.35%	1.85%	8.76%

Note. (1,321 firms; $n = 15{,}983$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table provides the results of the pooled regression analysis implemented on the filtered sample, using four different subsets of the control variables – for industries and for years. $\hat{\alpha}$ and $\hat{\beta}$ represent the pooled regression coefficients, were $\hat{\alpha}$ represent the intersect and $\hat{\beta}$ represents the association between the firm's return position and its subsequent risk level.

6. CONCLUSION

This research employed Prospect Theory (Kahneman and Tversky [1979]) to explain the relationship between risk and return at the organization level. Our research addressed shortcomings in the modeling approach used in previous research and suggested an approach aimed at resolving these problems. We suggested an alternative view for inferring the reference point, one of the key elements of PT, and the way of measuring risk, as well as a different representation of the risk-return association taking into consideration a timeline of a firm's state, its state dependent action, and consequences. Previous studies estimated a firm's reference points and risk and return position based on its time series of returns over the time period under study (usually 5–10 years). The underlying assumption in the approach taken by these studies was that a firm's behavior and situation are time invariant. The main criticism regarding this approach is that the use of the suggested measures may be appropriate only if the return distribution is constant over the studied time period. This criticism is especially noteworthy in the context of PT, as a firm's position relative to the reference level and hence its actions are state dependent.

Moreover, these studies, which usually measured the reference point by the industry return, held a latent assumption that the contemporaneous industry return is known to all firms before the end of the period. In our study, the reference point was calculated for each year separately, as the median of the industry return in the previous year, thus, resolving these two shortcomings.

Because of the weaknesses attached to the mean-variance approach implemented in previous studies, our research suggests a different approach for using accounting-based measures for risk and return. First, the return and risk measures are calculated in each year separately (from 1987–2001), allowing for the distribution of returns change over time, a property which is essential for accommodating PT-based actions. Second, the risk measure is defined as the absolute difference between a firm's return and its industry's contemporaneous median return, reflecting a firm's return dispersion around its *industry* median return. Implementing this measure enables to control for the effects of factors that are exogenous to firms and affect the whole industry. In addition, as opposed to previous research, risk is measured *ex-ante*, given the industry's median return, by using a lagged model

TABLE 8
Risk-Return Association for Industry Regression Analysis — Filtered Sample

	SIC No.	Industry Name	$\hat{\alpha}$	$\hat{\beta}$	No. Firms	Avg. Obs.
1	1311	CRUDE PETROLEUM & NATURAL GS	0.26**	−0.07***	88	74.1
2	4911	ELECTRIC SERVICES	0.03	−0.01**	86	81.3
3	6798	REAL ESTATE INVESTMENT TRUST	0.07	−0.03**	61	52.4
4	6021	NATIONAL COMMERCIAL BANKS	0.07***	−0.01**	63	55.3
5	7372	PREPACKAGED SOFTWARE	0.69***	−0.07**	66	52.0
6	2834	PHARMACEUTICAL PREPARATIONS	0.05	−0.03	35	29.0
7	4813	PHONE COMM EX RADIOTELEPHONE	0.10	0.02*	60	54.3
8	4931	ELECTRIC & OTHER SERV COMB	0.04	−0.02*	44	42.0
9	5812	EATING PLACES	0.17**	−0.09***	34	29.2
10	1040	GOLD AND SILVER ORES	0.31**	−0.06	41	35.1
11	3845	ELECTROMEDICAL APPARATUS	0.26***	−0.11***	34	28.9
12	3674	SEMICONDUCTOR,RELATED DEVICE	0.19**	−0.09***	44	39.3
13	6331	FIRE, MARINE, CASUALTY INS	0.29***	−0.05*	36	31.7
14	6022	STATE COMMERCIAL BANKS	0.10**	−0.02*	33	29.1
15	3663	RADIO,TV BROADCAST, COMM EQ	0.54***	−0.07***	42	36.2
	Total				767	

Note. ($^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table provides the estimation results of the industry regression analysis implemented on the filtered sample. The estimates of the regression coefficients, the number of firms, and the average firm-year observations of each one of the 15 largest industries are presented in this table.

where we examine the influence of a firm's return position on its subsequent risk level.

The analysis was performed in three configurations: (a) pooled regression; (b) separate regressions for the 15 largest industries; and (c) separate annual cross-sectional regressions from 1988–2001 (i.e., 14 regressions). Control variables were appended to eliminate time, industry, and firm specific effects. The pooled regression model was controlled for industry affiliation and year, the industry regression analysis was controlled for firm and year, and the annual cross-sectional regressions were controlled for industry affiliation.

For the pooled regression analysis, the results reinforced our main research hypothesis by showing a significant negative relationship between a firm's return position in its industry and its subsequent risk level. The results remained stable when four different subsets of the industry and time control variables were used in the analysis, indicating that even when taking in account the influence of these factors, the negative risk-return relationship still holds. This relationship was reinforced at the industry regression analysis, where the majority of the explored industries exhibited a negative relationship between the return position and the subsequent risk level. A further reinforcement of the significant negative relationship between the firms' return positions and their risk levels was achieved by the analysis of the annual cross-sectional regressions that were performed for each year separately from 1988–2001. This cross-sectional analysis showed that the means of the estimated coefficients were very close in their values to the estimated coefficients of the pooled regression model.

TABLE 9
Risk-Return Association for Annual Cross-Sectional Regression Analysis — Filtered Sample

	Annual Cross-sectional Regressions				
Coefficient/ Measure	Mean	Standard Deviation	Minimum	Maximum	Pooled Regression
$\hat{\alpha}$	0.2131	0.0548	0.1083	0.3093	0.2131***
$\hat{\beta}$	−0.0684	0.0259	−0.1364	−0.0417	−0.0662***

Note. (2,068 firms; $n = 24{,}797$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)
The table provides the statistical properties (mean, standard deviation, minimum and maximum) of the annual cross-sectional regression estimates implemented on the filtered sample. The Table presents. The rightmost column presents, for comparison, the pooled regression results.

All in all, the results indicate that firms with a return that is above the reference level (measured as the industry median return in the previous year) take less risk than firms with a return that is below the reference level. Similar results were observed when the same analyses were performed on a filtered sample from which "extreme" firms (most successful and unsuccessful firms) were excluded.

To summarize, the three empirical approaches: pooled, industry, and cross-sectional regressions analyses, implemented on both samples, full and filtered, yielded significant negative association between a firm's return position and its subsequent risk level. As indicated, the results of our analysis approach reinforce our main research hypothesis that firms with a return above the reference point take less risk relatively to firms with a return below the reference point that take more risk. These results also provide an additional support to PT propositions.

NOTES

1. For a detailed review, see Fiegenbaum and Thomas [1988] and Nickel and Rodriguez [2002].
2. For a detailed review, see Nickel and Rodriguez [2002].
3. Forty-five observations (0.015% of the total observations) with the most extreme values were removed from the total sample.
4. The results qualitatively held when the reference point was defined as the *market's* median return in the previous year. This additional analysis was performed to examine the robustness of the results when the reference point definition was changed from industry's median return to market's median return.
5. Excluding 45 observations (0.015% of the total observations) with the most extreme values, which were removed from the total sample data

REFERENCES

Amit, R. and J. Livnat. "Diversification and the Risk-return Trade-off." *Academy of Management Journal*, 31, (1988), pp. 154–166.

Beaver, W., P. Kottler, and M. Schools. "The Association Between Market Determined and Accounting Determined Risk Measures." *The Accounting Review*, October, (1970), pp. 654–682.

Bettis, R. and W. Hall. "Diversification Strategy, Accounting Determined Risk, and Accounting Determined Return." *Academy of Management Journal*, 25, (1982), pp. 254–264.

Bettis, R. and V. Mahajan. "Risk/Return Performance of Diversified Firms." *Management Science*, 31, (1985), pp. 785–799.

Bowman, E. "Risk/Return Paradox for Strategic Management." *Sloan Management Review*, Spring, (1980), pp. 17–31.

Bowman, E. "Risk Seeking by Troubled Firms." *Sloan Management Review*, 31, (1982), pp. 33–42.

Bowman, E. "Content Analysis of Annual Reports for Corporate Strategy and Risk." *Interfaces*, 14, (1984), pp. 61–71.

Bowman, R. G. "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables." *The Journal of Finance*, 34, (1979), pp. 617–630.

Bromiley, P. "Paradox or at Least Variance Found: A Comment on Mean-variance Approaches to Risk-Return Relationships in Strategy: Paradox Lost." *Management Science*, 37, (1991), pp. 1206–1215.

Bromiley, P. "Testing a Causal Model of Corporate Risk Taking and Performance." *Academy of Management Journal*, 24, (1991), pp. 37–59.

Chang, Y. and H. Thomas. "The Impact of Diversification Strategy on Risk-Return Performance." *Strategic Management Journal*, 10, (1989), pp. 271–284.

Conrad, G. and I. Plotkin. "Risk/Return: U.S. Industry Pattern." *Harvard Business Review*, 46, (1968), pp. 90–99.

Cool, K., I. Dierickx, and D. Jemison. "Business Strategy, Market Structure and Risk-Return Relationships: A Structural Approach." *Strategic Management Journal*, 10, (1989), pp. 507–522.

Coonter, P. H. and D. M. Holland. "Rate of Return and Business Risk." *Bell Journal of Economics*, 1, (1970), pp. 211–226.

Cyert, R. M. and J. G. March. *A Behavioral Theory of the Firm*, (1963), Englewood Cliffs, NJ: Prentice-Hall.

Fiegenbaum, A. and H. Thomas. "Dynamic and Risk Measurement. Perspectives on Bowman's Risk-Return Paradox for Strategic Management: An Empirical Study." *Strategic Management Journal*, 7, (1986), pp. 395–407.

Fiegenbaum, A. and H. Thomas. "Attitudes Toward Risk and the Risk-Return Paradox: Prospect Theory Explanations." *Academy of Management Journal*, 31, (1988), 85–106.

Fiegenbaum, A. "Prospect Theory and the Risk-Return Association: An Empirical Examination of 85 Industries." *Journal of Economic Behavior and Organization*, 14, (1990), pp. 187–203.

Fishburn, P. C. "Mean-Risk Analysis with Risk Associated with Below Target Returns." *American Economic Review*, 67, (1977), pp. 116–126.

Fishburn, P. C. and G. A. Kochenberger. "Two-piece Von Newmann-Morgenstern Utility Functions." *Decision Sciences*, 10, (1979), pp. 503–518.

Fisher, I. N. and G. R. Hall. "Risk and Corporate Rates of Return." *Quarterly Journal of Economics*, 83, (1969), pp. 79–92.

Frecka, T. J. and C. F. Lee. "Generalized Financial Ratio Adjustment Processes and Their Implication." *Journal of Accounting Research*, 21, (1983), pp. 308–316.

Friedman, M. and L. J. Savage. "The Utility Analysis of Choices Involving Risk." *The Journal of Political Economy*, 56, (1948), pp. 297–304.

Gooding, R. Z., S. Goel, and R. M. Wiseman. "Fixed Versus Variable Reference Points in the Risk-Return Relationship." *Journal of Economic Behavior and Organization*, 29, (1996), pp. 331–350.

Greve, H. R. "Performance, Aspirations and Risky Organizational Change." *Administrative Science Quarterly*, 43, (1998), pp. 58–86.

Hurdle, G. "Leverage, Risk, Market Structure and Profitability." *The Review of Economics and Statistics*, 66, (1974), pp. 78–85.

Jegers, M. "Prospect Theory and the Risk-Return Relation: Some Belgian Evidence." *Academy of Management Journal*, 34, (1991), pp. 215–225.

Johnson, H. J. "Prospect Theory in the Commercial Banking Industry." *Journal of Financial and Strategic Decisions*, 7, (1994), pp. 73–89.

Kahneman, D. and A. Tversky. "Prospect Theory: An Analysis of Decision Under Risk." *Econometrica*, 47, (1979), pp. 263–291.

Laughhunn, D. J., J. W. Payne, and R. Crum. "Managerial Risk References for Below-Target Returns." *Management Science*, 26, (1980), pp. 1238–1249.

Lee, D. Y. "The Impact of Poor Performance on Risk-Taking Attitudes: A Longitudinal Study with a PLS Causal Modeling Approach." *Decision Sciences*, 28, (1997), pp. 59–80.

Lev, B. "Industry Averages as Targets for Financial Ratios." *Journal of Accounting Research*, 7, (1969), pp. 290–299.

Lehner, J. M. "Shifts of Reference Points for Framing of Strategic Decisions and Changing Risk-Return Associations." *Management Science*, 46, (2000), pp. 63–76.

Lintner, J. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economic Statistics*, 47, (1965), pp. 13–37.

Markowitz, H. "The Utility of Health." *The Journal of Political Economy*, 60, (1952), pp. 497–527.

Miller, K. and P. Bromiley. "Strategic Risk and Corporate Performance: An Analysis of Alternative Risk Measures." *Academy of Management Journal*, 33, (1990), pp. 756–779.

Miller, K. and M. Leiblein. "Corporate Risk-Return Relations: Returns Variability Versus Downside Risk." *Academy of Management Journal*, 39, (1996), pp. 91–122.

Nickel, M. N. and M. C. Rodriguez. "A Review of Research on the Negative Accounting Relationship Between Risk and Return: Bowman's Paradox." *Omega*, 30, (2002), pp. 1–18.

Neumann, M., I. Bobel, and A. Haid. "Profitability, Risk and Market Structure in West German Industries." *Journal of Industrial Economics*, 27, (1979), pp. 227–242.

Ruefli, T. "Mean-variance Approaches to Risk-Return Relationships in Strategy: Paradox Lost." *Management Science*, 36, (1990), pp. 368–380.
Ruefli, T. "Reply to Bromiley's Comment and Further Results: Paradox Lost Becomes Dilemma Found." *Management Science,* 37, (1991), pp. 1210–1215.
Schoemaker, P. J. H. "The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations." *Journal of Economic Literature*, 20, (1982), pp. 529–563.
Sharpe, W. F. "A Simplified Model for Portfolio Analysis." *Management Science*, 9, (1963), pp. 277–293.
Singh, J. V. "Performance, Slack and Risk Taking in Organizational Decision Making." *Academy of Management Journal*, 29, (1986), pp. 562–585.
Sinha, T. "Prospect Theory and the Risk Return Association: Another Look." *Journal of Economic Behavior and Organization*, 24, (1994), pp. 225–231.
Tobin, J. "Liquidity Preference as Behavior Towards Risk." *Review of Economic Studies*, 26, (1958), pp. 65–86.
Tversky, A. and D. Kahneman. "Advances in Prospect Theory: Cumulative Representation of Uncertainty." *Journal of Risk and Uncertainty*, 5, (1992), pp. 297–323.
Von Neumann, J. and O. Morgenstern. *Theory of Games and Economic Behavior*, Princeton: Princeton University Press, 1944.
Wiseman, R. and P. Bromiley. "Risk-Return Associations: Paradox or Artifact? An Empirical Tested Explanation." *Strategic Management Journal*, 12, (1991), pp. 231–241.

APPENDIX

Tables 10–15 exhibit the results of the regression analyses for the three analysis approaches: (i) pooled regression, (ii) separate regressions for the 15 largest industries, and (iii) separate annual cross-sectional regressions from 1988–2001, which were performed on the full sample data, including the 3% of total observations that were removed as a filter of extreme observations.[5]

TABLE 10
Risk-Return Association for Industry-Control Analysis — Full Sample (Including Extreme Observations)

	Pooled Regression			
Coefficient	Model 1	Model 2	Model 3	Model 4
$\hat{\alpha}$	0.3574***	0.3123***	0.4530***	0.4093***
$\hat{\beta}$	−0.2102***	−0.2126***	−0.2110***	−0.2134***
Industry controls	No	Yes	No	Yes
Time controls	No	No	Yes	Yes
Adj R^2	1.3%	4.7%	1.5%	4.8%

Note. (2,164 firms; $n = 26{,}023$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)

TABLE 11
Risk-Return Association for Firm-Control Analysis — Full Sample (Including Extreme Observations)

	SIC No.	Industry Name	$\hat{\alpha}$	$\hat{\beta}$	No. Firms	Avg. Obs.
1	1311	CRUDE PETROLEUM & NATURAL GS	0.43*	−0.13***	156	133
2	4911	ELECTRIC SERVICES	0.08	−0.02*	125	118
3	7372	PREPACKAGED SOFTWARE	1.23***	−0.22**	113	90
4	2834	PHARMACEUTICAL PREPARATIONS	−0.09	−0.13	105	87
5	6798	REAL ESTATE INVESTMENT TRUST	0.05	−0.05**	99	87
6	6021	NATIONAL COMMERCIAL BANKS	0.07***	−0.01	97	85
7	4813	PHONE COMM EX RADIOTELEPHONE	0.24	0.07	86	76
8	5812	EATING PLACES	0.37**	−0.20***	76	63
9	4931	ELECTRIC & OTHER SERV COMB	0.04	−0.02**	67	64
10	3845	ELECTROMEDICAL APPARATUS	0.88*	−0.40***	65	53
11	3674	SEMICONDUCTOR,RELATED DEVICE	0.03	−0.20***	59	52
12	1040	GOLD AND SILVER ORES	0.43	−0.17*	59	51
13	7373	CMP INTEGRATED SYS DESIGN	0.48	−0.25**	58	49
14	6331	FIRE, MARINE, CASUALTY INS	0.27***	−0.04	57	49
15	6022	STATE COMMERCIAL BANKS	0.09**	−0.02**	53	47
	Total				1275	

Note. ($^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)

TABLE 12
Risk-Return Association for Annual Cross-Sectional Regression Analysis — Full Sample (Including Extreme Observations)

	Annual Cross-sectional Regressions				
Coefficient/Measure	Mean	Standard Deviation	Minimum	Maximum	Pooled Regression
$\hat{\alpha}$	0.3022	0.1777	0.1665	0.9025	0.3123***
$\hat{\beta}$	−0.2110	0.0379	−0.3008	−0.1547	−0.2126***

Note. (2,164 firms; $n = 26{,}023$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)

TABLE 13
Risk-Return Association for Industry-Control Analysis — Filtered Sample (Including Extreme Observations)

	Pooled Regression — Filtered Sample			
Coefficient	Model 1	Model 2	Model 3	Model 4
$\hat{\alpha}$	0.2914***	0.3573***	0.4002***	0.4687***
$\hat{\beta}$	−0.1400***	−0.1403***	−0.1401***	−0.1404***
Industry controls	No	Yes	No	Yes
Time controls	No	No	Yes	Yes
Adj R^2	0.6%	3.1%	0.8%	3.3%

Note. (1,379 firms; $n = 16{,}688$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)

TABLE 14
Risk-Return Association for Firm-Control Analysis — Filtered Sample (Including Extreme Observations)

	SIC No.	Industry Name	$\hat{\alpha}$	$\hat{\beta}$	No. Firms	Avg. Obs.
1	1311	CRUDE PETROLEUM & NATURAL GS	0.36	−0.16**	86	73
2	4911	ELECTRIC SERVICES	0.03	−0.01**	86	81
3	7372	PREPACKAGED SOFTWARE	1.25***	−0.25**	76	59
4	2834	PHARMACEUTICAL PREPARATIONS	0.00	−0.10	33	28
5	6798	REAL ESTATE INVESTMENT TRUST	0.07	−0.07**	61	53
6	6021	NATIONAL COMMERCIAL BANKS	0.07***	−0.01**	63	55
7	4813	PHONE COMM EX RADIOTELEPHONE	0.14	−0.01	61	55
8	5812	EATING PLACES	0.39*	−0.21***	39	33
9	4931	ELECTRIC & OTHER SERV COMB	0.04	−0.02*	44	42
10	3845	ELECTROMEDICAL APPARATUS	0.93*	−0.37**	37	32
11	3674	SEMICONDUCTOR,RELATED DEVICE	0.13	−0.19***	46	41
12	1040	GOLD AND SILVER ORES	0.32	−0.24**	41	36
13	7373	CMP INTEGRATED SYS DESIGN	0.24	−0.18	36	31
14	6331	FIRE, MARINE, CASUALTY INS	0.27***	−0.04	37	33
15	6022	STATE COMMERCIAL BANKS	0.10**	−0.02	33	29
	Total				779	

Note. ($^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)

TABLE 15
Risk-Return Association for Annual Cross-Sectional Regression Analysis — Filtered Sample (Including Extreme Observations)

	Annual Cross-sectional Regressions				
Coefficient/Measure	Mean	Standard Deviation	Minimum	Maximum	Pooled Regression
$\hat{\alpha}$	0.3380	0.3173	0.1218	1.4170	0.3573***
$\hat{\beta}$	−0.1382	0.0473	−0.2436	−0.0799	−0.1403***

Note. (1,379 firms; $n = 16{,}687$ observations; $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$)