Corporate Risk-Taking and Shareholder Diversification*

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Abstract

We construct a simple model that explains the relationship between portfolio diversification of large shareholders and corporate risk-taking behavior. We assume that manager affects risk level in contrast to standard models in the principal-agent literature. Taking account of multiple holdings of firms by a shareholder, we obtain the result the risk of firm is high when shareholder's portfolio is well-diversified.

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1 Introduction

Classical financial theory demonstrates that portfolio diversification reduces risks at every level of expected return. This suggests that investors should divide their wealth among many assets. Regarding corporate ownership structure, however, we find that a few shareholders hold a large fraction of the firm's stocks. They are large shareholders and some of them concentrate their wealth in the firm they own. When a controlling large shareholder concentrates her wealth in a firm she owns, her portfolio exposes the firm specific but avoidable risk.

Constructing well-diversified portfolio is beneficial to shareholders, on the other hand, if shareholders have monitoring technologies to improve firms' performance, holding a large fraction of shares profits them because it gives the control rights and eases agency problems. Therefore, large shareholders face the trade-off between portfolio diversification and costly monitoring.

Recently, Faccio et al. (2011, p.3601) find the empirical evidence that "firms controlled by nondiversified large shareholders invest more conservatively than firms controlled by well-diversified large shareholders." They hypothesize that, if their wealth is concentrated in the firms they own, risk-averse owners will direct managers to avoid risk even more so than they would had they held a diversified portfolio. Similarly, Panousi & Papanikolaou (2012) model risk-averse managers might underinvest when firm-specific uncertainty increases, and it leads to suboptimal level of investment from the perspective of well-diversified shareholders. These empirical studies suggest that the risk attitude of managers, owners and shareholders has effects on corporate investment policies. Thus, our aim is to investigate the relationship among them.

Our research is related to the literature on the agency problem between a manager and shareholders like Jensen & Meckling (1976). We construct a simple model where both risk-averse shareholder offers a contract to managers and managers have single risky investment project. The output is assumed to

be random, but the manager can select risk of the project. Our model is based on the model of Danielsson et al. (2002), in which the principal offers optimal linear contract where agent manage the risk of project. In their model, when principal cannot observe the manager's effort, the resulting volatility of project is higher than the first-best scenario.

Our model is related to the principal-agent model where a manager selects risk level. Hirshleifer & Suh (1992) offer the model that risk-neutral shareholders motivate a manager to select among projects with different risks and effort levels. In their model, shareholders are risk-neutral so that their portfolio are considered to be well-diversified.

In these models, risk preferences of shareholder are described by risk aversion. We instead assume that risk-averse shareholders own some firms in order to take into account portfolio diversification of shareholders.

This study is related to two strands of existing research. One strand concerns the role of a large shareholder in resolving managerial moral hazard problems via monitoring. Admati et al. (1994) and Huddart (1993) develop the model in which a risk-averse large shareholder has access to a costly monitoring technology affecting manager's effort. Ownership concentration matters in these papers because investors are risk-averse and have the need to diversify. They suggest the existence of a large shareholder helps mitigate agency conflicts between a firm's shareholders and its management. Admati et al. (1994) and Huddart (1993) show that a risk-averse controlling shareholder who has monitoring technologies hold a small fraction of stocks because of benefits from diversification.

Edmans (2014) reviews the relationship between blockholders (large shareholders) and corporate governance. He focuses on outside blockholders (large shareholders who are not the firm's officers). Edmans (2014, p.24) explains "the three mechanisms through which large shareholders can affect firm value: (a) improving it by governance through voice, (b) improving it by governance through exit, or (c) worsening it through extracting private benefits or other channels."

We don't consider directly firm value, but we should investigate the interrelation between shareholder structures and asset prices.

2 The Model

We focus on risk-taking behavior of the managers of N firms. These firms are owned by a large controlling shareholder and a group of small investors[1]. We assume that both the manager and the controlling shareholder has constant absolute risk aversion (CARA) utilities to avoid wealth effects. The coefficients of absolute risk aversion are different.

Assumption 1 *The coefficients of absolute risk aversion are $\alpha > 0$ for the manager and $\beta > 0$ for investors. Their utility functions for final wealth W are negative exponential: $U_A(W) = -e^{-AW}$, $A \in \{\alpha, \beta\}$.*

2.1 Risky Project

A manager i ($i \in \{1, \ldots, N\}$) has a firm-specific risky project with random cash flows according to

$$Y_i = \mu_i + \sigma_i(a)X_i \tag{1}$$

where X_i is a standard normal random variable; $X_i \sim N(0, 1)$. X_i is a shock specific to the firm. This randomness represents the risk of investment projects. Here, μ_i is the expected return and $\sigma_i^2(a) > 0$ is the risk of the investment project chosen by manager.

In order to describe the risk-managing behavior of manager, we follow the model of Danıelsson et al. (2002) and assume that the manager reduce the risk by his effort, specifically, $\sigma^2 = \Sigma a^{-1}$ with a is an effort level of the manager and $\Sigma > 0$ is a constant parameter. Accordingly, the output is normally distributed: $Y_i \sim N(\mu_i, \Sigma_i a^{-1})$. In addition, the effort cost is defined by ka. The manager

[1] We discuss the role of small investors when we take account of stock prices.

does not own any fraction of the firm, while he earns income which is dependent on the firm's performance $s(Y_i)$. The manager has a negative exponential utility, so his expected utility is the following:

$$E[U_m(s(Y_i)|a] = -E[\exp\left(-\alpha(s(Y_i) - ka)\right)|a].$$

The shareholder offers a linear contract $s(Y_i) = s_0 + s_1 Y_i$ for a manager i to maximize expected utility. In a single period principal-agent model, the second-best optimal contract would not be linear. However, we follow Holmstrom & Milgrom (1987) in considering our model a simplified representation of the continuous choice of effort.

In the principal-agent relation, the manager's choice of effort is unobservable and contractible to the shareholder, and thus, the shareholder solves the following problem:

$$\max_{s(Y)} E\left[U_s\left(\sum_{i=1}^{N}[Y_i - s(Y_i)]/N\right)|a\right],$$

subject to

$$\bar{U} \leq E[U_m(s(Y_i), a)|a] \text{ for } i \in \{1, \ldots, N\}$$
$$a \in \arg\max_{a'} E[u_m(S(Y), a')|a'].$$

where $\bar{U}$ represents the minimum utility offered in the managerial labor market.

2.2 Manager's Problem

The assumption of an exponential utility function and normally distributed returns reduces the problem to an optimization problem with mean-variance util-

ity:

$$E[-\exp(-\alpha\tilde{W})] = -E[\exp\{-\alpha(s(Y_i) - ka)\}]$$
$$= -\exp\{-\alpha(s_0 + s_1\mu - ka - (\alpha/2)s_1^2\Sigma a^{-1})\}$$

Equivalently, the manager solves the following problem:

$$\max_a CE_m = s_0 + s_1\mu - ka - \frac{\alpha}{2}s_1^2\Sigma a^{-1}$$

From the first order condition, we obtain $a = s_1(\alpha\Sigma/2k)^{1/2}$, and after substitution into CE, we obtain

$$CE_m = s_0 + s_1\mu - s_1\sqrt{2k\alpha\Sigma}$$

Shareholder offers the contract that managers have incentive to participate, we get

$$-s_0 = s_1\mu - s_1\sqrt{2k\alpha\Sigma}.$$

2.3 Controlling Shareholder's Problem

Shareholder maximizes his expected utility as managers' individual rationality (IR) and participation constraint (PC) are satisfied.

Given the assumptions of CARA utility and normality, a shareholder's certainty equivalent is

$$CE_s = \mu - s_1\sqrt{2k\alpha\Sigma} - \frac{\beta}{2}(1 - s_1)^2\frac{\sqrt{2k\Sigma}}{N\sqrt{\alpha}}\frac{1}{s_1} \tag{2}$$

Maximizing CE_s with respect to s_1 to obtain:

$$s_1^* = \sqrt{\frac{\beta}{2N\alpha + \beta}} \tag{3}$$

and

$$a^* = \sqrt{\frac{\alpha\beta}{2N\alpha+\beta}}\sqrt{\frac{\Sigma}{2k}}$$

The sensitivity of pay to performance s_1 is lower when N is larger, that is, shareholder diversifies her portfolio. This leads to induce less effort and increased risk. In fact, the volatility of the individual firms is

$$\sigma^2(a^*) = \sqrt{2k\Sigma}\frac{\sqrt{2N\alpha+\beta}}{\sqrt{\alpha\beta}}.$$

$\sigma^2(a^*)$ increases in the number of firms that shareholder owns. In other words, the individual volatility is higher if shareholder diversifies her portfolio.

3 Conclusion

We propose a model that explains the relationship between portfolio diversification of large shareholders and corporate risk-taking behavior where there exists principal-agent relationship. Based on Danielsson et al. (2002), we assume that managers can adjust the risk level of project by their effort. Shareholder offers linear contact to managers and encourage them to take risk.

When shareholder can hold several firms, volatility of total cash flows can be lower than the case of single holding. This portfolio diversification expands the risk attitude of shareholder. Therefore, the volatility of single project is higher when the shareholder's portfolio is well-diversified.

Empirical fact shows that there exists a large heterogeneity in shareholders' portfolio. Some shareholders have well-diversified portfolio, others have undiversified portfolio. What causes the heterogeneity? One simple answer is incomplete information in the sense of Merton (1987). In his model, investors access to the financial market but cannot hold assets that she doesn't know. This assumption of incomplete information generates under-diversification of portfolio. The connection between incomplete information and corporate risk-taking behavior

should be investigated for future research.

Recently, the relationship between large shareholders and stock prices has been investigate. In particular, the feedback loop between real decision making and financial (secondary) market is mainly focused **?**. The model that emphasizes the importance of feedback loops between real decision making and financial market like Cadenillas et al. (2007), and Edmans (2014). Our model assume that managerial compensation depends on the firm's performance. In addition, we can add the stock price into the contract, so the incentive based on the stock prices can be investigated with shareholders' portfolio diversification.

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