Journal of Economic Behavior and Organization 24 (1994) 225–231. North-Holland

Prospect theory and the risk return association: Another look

Tapen Sinha*

Bond University, Gold Coast, Queensland 4229, Australia

Received May 1991, final version received May 1992

In a seminal study, Fiegenbaum (1990) attempted to set down parameters of relationship between risk and return for firms and related it to 'two piece von-Neumann Morgenstern utility function' first explored empirically by Fishburn and Kochenberger (1979). I re-examine the estimated relationship. Specifically, I perform a meta-analysis of the above and below median returns to show that the relationship between risk and return is weaker above median than below median. I also show that the relationship between below median returns and above median returns is very small exhibiting compartmentalization of decision making by the firms similar to individual decision makers.

Key words: Prospect theory; Risk-return trade off
JEL classification: G11

1. Introduction

Prospect theoretic explanation of the behavior of the firm has opened a new era in the research of risk and return relationship at the firm level. The pioneering study of Bowman (1980, 1982, 1984) has led the way. Fiegenbaum and Thomas (1986, 1988) did much to expand the scope of the study over longer time spans as well as over larger bodies of data. However, Fiegenbaum (1990) went one step further: he attempted to set down parameters of relationships between risk and return and related it to 'two piece von-Neumann Morgenstern utility function' first explored empirically by Fishburn and Kochenberger (1979).

The strategy after establishing a relationship between risk and return is to proceed to estimate the relationship. In this paper, I will re-examine the estimated relationship obtained by Fiegenbaum, comment on some pitfalls in

Correspondence to: T. Sinha, School of Business, Bond University, Gold Coast, Queensland 4229, Australia.
*I am indebted to Avi Fiegenbaum, Richard Tress and all the participants of the seminars at Bond and Macquarie University for their input. Remaining errors are mine alone.

SSDI 0167-2681(94)E0028-X

estimation, connect the results of Fiegenbaum with further developments in Prospect Theory.

2. Some methodological issues

2.1. Statistical problems with the model

In Fiegenbaum's paper, risk and return relationship is postulated by a simple regression(OLS) model: risk = a + b · return + error for each industry. Then a and b estimates are used for all the subsequent inferences. There is one well known problem with the simple linear regression. The estimates are sensitive to outliers of data on risk and return. This problem is not simply of theoretical interest to us. I ran the regressions with Australian data and found that the estimates of a and b change dramatically when outliers are deleted (see below).

2.2. Validity of an analogy between individuals and firms

Using the Prospect Theory for analyzing firm behavior required a leap from the use of the theory in the domain of the individual behavior to the behavior of the firm. For Bowman (1982), the justification was provided with the following comment: 'Speaking of a company as an individual (i.e., a rational actor) is a kind of anthropomorphism that apparently is quite common in political science literature as well as in the literature of economic theory.'

For each industry, Fiegenbaum estimates the slope coefficient b for above median and below median rates of return. He finds the absolute value of b for below median firms to be three times the size of the value of b for above median firms. He then compares the result with the findings of Fishburn and Kochenberger. Unfortunately, this comparison is problematic. Fiegenbaum points out that he has gone a step further from Fishburn and Kochenberger by moving the domain from individuals to firms, but he does not explore it in detail. I set out the differences below.

First, Fishburn and Kochenberger fitted above target and below target equations with increments in wealth and utility. Fiegenbaum uses rate of return and variance. There could be an argument for likening the increments in wealth with rate of return. But utility and variance and two very distinct concepts. In a local sense, we could approximate an expected utility function as a polynomial with the mean and the variance as coefficients. But it is a far cry from identifying variance with utility.

Second, the utility functions estimated by Fishburn and Kochenberger were for individuals. If the decision-making process for individuals are very different from that of firms, the analogy may not hold. Specifically, considering utility of a firm is problematic (utility of whom? managers? shareholders?). Usually, firms are assumed to maximize profit. If firms maximize profits, the assumption of risk aversion becomes meaningless as profit maximization implies risk neutrality. However, some researchers have used utility functions by rationalizing them as the utility functions of managers (for example, Hey (1979) and McKenna (1985)).

There is an interesting parallel between the behavior of individuals and animals under uncertainty. A striking experimental demonstration was provided by Hamm and Shettleworth (1987) with pigeons. They showed that pigeons too like humans suffer from anchoring biases: they are risk averse above target and risk taking below target (where target is defined as the maintenance of body weight to survive).

3. A re-examination of risk return relationship with Australian data

3.1. Why do we need another study?

The only study that looked at the risk and return relationship outside of the US is Jegers (1991). In the sequel, I will look at the evidence with Australian data. There are several reasons for replication. First, replication of a theory is necessary to validate it across different economic environments. Second, I perform additional calculations to show how extreme values affect the estimates of a and b for different industries. Third, I perform a meta-analysis of the above and below median returns to show that the relationship between risk and return is weaker above median than below median. I also show that the relationship between below median returns and above median returns are very small. There is a compartmentalization of decision making by the firms. Fourth, unlike Jegers (but in the spirit of Fiegenbaum) I was able to 'decontaminate the data' by eliminating diversified companies. Compared with the US, Australia has far fewer companies in different industries. Moreover, the number of industries in Australia is much smaller compared with the US. As a result, the companies in different industries are 'purer'.

3.2. The dataset

There is no database similar to the one compiled by COMPUSTAT in Australia. The simple reason is that there is no reporting requirement analogous to 10K in the United States. Thus, it is very expensive to develop a database in Australia.

The best possible alternative is the one that comes from the Centre for Research in Finance (CRIF) of the Australian Graduate School of Management database of the Annual Report Record (1977–1985). The database contains records of all the publicly traded companies in Sydney Stock

Table 1

Regression results for Australian data (1977–85). Fitted equation: standard deviation = a + b(average) + error

Industry code	No. of firms	Below median			Above median		
		a	b	R^2	a	b	R^2
01	30	21*	−0.8*	0.22	17*	−0.0	0.01
02	37	22*	−1.1*	0.32	0.4	1.6*	0.20
04	10	11*	−1.6*	0.92	−0.8	1.5*	0.46
06	15	19*	−1.5*	0.70	−31	2.9*	0.35
07	31	16*	−1.3*	0.50	5.4	0.1	0.01
09	20	71*	−7.9*	0.77	−4*	0.6*	0.70
11	17	19*	−1.3*	0.33	3	0.3	0.03
13	25	12*	−0.8*	0.26	3	0.2	0.01
15	19	12*	−0.4	0.06	10	−0.1	0.01
16	10	15*	−1.2	0.09	1.3	0.2	0.01
17	10	15	−1.3	0.04	0.5	0.3	0.04
19	36	16*	−1.5*	0.36	−3.3	1.0*	0.17
21	33	17*	−0.6*	0.32	4	0.3	0.01
22	48	17	−1.6*	0.37	0.0	0.6*	0.29

* Denotes a statistically significant coefficient at 5% level of significance.

Exchange. The classification of companies are made according to the ASIC two digit codes. More recent figures are not available as the updating of the Annual Report Record was discontinued at the end of 1985 by CRIF. The number of companies in total was about 1,000. There are fewer industries in the dataset. But, as pointed out earlier, the Australian industry structure is much simpler.

3.3. Results

As a measure of risk, I take standard deviation of the firm's returns. In earlier studies, variance was used instead. The reason for using standard deviation is simple: standard deviation and mean have the same unit of measurement. The use of ordinary least square is more reliable in such a situation. As a measure of return, I use return on asset (ROA) and detrend them as suggested by Wiseman and Bromiley (1991).

Out of twenty two industries, there were fourteen industries with more than ten observations above and below the median rate of return. For below median cases, there were 13 (11) statistically significant values of a (b) at 5 percent level of significance. For above median cases, there were 2 (6) statistically significant values of a (b) at 5 percent level of significance. Thus, the negative risk return relationship is very strong for below median cases whereas the positive risk return relationship for above median cases is rather weak. Fiegenbaum's findings are similar as well (see Fiegenbaum's Table 1).

The counting of significant number of a and b is different in Fiegenbaum: he uses a somewhat unusual level of significance of ten percent (however, his

Table A1 in the appendix reports three levels of significance: one percent, five percent and ten percent). Nevertheless, we notice two sets of evidences in Fiegenbaum that support the conclusion that risk return association is stronger for the below median cases. First, the median coefficient of determination is larger for below median cases (0.4240 versus 0.2067). Second, the number of significant b's for below median cases is 59 out of 85 (69.4%) whereas the number of significant b's for above median cases is 47 out of 85 (55.3%). The relationship above median is weaker. In my sample, we observe a similar pattern: the proportion of significant b's for below median cases is 78.6% whereas the proportion of significant b's for above median cases is 42.9%. Therefore, the contrast is starker in my sample.

One surprising aspect of the existence of the target is how compartmentalized the decision making seems to be above and below target. This result was first noticed by Cohen et al (1987, p. 12–13) in the context of decision making of individuals. They found that (a) there was very little correlation between the certainty equivalent in the domain of losses and in the domain of gains but (b) a very strong correlation within the loss domain and within the gain domain (among different certainty equivalent sums). The correlations above median levels and below median levels in Fiegenbaum's Table A1 provides an opportunity to perform a meta-analysis of the correlation in the spirit of Cohen et al. Roughly speaking, if results of individual decision making translates to the behavior of the firms, we would expect a low correlation between the above median behavior and the below median behavior. This is exactly the case. The correlation between the above median correlation and the below median correlations is almost zero (statistically insignificant even at $p=0.001$). Thus, it seems the decision process above median is uncorrelated with decision below median industry returns.

4. Where do we go from here?

Prospect theory was very successful in dealing with a number of issues in decision making under uncertainty. However, it is not the only model to explain risk taking below a threshold. There are other competing models such as Regret Theory of Loomes and Sugden (1982), Skew Symmetric Bilinear Utility Theory of Fisburn (1982) and local expected utility theory of Machina (1982). These theories are competitors of the prospect theory. What we need to establish is how we could find if one theory is superior to another in some sense.

In the original article, Bowman (1980) expressed skepticism about the usefulness of this theory to market level tests. He writes 'Given that a negative correlation between risk and return (to the firm) within industries is established here, in what way, if any, does this idea carry over into the capital markets? It is unlikely – though not impossible – that a *market* *imperfection* would be discovered.' (p. 30) As a final thought, Bowman also cites Beaver et al. (1970) which finds a close correlation between total risk and beta at the firm level.

In a similar vein, Fiegenbaum (1990) remarks 'It should be noted that modern portfolio theory, ... , has developed sophisticated methods for understanding the relationships among risk, return, diversification at the security market and it is conceptualized in the CAPM.' (p. 192)

It seems that these researchers became almost apologetic for using variance or standard deviation as risk. Presumably, the use of beta (as a result of the capital asset pricing model) will be more desirable. However, recent evidence has shown that even ardent advocates of beta have become disillusioned with it. Fama and French (1991) have the following comment on their summary of beta as an explanatory variable for risk: 'The relationship between beta and average returns for 1941–1990 [for the stocks listed in the New York Stock Exchange] is weak, perhaps non-existent, even when beta is the only explanatory variable.' Therefore, using beta (instead of the standard deviation) to salvage the positive relationship between risk and return seems to be ruled out (Sinha, 1992).

References

Beaver, W., Kettler, P. and Scholes, M., 1970, The association between market determined and accounting determined risk measures, The Accounting Review, 654–682.

Bell, D., 1982, Regret in decision making under uncertainty, Operations Research 30, 961–981.

Bowman, E., 1980, A risk/return paradox for strategic management, Sloan Management Review 21, 17–31.

Bowman, E., 1982, Risk seeking by troubled firms, Sloan Management Review 23, 33–42,

Bowman, E., 1984, Content analysis of annual reports for corporate strategy and risk, Interfaces 14, 61–71.

Cohen, M., Jaffray, J. and Said, T., 1987, Experimental comparison of individual behavior under risk and under uncertainty for gains and for losses, Organizational Behavior and Human Decision Processes 39, 1–22.

Fama, E. and French, K., 1991, The cross section of expected stock returns, Working paper no. 333, Graduate School of Business, University of Chicago.

Fiegenbaum, A., 1990, Prospect theory and the risk return association: An empirical examination of 85 industries, Journal of Economic Behavior and Organization 14, 187–203.

Fiegenbaum, A. and Thomas, H., 1986, Dynamic and risk measurement perspectives on Bowman's risk-return paradox for strategic management: An empirical study, Strategic Management Journal 7, 395–407.

Fiegenbaum, A. and Thomas, H., 1988, Attitudes towards risk and risk return paradox: Prospect Theory explanations, Academy of Management Journal 31, 85–106.

Fisburn, P., 1982, Nontransitive measurable utility, Journal of Mathematical Psychology 26, 31–67.

Hamm, S. and Shettleworth, S., 1987, Risk aversion among pigeons, Journal of Experimental Psychology: Animal Behavior Process 13, 376–383.

Hey, J., 1979, Uncertainty in Microeconomics (Martin Robertson, Oxford).

Jegers, M., Prospect Theory and the risk-return relation: some Belgian evidence, Academy of Management Journal 34, 215–225.

Kahneman, D. and Tversky, A., 1979, Prospect Theory: An analysis of decision under risk, Econometrica 47, 263–291.

Loomes, G. and Sugden, R., 1982, Regret theory: An alternative theory of rational choice under uncertainty, Economic Journal 92, 805–824.
Machina, M., 1982, Expected Utility Analysis without the Independence Axiom, Econometrica 50, 277–323.
McKenna, C., 1985, Uncertainty and the Labour Market (Wheatsheaf Books, Brighton).
Sinha, T., 1992, Risk/return, Journal of Australian Society of Security Analysts, September, 30–32.
Wiseman, R. and Bromiley, P., 1991, Risk return associations: Paradox or artifact? An empirically tested explanation, Strategic Management Journal 12, 231–241.
Yates, J., 1990, Judgement and decision making (Prentice Hall, Englewood Cliffs).

current address
Tapen Sinha
tapen@itam.mx
ITAM, Mexico