Journal Of Financial And Strategic Decisions
Volume 7 Number 1 Spring 1994

PROSPECT THEORY IN THE COMMERCIAL BANKING INDUSTRY

Hazel J. Johnson[*]

Abstract

This study examines Kahneman and Tversky's prospect theory in the commercial banking industry. Prospect theory predicts increased risk-taking behavior in the presence of below-target outcomes. Fishburn redefined risk (commonly measured as dispersion about the mean outcome) as the integral of a function that is based on distance below target outcome. This study uses rates of return and the primary capital ratios of 142 U.S. commercial banks over the period 1970 through 1989 to test whether distance from target is related to dispersion about the mean and to test alternative target mechanisms. Cross-sectional medians of return on assets, return on equity, and primary capital ratio are used as target outcomes. Distance from target is defined as the difference between individual bank median and target outcome. The correlation between standard deviation of individual bank measures and distance from target is measured using Kendall's τ.

Below target, the results confirm Fishburn's measure of risk and prospect theory and suggest that rates of return may be the operative target outcomes. The below-target results also suggest possible regional and size differences. Above target, distance from target is generally found to not be associated with the degree of dispersion about the mean.

INTRODUCTION

During the 1980s, more commercial banks failed than in the previous 40 years [4], suggesting that industry risk may have increased.[1] On this subject, Paul Volcker [32], former Chairman of the Board of Governors of the Federal Reserve, remarked that:

> ... [in] the decades that have passed since any serious weaknesses in the financial system had been evident, a sense of security among depositors, rooted in part in the knowledge of a strong governmental "safety-net" protecting the financial system, and expectations of a persistent inflationary trend have all seemed to *encourage less caution and a willingness--deliberately or not--for managers of financial institutions to undertake greater leverage and risk in the search of higher returns* (emphasis added). [32, p.55]

This study is motivated by this perception of increased risk in the commercial banking industry. Fishburn [7] suggests that perceived risk is more related to the extent to which decision makers find themselves operating below target than to the dispersion of outcomes about the mean. According to prospect theory as proposed by Kahneman and Tversky [13], decision makers can become less risk averse and even risk seeking if they find that they are operating below target or aspiration levels. High-variance (riskier) alternatives may provide a decision maker a better chance of achieving the desired outcome than low-variance (safer) alternatives. This study examines the power of prospect theory and Fishburn's measure of risk to explain *variability of accounting measures* and attempts to differentiate between alternative definitions of *target outcomes* in the banking industry.

Fiegenbaum and Thomas [6] studied the risk/return characteristics of a number of industries, including commercial banking, using rate of return on equity (*ROE*) and variance of *ROE* as return and risk measures,

[*]University Of Louisville

respectively, from 1960 through 1979. Their objective was to determine whether prospect theory could satisfactorily explain previously noted associations of high return/low variance and low return/high variance [see Fiegenbaum and Thomas [5 and 6]].

Within an industry, each firm's average annual *ROE* for the relevant time period was computed. Fiegenbaum and Thomas then ranked all firms in the industry according to their respective mean *ROE*s, assigning a high (H) value for those above median *ROE* (target return) and a low (L) value for those below. Similarly, variances of *ROE* were calculated, the firms ranked, and H or L values assigned, where a composite label of *HL* implied high *ROE* and low variance. A negative association ratio, *(HL + LH)/(HH + LL)*, was constructed for each industry. A ratio greater than one suggests a negative association between risk and return for a particular group of firms.

Their results show negative association ratios higher than one for all firms with below-median *ROE* and ratios less than one for firms with above-median *ROE*. These results are consistent with prospect theory.

This study builds on the Fiegenbaum and Thomas [6] framework. The contributions of this study are that it:

1. Concentrates on the banking industry over the period 1970 through 1989, a period of significant change in the industry,
2. Measures the relationship between distance from target and outcome variability,
3. Examines the question of an appropriate target for the commercial banking industry, and
4. Tests for regional and size effects.

THEORIES OF DECISION MAKING

Von Neumann-Morgenstern [33] axioms of choice form the basis for much of the literature with respect to risky choice behavior in economics and finance. Although a specific *type* of utility function is not prescribed by von Neumann-Morgenstern axioms, the assumption of risk aversion, i.e., concavity of the utility function, is not uncommon in studies of the commercial banking industry and other areas of economics and finance [e.g., Blair and Heggestad [1], Edwards and Heggestad [3], Ho and Saunders [11], Koehn and Santomero [18], Pyle [25], Santomero [26], and Schoemaker [27]].

Friedman and Savage [9] questioned universal risk aversion when they noted that the same individuals who buy insurance also purchase lottery tickets, suggesting both concave and convex segments of the utility function. Swalm [30] confirmed this intuition in laboratory studies, finding that the inflection point appeared to be a zero change in wealth. Above this point, utility functions were concave, and below this point, convex.

Fishburn [7] respecified the concept of risk by suggesting that risk was not necessarily a measure of dispersion about an expected value, but rather a function of distance from a target outcome.

Equation 1

$$R(t) = \int_{-\infty}^{t} (t - x)^{\alpha} \, dF(x)$$

where:

$R(t)$ = measure of risk
t = target or aspiration level
α = sensitivity to deviation from target, $\alpha>0$
$F(t)$ = probability density function of x

Thus, $R(t)$ is not a function of dispersion of a distribution about its mean, but of the likelihood of below-target outcomes. The positive parameter α measures an individual's attitude toward these below-target results.[2] Laughhunn, Payne, and Crum [19] estimated the α values of 224 managers from the United States, Canada, and Europe, finding the majority of managers were risk seekers when faced with below-target outcomes.

Kahneman and Tversky [13] suggested prospect theory as an explanation for the phenomena noted by Friedman and Savage and by Swalm, incorporating Fishburn's concept of risk. According to prospect theory, decision makers will be risk-seeking if they perceive themselves to be operating below target. Conversely, if they are operating above target, they will be risk-averse. Laboratory studies by Payne, Laughhunn, and Crum [23, 24] confirm the Kahneman and Tversky results. Thus, according to prospect theory, an individual can rationally exhibit differing degrees of risk aversion over time, depending on his position relative to target outcome.

Segal [29] suggested that decision makers will not necessarily reduce probabilities (multiply them to arrive at joint probabilities) when confronted with an ambiguous lottery, i.e., one for which the probabilities are uncertain. When probabilities are unknown, individuals may exhibit ambiguity aversion, not entirely unlike risk aversion. However, in the context of the commercial banking industry, this framework seems to offer little potential explanatory power for perceived increases in risktaking.[3]

Karni and Safra [14] explained price reversal phenomena with the theory of expected utility with rank-dependent probabilities (*EURDP*). Price reversals occur when decision makers choose lottery *A* over lottery *B*, i.e., *CE(A)*, the certainty equivalent of lottery *A*, exceeds *CE(B)*, but announce a minimum price to forego lottery *B* that exceeds their announced price for *A*, i.e., *V(B)*, the value of lottery *B*, exceeds *V(A)*. Lottery *A* is characterized as a "P" bet, i.e., one for which there is a high probability of a small pay-off. On the other hand, lottery *B* is considered a "$" bet with a lower probability of a larger pay-off. Also, both lotteries have essentially the same expected return, but lottery *B* has a greater variance. Karni and Safra [14] explain preference reversal by suggesting that these decisions are consistent with expected utility theory, but that the probability transformation function may not be continuous.

In a later study, Karni and Safra [15] conclude that the utility function is strictly concave but that the probability transformation function is first concave and then convex, causing smaller probabilities to be underweighted and larger probabilities to be overweighted. This appears to explain the greater propensity for risk noted in choices involving lotteries *A* and *B*.[4] However, in the context of the banking industry, bankers should have *always* behaved in this way. In other words, *EURDP* does not appear to address dynamic change in the decision making process.[5]

While *EURDP* theory has interesting implications, these implications appear to be less applicable and less intriguing than prospect theory in the context of the commercial banking industry. Likewise, anticipated utility theory and expected utility theory appear to offer few potential insights into recent developments within the banking industry.

IMPLICATIONS OF PROSPECT THEORY

Prospect theory suggests that the same individuals can be both risk seekers and risk averters. Kahneman and Tversky [13] offered laboratory subjects two sets of alternatives. The first set involved only positive outcomes. The second set offered alternatives that were mirror images of the first, i.e., previously positive outcomes became negative. In general, most of the subjects initially exhibited risk-averse behavior. When confronted with the second set of alternatives, however, most shifted to risk-seeking behavior.

For example, 95 subjects were given the choice of a gamble for $4,000 with 0.8 probability ($4,000, 0.8) or a certain $3,000 ($3,000). Eighty percent chose the second alternative with a lower expected return, but a zero variance. Prospect theory would suggest that the subjects were operating above a "breakeven" target and were, therefore, risk averse. However, when the outcomes were negatively transformed [(-$4,000, 0.8) or (-$3,000)], the majority chose the first alternative with a lower expected return and a higher variance. Prospect theory would explain this apparent contradiction by suggesting that the expected value of each alternative placed the subjects below the "breakeven" target, but that the gamble was the only alternative that at least offered a chance of breaking even. In this context, risk-seeking behavior appears completely rational.

It should be noted that prospect theory predictions will not always be consistent with mean-variance criterion or with first order stochastic dominance.[6] For example, Kahneman and Tversky [13] also offered subjects the following choice:

Alternative I : (-$3,000, 0.90; 0, 0.10)
Alternative II: (-$6,000, 0.45; 0, 0.55)

Ninety-two percent of the subjects selected Alternative II. Since the expected value of the two alternatives is equal (-$2,700) and the variance of Alternative I is less than the variance of Alternative II, mean-variance criterion suggests that I dominates II. There is no first order stochastic dominance because the cumulative probability distributions cross.[7] Since the subjects were operating below target (breakeven), prospect theory predicts that Alternative II may be preferable because it offers a higher probability of reaching the target outcome of breakeven.[8] As illustrated by this example, the lack of consistency between (1) prospect theory and (2) mean-variance criterion (*MV*) and first order stochastic dominance (*FSD*) appears to be linked to the inability of *MV* and *FSD* to predict a very reasonable course of action when decision makers operate below target.

Payne, Laughhunn, and Crum [24] showed that a target need not necessarily be of the "breakeven" variety. In one set of laboratory experiments, targets or aspiration levels were manipulated, through explicit instruction, to be positive monetary amounts. Alternatives involved outcomes that were either above or below these targets. The results were completely consistent with the Kahneman and Tversky findings.

Thus, prospect theory suggests that a combination of lower expected return and lower variance may be selected when *all* outcomes are above the target level, i.e., risk aversion will be exhibited. However, when operating below target, a combination of lower expected return and higher variance may be preferable, i.e., there may be less risk aversion. The decision maker's exhibited behavior, not his utility function, may change.

RISK AND RETURN IN COMMERCIAL BANKING

Fiegenbaum and Thomas [6] note that, in their 1986 study, an analysis of market risk or beta (the relevant measure for the shareholder), instead of total risk, seemed to nullify the negative association effect (low return/high variance and high return/low variance). However, they also suggest that total risk (variance) may be more appropriate for measuring managerial risk. Variability of outcome is more appropriate than beta as a measure of risk for this study because the objective is to gain insight into management behavior.

A number of researchers have modeled the decision making process of the commercial bank in terms of rates of return on assets or equity [Hart and Jaffee [10], Blair and Heggestad [1], Edwards and Heggestad [3], Klein [16], Koehn and Santomero [18], and Sealey [28]]. A 1% *ROA* has been widely recognized as an industry benchmark in the past.[9] At the same time, *ROE* is also a widely reported and analyzed statistic. Recently, capital ratios have received increasing attention by regulators and financial markets [International Monetary Fund [12], Brewer and Lee [2]]. In fact, these three measures are related:

Equation 2

$$ROA = E/TA \times ROE$$

where:

ROA = return on assets, net income to total assets
E/TA = the equity or capital ratio, equity to total assets
ROE = return on equity, net income to equity

In this study each of these is investigated as a possible industry target. The measure of risk is standard deviation of outcome.

DATA FOR THE STUDY

The data for the study are contained on Bank Compustat tapes for the period 1970 through 1989, with the number of banks ranging from 82 in 1970 to 150 in 1988. However, no bank with less than 8 years of data was retained. As a result, the number of banks in the study is 142. For each bank, the annual rates of return on assets and equity and the primary capital ratio were computed.

Equation 3

$$ROA_{in} = Ni_{in} / TA_{in}$$

Equation 4

$$ROE_{in} = Ni_{in} / BV_{in}$$

Equation 5

$$PCR_{in} = Pc_{in} / TA_{in}$$

where:

ROA_{in} = rate of return on assets for bank i in year n
Ni_{in} = net income
Ta_{in} = net total assets for the year, i.e., gross total assets net of reserves for securities and loans
ROE_{in} = rate of return on equity
Bv_{in} = total book value, i.e., common stock, surplus, undivided profits, and contingency and other reserves
PCR_{in} = primary capital ratio
Pc_{in} = total primary capital, i.e., book value, perpetual preferred stock, minority interest in consolidated subsidiaries, and loan loss reserves

The calculation of primary capital generally conforms with thedefinition established by federal regulators [Koch [17, p.190]].

TEST DESIGN

While prospect theory describes choices concerning *future* alternatives, this study attempts to examine *historical* data to determine whether there is any evidence that is consistent with prospect theory. Essentially, the objective is to measure the relationship between outcome variability and distance from target. If variability of bank returns is related to the extent to which the banks operate below target, such results would be consistent with prospect theory and Fishburn's measure of risk (Equation (1)).

Target

For experiments in the laboratory, "breakeven" targets and "explicit instruction" targets are theoretically sound. However, the assumption of a "breakeven" target in commercial banking is, generally, not reasonable. Further, "explicit instruction" targets are not possible on an *ex-post* basis. Thus, an approximated target is necessary. Lev [20] and Frecka and Lee [8] studied the behavior of corporate financial ratios and found, *inter alia*, that *ROA* tends to adjust to industry means. Fiegenbaum and Thomas [6] used industry median *ROE* as the target. Median return

has the advantage over mean return of not being affected by outliers. Accordingly, the first target tested in this study is median *ROA*. The first tests are conducted using median values that apply to the entire group of 142 banks.

TABLE 1
Commercial Bank Groups By Region And Size

#	Regional Group Description	Size Category 1	2	3	4	Total
1	Money Center	4	1	2	14	21
2	Eastern	11	4	9	1	25
3	Southeastern	14	12	8	1	35
4	Midwestern	12	6	8	3	29
5	Southwestern And West Coast	21	2	4	5	32
	Total	62	25	31	24	142

Note: Size categories are based on the mean value of net total assets (gross assets less reserves for securities and loans) during the period 1970-1989. Only those banks that were represented in eight of the 20 years have been included.

Net Total Assets
(Dollars In Million)

≥	<	Size
$0	$3,000	1
$3,000	$5,000	2
$5,000	$10,000	3
$10,000		4

Liang and Rhoades [22] and Liang [21] show that commercial bank performance can be affected by geographical factors. In order to remove some of the effect of geographic differences, the 142 banks in this study are also tested in regional groups. The only exception to this regional partitioning is money center banks, which have been grouped together regardless of head office location so as to control for any differences in their risk/return characteristics. Table 1 describes regional groups 1 through 5. The second set of tests in this study focuses on these *REGIONS*.

Size may also affect risk/return patterns of commercial banks since peer group designations are often based on size. The banks have also been assigned a *SIZE* variable from 1 to 4. The basis for these assignments is the average of total assets for the period tested. Quarterly statistics are compiled by the Federal Deposit Insurance Corporation using the cut-offs of $100 million, $1 billion, and $10 billion to form four peer groups. However, if these cut-offs were used in this study, the grouping of banks with assets between zero and $100 million would contain no banks while the $1 billion to $10 billion group would contain 118 of the 142 banks. The cut-offs of $3 billion, $5 billion, and $10 billion were selected to provide for a better comparison of size effects while allowing at least 10 banks above and below target of each size group. Banks with average assets of less than $3 billion are designated *SIZE* 1, at least $3 billion but less than $5 billion, *SIZE* 2, at least $5 billion but less than $10 billion, *SIZE* 3, and at least $10 billion, *SIZE* 4. Table 1 also shows the *SIZE* breakdown of banks in the study. The third set of tests is conducted within *SIZE* groups.

In each case, the median annual rate of return on assets (time series median *ROA*) for each bank was determined. Then the median value of these median returns (cross-sectional median *ROA*) was established as the target return, as appropriate for each set of tests. In the first set of tests there were no subsets and the target *ROA* divided the banks into two groups with 71 banks above target and 71 banks below.

In the second set of tests, a cross-sectional median *ROA* within each *REGION* was found and the banks separated into above- and below-target groups. For example, *REGION* 1 contains a total of 21 banks. Accordingly, 10 were classified above-target and 11 below-target. Similarly, in the third set of tests, a cross-sectional median *ROA* with each *SIZE* group was set as the target. Using *SIZE* 1 as an example, there are 62 banks in this category, 31 above and 31 below target.

Within each set of tests, the return on equity (*ROE*) and the primary capital ratio (*PCR*) are also examined. The classification scheme is identical to that described for *ROA*. Table 2 provides the cross-sectional median values that were used as targets in each set of tests.

The targets are roughly the same order of magnitude. However, some interesting differences are suggested that are consistent with certain banking trends. The targets for money center banks (*REGION* 1) are consistently lower than any other *REGION*. Banks in the Southwest and the West Coast (*REGION* 5) are next lowest. This appears reasonable in light of the well-documented thinner margins of money center banks and the financial distress of the Southwest during the 1980s. Within the *SIZE* categories, targets generally decrease in magnitude for the larger banks. This, too, appears reasonable.[10]

TABLE 2
Cross-Sectional Median Values Used As Targets

	MEDMROA	***MEDMROE***	***MEDMPCR***
No Subgroups			
All Banks	0.007638	0.130607	0.067866
Regional Groups			
REGION:			
1	0.006108	0.122136	0.062012
2	0.008242	0.130258	0.068552
3	0.008208	0.137609	0.069387
4	0.007687	0.126021	0.068372
5	0.006902	0.124831	0.065644
Size Groups			
SIZE:			
1	0.008589	0.131031	0.070340
2	0.007739	0.126510	0.068285
3	0.007533	0.134354	0.065735
4	0.006227	0.126785	0.057537

Legend:

Cross-Sectional Median	Based On Individual Time Series Bank Median
MEDMROA	Return On Assets
MEDMROE	Return On Equity
MEDMPCR	Primary Capital Ratio

TABLE 3
Summary Of Banks Above And Below Target

RV[1] All Banks:	Total	Classification 1 - Above Target	2 - Below Target
ROA	142	71	71
ROE	142	71	71
PCR	142	71	71

By *REGION*:

		Total		Region					Total		Region					Total	
	Size	#	%[2]	1	2	3	4	5	#	%[3]	1	2	3	4	5	#	%[4]
ROA	1	62	43.7%	4	9	10	7	12	42	59.1%	-	2	4	5	9	20	28.2%
	2	25	17.6%	1	1	4	3	2	11	15.5	-	3	8	3	-	14	19.7
	3	31	21.8	-	2	3	3	2	10	14.1	2	7	5	5	2	21	29.6
	4	24	16.9	6	1	-	1	-	8	11.3	8	-	1	2	5	16	22.5
		142		11	13	17	14	16	71		10	12	18	15	16	71	
ROE	1	62	43.7%	2	6	8	5	9	30	42.3	2	5	6	7	12	32	45.1
	2	25	17.6	1	-	4	3	1	9	12.7	-	4	8	3	1	16	22.5
	3	31	21.8	-	5	4	5	3	17	23.9	2	4	4	3	1	14	19.7
	4	24	16.9	8	1	1	2	3	15	21.1	6	-	-	1	2	9	12.7
		142		11	12	17	15	16	71		10	13	18	14	16	71	
PCR	1	62	43.7%	4	7	10	7	13	41	56.9	-	4	4	5	8	21	30.0
	2	25	17.6	1	2	5	4	2	14	19.5	-	2	7	2	-	11	15.7
	3	31	21.8	-	3	3	4	1	11	15.3	2	6	5	4	3	20	28.6
	4	24	16.9	5	1	-	-	-	6	8.3	9	-	1	3	5	18	25.7
		142		10	13	18	15	16	72		11	12	17	14	16	70	

1. RV = Ranking variable
2. Percentage of total banks in the relevant size group.
3. Percentage of above-target banks in the relevant size group.
4. Percentage of below-target banks in the relevant size group.

Table 3 shows the breakdown of banks above and below target. Banks whose (time series) median outcome equals or exceeds the target outcome (cross-sectional median) have a classification of 1, i.e., above-target. Below-target banks have a classification of 2. When no subsets are formed, there is a total of 71 banks both above and below target. The composition of subsets does not reflect a uniform distribution across *REGION* and *SIZE*, however. When regional median values are used as targets (see *By REGION*), larger banks represent a smaller share of above-target banks than their total numbers would suggest. For example, while banks with assets of at least $10 billion are 16.9% of the total sample, they are only 11.3% of above-target banks when ranking is based on *ROA*. The opposite is true for the smaller banks. This is also generally true when *PCR* is the ranking variable. Because *ROE* is the product of *ROA* and the equity multiplier (the inverse of the capital ratio), the lower capital ratios of the larger banks help compensate for low *ROA* and make the *SIZE* distribution around median *ROE* more uniform.

TABLE 3
Summary Of Banks Above And Below Target

(CONT'D)

By *SIZE*:

		Total		Size				Total		Size				Total	
	Region	**#**	**%**[5]	**1**	**2**	**3**	**4**	**#**	**%**[6]	**1**	**2**	**3**	**4**	**#**	**%**[7]
ROA	1	21	14.8%	1	-	-	6	7	9.9%	3	1	2	8	14	19.7%
	2	25	17.6	7	3	4	1	15	21.1	4	1	5	-	10	14.1
	3	35	24.7	9	6	6	1	22	31.0	5	6	2	-	13	18.3
	4	29	20.4	5	2	4	3	14	19.7	7	4	4	-	15	21.1
	5	32	22.5	9	1	2	1	13	18.3	12	1	2	4	19	26.8
		142		31	12	16	12	71		31	13	15	12	71	
ROE	1	21	14.8%	1	1	-	6	8	11.4	3	-	2	8	13	18.1
	2	25	17.6	6	1	4	1	12	17.1	5	3	5	-	13	18.1
	3	35	24.7	11	6	5	1	23	32.9	3	6	3	-	12	16.7
	4	29	20.4	4	3	5	1	13	18.6	8	3	3	2	16	22.2
	5	32	22.5	9	1	1	3	14	20.0	12	1	3	2	18	25.0
		142		31	12	15	12	70		31	13	16	12	72	
PCR	1	21	14.8%	1	-	-	7	8	11.1	3	1	2	7	13	18.6
	2	25	17.6	5	2	5	1	13	18.1	6	2	4	-	12	17.4
	3	35	24.7	10	5	5	-	20	27.8	4	7	3	1	15	21.4
	4	29	20.4	6	5	5	3	19	26.4	6	1	3	-	10	14.3
	5	32	22.5	9	1	1	1	12	16.7	12	1	3	4	20	28.6
		142		31	13	16	12	72		31	12	15	12	70	

1. RV = Ranking variable
5. Percentage of total banks in the relevant regional group.
6. Percentage of above-target banks in the relevant regional group.
7. Percentage of below-target banks in the relevant regional group.

When *SIZE* groups are used to form the subsets (see *By SIZE* in Table 3), money center banks (*GROUP 1*) and Southwestern and West Coast banks (*GROUP 5*) are under-represented among the above-target banks no matter what ranking variable is used. Thus, the data show that the ranks of the below-target banks are generally skewed toward larger banks classified as money-center banks and those in the Southwest and West Coast areas.

Statistical Test

The Fishburn measure of risk and prospect theory suggest that decision makers are more willing to accept variability the further below target they find themselves. Thus, the standard deviation of outcome should be related to distance from target when decision makers are below target.[11] Distance from target is defined as follows:

Equation 6

$$DTROA_i = MEROA_i - MEDMROA$$

Equation 7

$$DTROE_i = MEROE_i - MEDMROE$$

Equation 8

$$DTPCR_i = MEPCR_i - MEDMPCR$$

where $MEROA_i$, $MEROE_i$, $MEPCR_i$ = time series median *ROA*, *ROE*, and *PCR*, respectively, for bank i. Standard deviation of outcome is designated by the following variables.

Variable	(Time series) Name Standard Deviation Of Bank i's
$SDROA_i$	Rate of return on assets (*ROA*)
$SDROE_i$	Rate of return on equity (*ROE*)
$SDPCR_i$	Primary capital ratio (*PCR*)

Kendall's τ is used to measure the correlations between these variables within the relevant groups (all banks, regional groups, and size groups). The possible values of Kendall's τ range from +1 (perfect positive correlation) to -1 (perfect negative correlation).

It should be noted that $SDROA_i$, for example, is a function of individual bank results, not group results. There is no customary statistical relationship between the standard deviation *ROA* for an individual bank and the median *ROA* for the group, however that group is defined. Further, the groups are formed based either on geographical location or on average asset size, neither of which is one of the variables being analyzed. So the groupings should not bias the results.[12]

However, if Kendall's τ is consistently negative below target, such results would tend to support the Fishburn measure of risk and prospect theory. This can be seen by first considering that the distance from target will be negative for all banks below target (see Equations (6) through (8)). Greater distances from target are associated with more negative (smaller) values of *DTROA*, *DTROE*, and *DTPCR*. Prospect theory would suggest that below-target banks will be risk seeking. The Fishburn measure of risk would predict that the smaller these values (the greater the distance from target), the more appealing larger standard deviations should be. Thus, a negative Kendall's τ is predicted below target. The null and alternative hypotheses are:

Equation 9

$$H_0: \tau_{BT} < 0$$

$$H_A: \tau_{BT} \geq 0$$

where τ_{BT} = Kendall's τ correlation between distance from target and standard deviation for below-target banks.

Rejection of the null hypothesis would suggest that distance below target (related to the Fishburn measure of risk) is associated with greater variability in the observed variable.

Above target, prospect theory suggests risk aversion. It is intuitively appealing to predict that greater distance above target should induce less risk taking (i.e., less variability of return) and, therefore, a negative correlation. However, Fishburn's measure of risk is strictly a below-target measure. Thus, above target, Fishburn's measure of risk has a value of zero and distance from target should have little impact on variability. A zero Kendall's τ is predicted above target. The null and alternative hypotheses are:

Equation 10

H_0: $\tau_{AT} = 0$

H_A: $\tau_{AT} \neq 0$

where τ_{AT} = Kendall's τ correlation between distance from target and standard deviation for above-target banks.

Rejection of the null hypothesis would suggest that distance above target (about which the Fishburn measure of risk is silent) is related to the degree of variability in the observed variable.

If the null hypothesis in Equation (9) is rejected while the null hypothesis in Equation (10) is not, this would suggest that distance from target has potential explanatory power below target, but not above. Such results would support the Fishburn measure of risk and prospect theory.

TEST RESULTS

Table 4 contains the Kendall's τ correlations for each group of tests. Generally, the correlations are not significant above target. Results are mixed below target.

All Banks

When no subsets are formed, none of the above-target τs are statistically significant. All of the below-target τs are significant at the 0.5% level and all are negative. The magnitude of the correlations ranges from -0.286 (for the *ROE* ranking) to -0.398 (for the *ROA* ranking).

TABLE 4
Kendall's τ Correlations

RV[1]	**Classification**	
All Banks:	**1 - Above Target**	**2 - Below Target**
ROA	-0.073	-0.398***
ROE	-0.025	-0.286***
PCR	0.097	-0.346***

By REGION:

	Classification 1 - Above Target *REGION*				
	1	**2**	**3**	**4**	**5**
ROA	0.011	-0.077	-0.015	-0.495**	-0.118
ROE	0.077	0.061	-0.250	-0.371*	-0.450**
PCR	0.051	0.200	0.368*	-0.067	0.111

TABLE 4
Kendall's τ Correlations

(CONT'D)

	Classification 2 - Below Target ***REGION*** 1	2	3	4	5
ROA	-0.378	-0.473**	-0.450**	-0.390*	-0.221
ROE	-0.244	-0.410*	-0.766***	-0.269	-0.020
PCR	-0.455*	-0.212	0.044	-0.253	-0.367*

By SIZE:

	Classification 1 - Above Target ***SIZE*** 1	2	3	4
ROA	-0.002	-0.121	-0.183	-0.231
ROE	0.191	-0.545**	0.181	0.055
PCR	0.127	0.187	-0.017	-0.407

	Classification 2 - Below Target ***SIZE*** 1	2	3	4
ROA	-0.457***	-0.165	-0.505**	-0.333
ROE	-0.352***	-0.473**	-0.033	-0.303
PCR	-0.080	-0.091	-0.162	-0.039

1. RV = Ranking Variable
Significance levels: * 5.0%, ** 2.0%, *** 0.5%

Regional Groups

Within regional groups, the results may be summarized as follows:

	Above Target			Below Target	
	Positive	Negative		Positive	Negative
Significant Correlations	1	3	Significant Correlations	0	7
Nonsignificant Correlations	6	5	Nonsignificant Correlations	1	7

Above target, 11 of 15 (73%) are not significantly different from zero. The average value of the 11 nonsignificant τ values is -0.00145. Of the 4 that are significant, 3 (20%) are negative, suggesting that when there is a significant relationship, a greater distance above target is associated with less variability of return. The values range from -0.495 (*ROA* ranking, *REGION* 4) to 0.368 (*PCR* ranking, *REGION* 3) and the average is -0.237.

Below target, 7 of 15 (46.7%) are significantly different from zero and negative. Furthermore, *ROA* and *ROE* rankings produce 5 of the 7. These 5 significant correlations represent 5 of the 6 tests for rates of return in *REGIONS* 2, 3, and 4. The values range from 0.766 (*ROE* ranking, *REGION* 3) to -0.367 (*PCR* ranking, *REGION* 5). The average value for the significant results is -0.473. The average value of Kendall's τ for the 8 nonsignificant results is -0.194.

Size Groups

Within size groups, the results may be summarized as follows:

	Above Target			Below Target	
	Positive	Negative		Positive	Negative
Significant Correlations	0	1	Significant Correlations	0	4
Nonsignificant Correlations	5	6	Nonsignificant Correlations	0	8

Above target, 11 of 12 (92%) are not significantly different from zero. The average value of the 11 nonsignificant τ values is 0.02. The one significant value is for *ROE* ranking, *SIZE* 2. The Kendall's τ is -0.545, again, a negative relationship.

Below target, only 4 (33.3%) are significantly different from zero; all are negative. However, these 4 represent 67% of the 6 rate of return rankings for *SIZES* 1, 2, and 3. The values range from -0.505 (*ROA* ranking, *SIZE* 3) to -0.473 (*ROE* ranking, *SIZE* 2). The average value for the 4 significant correlations is -0.447. The average value of the 8 nonsignificant correlations is -0.151. No correlation for the primary capital ratio is significant.

CONCLUSION AND DISCUSSION

The results of the study support prospect theory and Fishburn's measure of risk among the below-target banks. When no sub-groups are formed, the results are unambiguously as predicted.

In the regional tests, for the significant results, the relationship is twice as strong in below-target banks as compared to above-target banks and is concentrated in measures of rate of return. (This is also noted among those regional correlations that are not statistically significant.) This suggests that the Fishburn measure of risk is more strongly associated with variability below-target. Greater distances from target (smaller values) are more often associated with greater variability of rate of return. Above target, the distance from target is not as strongly correlated with reduced variability. When it is correlated, there is a negative relationship, suggesting less risk aversion when relatively higher above target.

With respect to the size tests, the average significant below-target Kendall's τ is 82% of the one significant above-target correlation. (Again, the average nonsignificant τ below target is much larger than the above-target average.)

The evidence is strongest for *ROA* and *ROE*. Eleven of 20 *ROA* and *ROE* rankings below target (two including all banks, 10 by *REGION*, eight by *SIZE*) resulted in significant correlations, while only three of the 10 below-target *PCR* rankings (one including all banks, five by *REGION*, four by *SIZE*) did so. For these below-target banks, this evidence may suggest that *ROA* and *ROE* are more likely to be considered managerial targets than the capital ratio.

It should be noted that commercial bank managers do have the ability to effect certain changes in all three ratios. For example, should a bank's management find itself operating below-target, a profitable sale of appreciated securities can quickly add to the bottom line. This practice is commonly called "gains trading." But earnings will improve only for the accounting period of the sale. Profits can be augmented on a more lasting basis by increasing the loan portfolio through the provision of credit to higher risk borrowers, resulting in higher interest income per dollar invested. This can be accomplished either through direct loans or participations in loans originated by other banks. Generating the funds to finance these loans is also possible through active liability management. By increasing the rate paid on negotiable and nonnegotiable certificates of deposit, a bank can attract new money, especially if the deposit instruments are being promoted by a securities broker in insured $100,000 blocks.[13]

Clearly, if the spread on the loans over and above the deposit rate is higher than usual, the profitability of the bank will be enhanced, enabling a below-target bank to come closer to reaching the aspiration level of earnings. Of course, should the loans fail to be repaid as originally contracted (which probability is increased when more risky loans are booked), earnings will continue to deteriorate. On the other hand, banks that are operating above target need not resort to this approach.

A bank's management can also change its capital ratio. The primary capital ratio, used in this study, is a ratio of the sum of common equity capital, preferred stock, minority interest in consolidated subsidiaries, and loan loss reserve to total assets. If the current provision for loan loss (a noncash expense item subject to management discretion) is increased for a given period, this will have the effect of increasing the primary capital ratio because *ceteris paribus* the numerator will increase and the denominator will decrease. Also the sale of assets at (or above) book value to retire liabilities will increase the capital ratio because the numerator will be unchanged (or increase) while the denominator is reduced. This can often be accomplished through the securitization of loans for sale on the secondary market. This is especially true for larger banks such as those included in this study.

If it is true that rates of return serve as management targets instead of capital ratios, there may be important implications for commercial bank regulators. This is particularly true since there is strong national and international emphasis on improving bank capital ratios. Bank managers that are operating below target may be less concerned with capital ratios and more concerned with achieving desired rates of return. Moreover, the further below target the bank operates, the greater the variability of rates of return. At a minimum, the results of the study at least suggest that bank managers operating below target will not necessarily be risk averse and that perhaps greater variability of rates of return should be expected when banks operate below target.

Above target, the results fail to reject the null hypothesis in only four of the 20 *ROA* or *ROE* rankings and one of the 10 *PCR* rankings. Thus, the distance from target is far less frequently correlated with variability of outcome for above-target banks than for those operating below target.

There also appear to be some regional and size differences among the below-target banks. For *REGION*s 1 (money center banks) and 5 (Southwest and West Coast), only the ranking by the primary capital ratio resulted in a statistically significant correlation. *REGIONS* 2 (Eastern), 3 (Southeastern), and 4 (Midwestern) exhibit significant correlations in five of six *ROA* and *ROE* rankings. These results suggest that there may be different target mechanisms in different regions.

This mixture of regional results no doubt contributes to the lack of a significant correlation among *SIZE* 4 banks (average assets of at least $10 billion). Nevertheless, for the next largest banks, *SIZE* 3 (average assets at least $5 billion, but less than $10 billion), the evidence suggests *ROA* may be the target mechanism for banks operating below target (τ = -0.505). For *SIZE* 2 banks (average assets at least $3 billion, but less than $5 billion), equally strong evidence is presented for *ROE* (τ = -0.473). The results for the smallest group, *SIZE* 1 (average assets less than $3 billion) suggest both *ROA* and *ROE* may be operative (τ = -0.457 and -0.352, respectively). Whether *REGION* or *SIZE* is considered, within the banking industry, rates of return appear to be much more likely target mechanisms than capital ratios.

These results offer support both for Fishburn's measure of risk and Kahneman and Tversky's prospect theory. Outcome variability below target may be related to distance from target.

(While above target results may induce less variability, the reduced variability is not clearly related to distance from target.) Rates of return may perform the target function but these relationships can be affected by geographical location and size.

Theoretically, if the utility functions of bank managers do contain convex segments below target, models of the banking firm that assume universal risk aversion or risk neutrality are improperly specified. The results of this study suggest that the concepts of target outcome and distance below target should be incorporated into models that rely on risk preference assumptions. The target return is the point of inflection of the utility function and outcomes below target may induce significantly different levels of risk tolerance. Furthermore, the distance below target can affect the degree of change in risk tolerance. It is clear that models of the banking firm may be at best imprecise without considering the possibility of convex segments of the utility function below target.

From a practical standpoint, bank regulators will be better equipped to monitor the banking system if they understand that bank managers may become less risk-averse when they operate below target and that this tendency increases as operating results worsen. If bank regulators are cognizant of these relationships, perhaps the oversight function can be made more effective.

ENDNOTES

1. From 1940 through 1979, 300 banks closed because of financial distress. Between 1980 and 1988, the total was 831. In recent years, the average has been on the order of 200 per year [4].

2. Note that when α falls within the interval (0,1), *R(t)* is a concave function. Accordingly, by Jensen's inequality, the risk of a below-target gamble will be less than the risk of a certain below-target outcome, even if the expected value of the gamble is exactly equal to the certain outcome. In the traditional sense, when an individual selects the alternative with a greater variance and the same expected return, he is considered to be risk seeking. When α is greater than 1, *R(t)* is a convex function, the reverse inequality is true, and the decision maker is considered risk averse.

3. In fact, Segal [29] shows that expected utility theory is a subset of anticipated utility theory.

4. The probability transformation function of Karni and Safra [15] is similar to the probability weighting scheme of Kahneman and Tversky [13] and Tversky and Kahneman [31]. However, Kahneman and Tversky conclude that small probabilities may be overweighted while moderate and high probabilities may be underweighted.

5. Conceivably, real estate loans and credit card operations could be examples of higher payoff alternatives for banks, with somewhat lower probabilities of payoff than other commercial bank investments ("$" bets). But both were an important part of bank asset portfolios by the early 1970s. Thus, *EURDP* does little to explain the perceived change in risk taking. Lastly, *EURDP* theory does not address behavior when decision makers are faced with losses, a very real consideration in the commercial banking industry.

6. A random variable *X* dominates a random variable *Y* by mean-variance criterion if the expected value of *X*, *E(X)*, is greater than *E(Y)* and the variance of *X*, *V(X)*, is less than *V(Y)*. Alternatively, *X* will dominate *Y* if $E(X) = E(Y)$ and $V(X) < V(Y)$ or if $E(X) > E(Y)$ and $V(X) = V(Y)$. *X* will stochastically dominate *Y* to the first order if the cumulative probability function of *X* nowhere exceeds that of *Y* [Schoemaker [27, p.549 footnote]]. *X* will stochastically dominate *Y* to the second order if the area under the cumulative probability distribution of *X* is less than or equal to the area under the cumulative probability function of *Y* and strictly less for at least one value [see Payne, Laughhunn, and Crum [23, p.1051]].

7. Alternative II does dominate by second order stochastic dominance, however. In fact, prospect theory predictions are generally consistent with second order stochastic dominance.

8. *EURDP* theory would not appear to predict dominance in this situation since the favorable outcomes are equal (zero) and neither of the alternatives can be classified as a "P" lottery (high probability of winning a small amount of money in exchange for a small price) or a "$" lottery (low probability of winning a relatively large amount of money).

9. Eroding industry profits have made the 1%-*ROA* benchmark much less common.

10. It should be noted that although the median values are very similar, each test depends on using the exact median value for the relevant group, i.e., that value which separates the banks into above-and below-target subgroups.

11. To ensure representative standard deviations of return, no bank with few than eight years' data was used in the tests.

12. The banks in this study represent the largest institutions in the United States, with over 12,500 smaller banks not being included. This does not bias the study, however, because comparable banks are being analyzed. Some are below target and some above. The test centers on differences within this group, not differences between this group and another group. Also, to the extent that these larger banks have greater money and capital market access (and the attendant flexibility of such access), they are perhaps in a better position to manipulate accounting results. Thus, if there is any size bias in the study, the inclusion of only larger banks would tend to obscure the results rather than to accentuate them, rendering any observed support of prospect theory even more significant.

13. During the period of this study (1970-1989), there were no restrictions on "brokered" deposits for commercial banks. The FDIC Improvement Act of 1991 prohibits the practice only if the issuing bank is undercapitalized.

REFERENCES

[1] Blair, Roger D. and Arnold A. Heggestad, "Bank Portfolio Regulation and the Probability of Bank Failure, A Note, " *Journal of Money, Credit and Banking* 10, 1978, pp. 88-93.

[2] Brewer, Elijah III and Cheng Few Lee, "How the Market Judges Bank Risk," *Economic Perspectives* (Federal Reserve Bank of Chicago) 10, 1986, pp. 25-31.

[3] Edwards, Franklin R. and Arnold A. Heggestad, "Uncertainty, Market Structure, and Performance: The Galbraith-Caves Hypothesis and Managerial Motives in Banking," *Quarterly Journal of Economics* 87, 1973, pp. 455-473.

[4] *Federal Deposit Insurance Corporation 1988 Annual Report*, Washington, D.C., 1989.

[5] Fiegenbaum, Avi and Howard 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.

[6] Fiegenbaum, Avi and Howard Thomas, "Attitudes Toward Risk and the Risk-Return Paradox: Prospect Theory Explanations," *Academy of Management Journal* 31, 1988, pp. 85-106.

[7] Fishburn, Peter C., "Mean-Risk Analysis with Risk Associated with Below-Target Returns," *American Economic Review* 67, 1977, pp. 116-126.

[8] Frecka, Thomas J. and Cheng F. Lee, "Generalized Financial Ratio Adjustment Processes and Their Implications," *Journal of Accounting Research* 21, 1983, pp. 308-316.

[9] Friedman, Milton, and Leonard J. Savage, "The Utility Analysis of Choices Involving Risk," *Journal of Political Economy* 56, 1948, pp. 279-304.

[10] Hart, Oliver D. and Dwight M. Jaffee, "On the Application of Portfolio Theory to Depository Financial Intermediaries," *Review of Economic Studies* 41, 1974, pp. 129-147.

[11] Ho, Thomas S.Y. and Anthony Saunders, "The Determinants of Bank Interest Margins: Theory and Empirical Evidence," *Journal of Financial and Quantitative Analysis* 16, 1981, pp. 581-600.

[12] International Monetary Fund, "Recent Developments in Financial Regulation and Market Structures," *International Capital Markets: Developments and Prospects*, Washington, D.C., 1990, pp. 43-51.

[13] Kahneman, Daniel and Amos Tversky, "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica* 47, 1979, pp. 263-291.

[14] Karni, Edi and Zvi Safra, ""Preference Reversal" and the Observability of Preferences by Experimental Methods," *Econometrica* 55, 1987, pp. 675-685.

[15] Karni, Edi and Zvi Safra, "Rank-Dependent Probabilities," *The Economic Journal* 100, 1990, pp. 487-495.

[16] Klein, Michael, "Theory of the Banking Firm," *Journal of Money, Credit, and Banking*, May 1971, pp. 205-218.

[17] Koch, Timothy W., *Bank Management*, Dryden Press, Hinsdale, Illinois, 1988.

[18] Koehn, Michael and Anthony M. Santomero, "Regulation of Bank Capital and Portfolio Risk," *Journal of Finance* 35, 1980, pp. 1235-1244.

[19] Laughhunn, Dan J., John W. Payne, and Roy Crum, "Managerial Risk Preferences for Below-Target Returns," *Management Science* 26, December 1980, pp. 1238-1249.

[20] Lev, Baruch, "Industry Averages as Targets for Financial Ratios," *Journal of Accounting Research* 7, 1969, pp. 290-299.

[21] Liang, Nellie, "Bank Profits, Risk, and Local Market Concentration," *Journal of Economics and Business* 41, 1989, pp. 297-305.

[22] Liang, Nellie and Stephen A. Rhoades, "Geographic Diversification and Risk in Banking," *Journal of Economics and Business* 40, 1988, pp. 271-284.

[23] Payne, John W.; Dan J. Laughhunn; and Roy Crum, "Translation of Gambles and Aspiration Level Effects in Risky Choice Behavior," *Management Science* 26, October 1980, pp. 1039-1060.

[24] Payne, John W.; Dan J. Laughhunn; and Roy Crum, "Further Test of Aspiration Level Effects in Risky Choice Behavior," *Management Science* 27, 1981, pp. 953-958.

[25] Pyle, David H., "On the Theory of Financial Intermediation," *Journal of Finance* 26, 1971, pp. 737-747.

[26] Santomero, Anthony M., "Fixed Versus Variable Rate Loans," *Journal of Finance* 38, 1983, pp. 1363-1380.

[27] Schoemaker, Paul J.H., "The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations," *Journal of Economic Literature* 20, 1982, pp. 529-563.

[28] Sealey, C.W., Jr., "Valuation, Capital Structure, and Shareholder Unanimity for Depository Financial Intermediaries," *Journal of Finance*, XXXVIII, 1983, pp. 857-871.

[29] Segal, Uzi, "The Ellsberg Paradox and Risk Aversion: An Anticipated Utility Approach," *International Economic Review* 28, 1987, pp. 175-202.

[30] Swalm, Ralph O., "Utility Theory-Insights Into Risk Taking," *Harvard Business Review* 47, 1966, pp. 123-136.

[31] Tversky, Amos and Daniel Kahneman, "The Framing of Decisions and the Psychology of Choice," *Science* 211, 1981, pp. 453-458.

[32] Volcker, Paul A., "Statement by Paul A. Volcker, Chairman, Board of Governors of the Federal Reserve System," Hearings before the Committee on Banking, Housing, and Urban Affairs, United States Senate, April 26, 1983.

[33] Von Neumann, John and Oskar Morgenstern, *Theory of Games and Economic Behavior*, 3e., Princeton, N.J.: Princeton University Press, 1953.