



Forecasting Crash risk using Business Strategy, Equity Overvaluation and Conditional Skewness in Stock Price

Zahra Razmian Moghadam

PhD Candidate, Faculty of Management, Tehran North Branch, Islamic Azad University, Tehran, Iran.
Zahra.razmianm@gmail.com

Mirfeiz Fallah Shams

Department of Finance and Economic, Central Tehran branch, Islamic Azad University, Tehran, Iran.
(Corresponding Author)
mir.Fallahshams@iauctb.ac.ir

Mohammad Khodaei Valahzaghari

Department of Accounting and Finance, North Tehran Branch, Islamic Azad University, Tehran, Iran.

Mohamad Hasani

Department of Accounting and Finance, North Tehran Branch, Islamic Azad University, Tehran, Iran.

ABSTRACT

A firm is called to have stock price crash risk if the firm has a tendency to experience a sudden drop in its stock price. In this study, the relation between the firm-level of business strategy and future stock price crash risk is examined, as well as the effect of stock overvaluation on the relationship between business strategy and crash risk investigated. Using the strategy index and crash risk indicators the question that whether innovative business strategies (prospectors) are more prone to future crash risk than defenders is investigated. In so doing, we identify two main hypotheses and the data of 111 listed companies of Tehran Stock Exchange for the period between 2009 and 2017 were analyzed and a panel data approach has been used to test of research hypotheses.

We develop a measure of business strategy based on Miles and Snow and test the association between this business strategy measure, overvaluation and stock price crash risk. Our investigations show that overvalued firms on average have higher price crash risk.

Keywords:

Stock Price, Crash Risk, Business Strategy, Equity Overvaluation.

1. Introduction

This paper explores the firm level determinants of future stock price crash risk. These factors include business strategies and overvaluation. We survey the current literature on the firm-specific determinants of future stock price crash risk. Also, this paper offers research suggestions for both the determinants and consequences of crash risk.

The stock price crash literature is based on the bad news hoarding theory. The motivation for bad news hoarding theory comes from the extreme stock price declines associated with recent financial crisis (2008-2009) and accounting scandals (e.g., World.Com). Starting from Jin and Myers (2006) and Bleck and Liu (2007), researchers have been concerned that agency costs arising from managers' inside information could be related to stock price crash risk. A firm is called to have stock price crash risk if the firm has a tendency to experience a sudden drop in its stock price.

Crash risk is of high importance to investors due to its undiversifiable nature. In the aftermath of 2008 financial crisis, the investors' sense of crash risk is increased. Also, investors' uncertainty and fear of further crash risk have been identified among the various factors of causing a dramatic drop in prices. Therefore, the crash risk is a crucial element in the return on the stock of investors, because, unlike the risks of systematic fluctuations, it cannot be eliminated through diversification.

extant literature on the underlying reason of the crash risk can be found in the Agency theory, which states that managerial incentives, in line with personal interests, such as compensation contracts, career concerns, litigation risks and earnings targets withhold bad news and accumulate them within the company. Maintaining of bad news continues by managers until a certain threshold, and When managers' incentives for hiding bad news collapse or when the accumulation of bad news reaches a critical threshold level, all of the hitherto undisclosed negative firm-specific shocks become public at once, resulting in an abrupt decline in stock prices (Hutton et al.,2009).

In a company, the agency costs occur when the managers who are involved in the affairs of the company have interests that are in contrast to the interests of other shareholders. Because of managers gain more benefits during the overvaluation, overvaluation is likely to have significant agency costs. The important issue is that managers of

overvalued companies not only do not correct market mistakes, but also actively try to prolong the evaluation more.

Instead of revealing information to frustrate the market (shareholders and even the board of directors), they will take steps to get the market's optimistic expectations.

Among these measures are takeover of other companies and profit management. The management of an overvalued company has a strong incentive to mislead the investor community and even the board of directors. Management motivation is accumulation of benefits through overvaluation and continuous growth of the company, in the form of higher rewards and higher valuations of their personal shares in the company. these management measures make market participants increase their performance expectations of overvalued stocks. As a result, agency theory will directly link these actions with lower stock performance in the future.

Miles and Snow suggest that business level strategies generally fall into one of four categories: prospector, defender, analyser, and reactor. Lying at opposite ends of the continuum, prospectors and defenders' strategies are in our focus in this research.¹

According to Miles and Snow, organizations implementing a defender strategy attempt to protect their market from new competitors. As a result of this narrow focus, these organizations seldom need to make major adjustments in their technology, structure, or methods of operation. Instead, they focused on efficiency in the production and distribution of goods and services.

They define prospectors as innovative organizations, seeking out new opportunities, taking risks and grow. To implement this strategy, organizations need to encourage creativity and flexibility. Thus, these organizations often are the creators of change and uncertainty to which their competitors must respond. In such an environment, research and development (R&D) and marketing is more important than efficiency.

Due to high levels of uncertainty, prospectors face more information asymmetry and this can increase misstatements of financial results

(Rajagopalan ,1998; Singh and Agarwal, 2009).

In order to make profits from innovative ideas, prospectors require compensation contracts to

encourage managers for risk-taking behaviour and persuade them to take longer-term

perspective. On the other hand, due to less outcome ambiguity in defenders, compensation contracts with shorter-term perspective is more common.

Also, Bentley et al. (2015) shows higher control risk in prospectors is the possible source of financial results restatements.

They empirically experiment with why prospectors continually renegotiate their financial statements despite higher control risk. Although it is found that the relationship between strategy and restatements can be mitigated by Internal Control over Financial Reporting (ICFR), but difficulties of on time detecting and reporting weaknesses of prospectors, may still lead to accumulation of bad news.

This paper identifies an additional factor that explains stock price crashes and explains the factors that affect it.

The rest of paper is organized as follows. Section 2 covers literature review and hypothesis development. Section 3 describes data and research framework. Section 4 demonstrates analysis of empirical data. And finally, section 5 presents our conclusions, limitations and future research directions.

2. Literature Review

Since the financial crisis in 2008 and due to the emergence of stock-price crash, it received arousing attention. The decline in market-wide price results in lots of research aiming at better handling of stock-price crash risk in order to lessen its adversity. One of the most important indicators of financial performance are stock market (Ansari and Riasi, 2016); therefore, there can be a severe negative impact of stock price crash on a firm's financial stability (Riasi and Aghdaie, 2013).

The tendency to hide bad news from outside investors by managers produces crash risk (Mc. Nichols et al., 1988). Therefore, the stock price crash literature is based on the bad news hoarding theory.

First, managers' concerns regarding the effect of bad news on their career incentivize them to withhold bad news hoping future events bring the opportunity to "bury" the bad news.

Second, compensation motivators, including gaining performance-based bonuses and avoiding a decline in the value of stocks, stock appreciation

rights, and options, can also prompt managers to disguise negative news in the company. Third, litigation risks, such as avoiding debt covenant violations that could lead to restrictions on new investment, can also be dominant reasons for managers to withhold bad news. Different from the argument of withholding bad news to meet financial expectations, Ball (2009) argues that managers' nonfinancial motives are also powerful incentives for managers to withhold bad news. He points out that nonfinancial motivators, such as maintaining the esteem of one's peers or empire building, are more powerful than commonly believed, and sometimes are the main reason to conceal negative information. Collectively, prior literature has found that both financial and nonfinancial motives play important roles for managers to opportunistically withhold bad news in the firm.

"Stock-price crash risk" is an entity, meaning experiencing frequent negative skewness in stock returns that is asymmetrically distributed and is described simply by abrupt large movements in the stock returns that are usually decreasing, rather than increasing.

The literature defines crash risk as related to negative skewness in the distribution of returns for individual stocks (Callen and Fang, 2013; Chen and Stein, 2001). Andrew Van Buskirk (2011) showed that firms with greater volatility skew are more likely to experience large earnings period stock price drops declaring that having information about future earnings is not the same as knowing them when they are revealed due to non-timely disclosure of information.

A number of approaches have been used to measure skewness in the crash risk literature and bulk of the literature relates these estimates to a variety of explanatory variables in order to identify potential determinants of stock price crash risk. Crash risk captures higher moments of the stock return distribution i.e., extreme negative returns (Callen and Fang, 2015) and hence has important implications for portfolio theories, and for asset and option-pricing models (Kim and Zhang, 2016).

Jin and Myers extended the work of Myers and investigated the relationship between the lack of informational transparency and stock price crash. Depending on studies, they assumed that all outside investors are imperfectly informed and all private

information is held by inside managers. They found that when the accumulated hidden bad news comes out, extreme negative outcomes in stock returns took place (i.e., stock price crash) and that less transparent markets exhibit more frequent crashes.

Differences in the executive compensation structure between prospectors and defenders also contribute to the possibility of crash risk. There is a decreased emphasis on accounting measures in firms pursuing an innovative strategy. It requires investments in brand recognition and innovative products, investments that are subject to unfavourable accounting treatment. These results indicate that compensation committees link executive rewards to firm strategy (Balsam and Fernando, 2011).

It is not concluded yet whether compensation packages focused on innovation will lead managers to misreport in order to maximize personal wealth.

However, prior research finds that option compensation can provide managers with incentives to act in the best interests of shareholders. Indeed, several studies find that the asymmetric payoff provided by stock options can reduce agency costs by encouraging risk taking by managers of firms with growth opportunities (Efendi et al., 2007).

Companies that implemented business prospector strategies will be faced with higher uncertainty than defender business strategies. Furthermore, the prospector's business strategy can be a source of stock price crash risk through equity overvaluation (Habib et al., 2016). Companies that implemented business prospector strategies will tend to overvalued equities, which can lead to future stock price crashes.

Equity is overvalued when a firm's stock price is higher than its underlying value. By definition, this means the company will not be able to deliver—except by pure luck—the performance to justify its value (Jensen, 2008).

As evidence suggests, overly optimistic expectations about the prospects of stocks are common in growth stocks. Therefore, these stocks are more prone to overvaluation (Lakonishok, et al., 1994; Skinner and Sloan, 2002).

As overvaluation is more of a case in prospectors, it can be concluded that these firms have more incentive to conceal bad news from investors to sustain such overvaluation.

Companies that pursue innovator business strategies are more likely prone to experience equity overvaluation for the following reasons:

Excessively optimistic expectations about the future growth of stocks;

More uncertainty of income.

Baker et al. (2003) suggest that turnover, or more generally liquidity, can serve as a sentiment index: In a market with short-sales constraints, irrational investors participate, and thus add liquidity, only when they are optimistic; hence, high liquidity is a symptom of overvaluation.

Further to the discussion that equity overvaluation motivates managers to commit financial misreporting, it follows that crash risk will be higher for prospectors during periods of equity overvaluation.

3. Methodology

Testing research hypothesis

The aim of this test is investigating the effect of business strategy and overvalued equities on Stock Price crash risk of stock price. We have developed the following hypothesis to test this proposition:

H1. *Ceteris paribus*, firms with a prospector (defender) business strategies are more(less) prone to crash risk.

H2. *Ceteris paribus*, equity overvaluation has a positive impact on crash risk for firms with a prospector business strategy.

Research Models and Variables Measurement

a. Research statistical model

This research is categorized in empirical researches and also type of this study is descriptive-correlation research. To obtain research results via referred variables in last section, Multi variate regression and panel data model has been used.

b. Sample

The statistical population of this research includes all accepted companies in Tehran Stock Exchange during the period of 2009-2017. Since the applied data for calculating variables of this research include the information of the previous year and the two subsequent years, the 9-year period from 2009 to 2017 was considered as the domain of time for testing the hypotheses. In order to gather required quantitative data including market value,

stock price, equity, assets and others, Tehran Stock Exchange website, Tehran Stock Exchange data base and CODAL network were used.

The sampling method in this research was established according to the systematic elimination, therefore all of the companies in this sample are ought to have the following characteristics:

- 1) To be accepted in Tehran Stock Exchange before 2010, in order to synchronize the statistical sample in the years under review.
- 2) To have financial periods by the end of March, in order to increase the ability of comparing.
- 3) To have static activities and static fiscal year during the aforementioned years.
- 4) To have suitable conditions and comprehensive information on the research pattern's required variables.
- 5) To trade the company's shares in the course of research period, and the cancellation of above-mentioned shares' transaction not to exceed 6 months.
- 6) To have a high frequency of data (at least 28 data of year-company) for the studied industry, since the modified Rhodes et al. (2005) model are applied in this research to fit each industry.

According to Article 6 and due to the limited industries, 8 industries were selected (the industries with at least 14 companies in the stock market). After considering the items 1 to 5, 111 companies (999 data year- company), which had all conditions, were selected as the statistical sample.

c. Business strategy composite measure

Relying on Bentley et al. (2013) we construct a discrete STRATEGY composite measure, which proxies for the organization's business strategy. Higher STRATEGY scores represent companies with prospector strategies and lower scores represent companies with defender strategies. Similar to Bentley et al. we use the following characteristics for the STRATEGY composite measure: (a) the ratio of research and development to sales, (b) the ratio of employees to sales, and (c) the historical growth measure (one-year percentage change in total sales), (d) the ratio of fixed assets to total assets, and (e) the market-to-book ratio.

Each of the six individual variables is ranked by forming quintiles within each two-digit SIC industry-year.

Within each company-year, those observations with variables in the highest quintile are given a score of 5, in the second-highest quintile are given a score of 4, and so on, and those observations with variables in the lowest quintile are given a score of 1. Then for each company-year, we sum the scores across the six variables such that a company could receive a maximum score of 30(prospector- type) and a minimum score of 6(defender-type).

d. Stock price crash risk

In this study, we follow previous literature and use two measures of firm-specific crash risk. Both measures are based on the firm-specific weekly returns estimated as the residuals from the market model. To calculate the firm-specific abnormal weekly returns for each firm and year, denoted as W , we run the following expanded index regression model:

$$r_{j,\theta} = \beta_0 + \beta_{1j} r_{m,\theta-2} + \beta_{2j} r_{m,\theta-1} + \beta_{3j} r_{m,\theta} + \beta_{4j} r_{m,\theta+1} + \beta_{5j} r_{m,\theta+2} + \varepsilon_{j,\theta} \quad (1)$$

Where $r_{j,\theta}$ is the return of firm j in week θ , and $r_{m,\theta}$ is the return on CRSP value-weighted market return in week θ . The lead and lag terms for the market index return is included, to allow for non-synchronous trading (Dimson, 1979). The firm-specific weekly return for firm j in week θ ($w_{j,\theta}$) is calculated as the natural logarithm of one plus the residual return from Eq. (1) above. In estimating Eq. (1), each firm-year is required to have at least 26 weekly stock returns.

Our first measure of crash risk is the negative conditional skewness of firm-specific weekly returns over the fiscal year (NCSKEW). NCSKEW is calculated by taking the negative of the third moment of firm-specific weekly returns for each year and normalizing it by the standard deviation of firm-specific weekly returns raised to the third power. Specifically, for each firm j in year θ , NCSKEW is calculated as:

$$Ncskew_{j,\theta} = -[n(n-1)^2 \sum_1^n W_{j,\theta}^3] / [(n-1)(n-2) (\sum_1^n W_{j,\theta}^2)^{3/2}] \quad (2)$$

The down-to-up volatility (DUVOL) is used as the other measure of stock price crashes, consistent with Chen et al. In order to calculate DUVOL, we first separate all the weeks into “down” weeks if firm-specific abnormal weekly returns are lower than the annual average return and “up” weeks if the firm-specific abnormal weekly returns are higher than the annual average return. DUVOL is the logarithm of the standard deviation on the down weeks minus the logarithm of the standard deviation on the up weeks.

$$Duvol_{j,t} = \log\left\{ \frac{(n_u - 1) \sum_{DOWN} w_{jt}^2}{(n_d - 1) \sum_{UP} w_{jt}^2} \right\} \quad (3)$$

Where n_u is the number of up weeks and n_d is the number of down weeks. Again, the higher value of this measure corresponds to a more left skewed distribution, which indicates the higher incidence of stock price crashes.

e. Equity Overvaluation

A common valuation measure is the ratio of market value of assets to book value of assets (M/B). The literature has used M/B as proxies for both misvaluation and growth opportunities. As Rhodes et al. how, if there exists a perfect measure of the firm’s true value, V , we can first think of M/B as:

$$M/B = M/V \times V/B, \quad (4)$$

where M/V captures misvaluation and V/B captures growth opportunities. Rewrite (4) into logarithm form, we obtain:

$$m - b = (m - v) + (v - b), \quad (5)$$

where the lowercase letters denote logarithm values. $(m - v)$, the deviation of the firm’s market value from its true value, can arise from industry-wide misvaluation or firm-specific misvaluation. Therefore, for any firm i at year t , we can further decompose $(m - v)$ into two components and rewrite $(m - b)$ as following:

$$m_{it} - b_{it} = m_{it} - v(\theta_{it}; \alpha_{jt}) + v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j) + v(\theta_{it}; \alpha_j) - b_{it} \quad (6)$$

where we use j to denote industry. We express v as a linear function that multiplies some firm-specific accounting information it and a vector of estimated accounting valuation multiples α . $v(\theta_{it}; \alpha_{jt})$ is the estimated firm value based on contemporaneous

industry-level valuation multiples α_{jt} . Thus, the first component in Eq. (6) captures the valuation error caused by firm specific deviation from contemporaneous industry-level valuation.

$v(\theta_{it}; \alpha_j)$ is the estimated firm value based on long-run industry-level valuation multiples α_j . Thus, the second component in Eq. (6) captures the valuation error caused by the deviation of current industry valuation from the long-run industry valuation. The third component in Eq. (6) is the difference between long run value and book value, i.e., the logarithm of the true value-to-book ratio, capturing growth opportunities. Note that each of the three components varies across firms and years because each component utilizes θ_{it} , which is firm i ’s accounting information at year t .

To operationalize, we need to estimate the valuation models $v(\theta_{it}; \alpha_{jt})$ and $v(\theta_{it}; \alpha_j)$.

The first term on the right-hand side of Eq. (6), $m_{it} - v(\theta_{it}; \alpha_{jt})$, referred to as the firm-specific error (FSE), measures the difference between market value and fundamental value, and is estimated using firm-specific accounting data, θ_{it} , and the contemporaneous sector accounting multiples, α_{jt} , and is intended to capture the extent to which the firm is misvalued relative to its contemporaneous industry peers. The second term, $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$, referred to as time-series sector error (TSSE), measures the difference in estimated fundamental value when contemporaneous sector accounting multiples at time t , α_{jt} , differ from long-run sector multiples, α_j , and is intended to capture the extent to which the industry (or, possibly, the entire market) may be mis-valued at time t . Total valuation error (TVE) is the sum of FSE and TSSE. The third term, referred to as LRVTB, measures the differ measure is interpreted as the investment opportunity component of the MTB ratio.

Rhodes et al. use three different models to estimate $v(\theta_{it}; \alpha_{jt})$ and $v(\theta_{it}; \alpha_j)$. The models differ only with respect to the accounting items that are included in the accounting information vector, θ_{it} . The 3rd model is the most comprehensive model that includes the book value (b), net income (NI), and market leverage (LEV) ratio in the accounting information vector. Expressing market value as a simple linear model of these variables yields.

$$m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} \ln(NI)_{it}^+ + \alpha_{3jt} I(< 0)NI_{it} + \alpha_{4jt} LEV_{it} + \varepsilon_{it} \quad (7)$$

where, because NI can sometimes be negative, it is expressed as an absolute value $(NI)^+$ along with a dummy variable, $I(<0)$, to indicate when NI is negative.

To calculate the contemporaneous accounting multiples, α_{jt} , each year we group all CRSP/Compustat firms according to the 12 Fama and French industry classifications; run annual, cross-sectional regressions (of Eq. (7)) for each industry; and generate estimated industry accounting multiples for each year $\hat{\alpha}_{jt}$. The estimated value of $v(\theta_{it}; \alpha_{jt})$ is the fitted value from regression Eq. (8).

$$v(b_{it}, NI_{it}, LEV_{it}, \hat{\alpha}_{0jt}, \hat{\alpha}_{1jt}, \hat{\alpha}_{2jt}, \hat{\alpha}_{3jt}, \hat{\alpha}_{4jt}) = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt} b_{it} + \hat{\alpha}_{2jt} \ln(NI)_{it}^+ + \hat{\alpha}_{3jt} I(<)(NI)_{it}^+ + \hat{\alpha}_{4jt} LEV_{it} \quad (8)$$

f. Control variables

To differentiate between the effect of Business Strategy type (Defenders/Prospectors) and overvaluation of stock price on crash risk from other variables, some control variables are defined in this study, including:

TURN: TURN is the difference of the average monthly share turnover over the current fiscal year and the previous fiscal year, where monthly share turnover is defined as the monthly trading volume divided by the total number of shares outstanding during the month. Chen et al. indicate that this variable is used to measure differences of opinion among shareholders and is positively related to crash risk proxies.

RET: Chen et al. show that negative skewness is larger in stocks that have had positive stock returns over the prior 36 months. To control for this possibility, we include past one-year weekly returns (RET).

SDRET: SDRT is the standard deviation of firm-specific weekly returns over the fiscal year denoting stock volatility as more volatile stocks are likely to be more crash prone.

SIZE: To control for the size effect, we add SIZE measured as the natural log of total assets.

MTB: The variable MTB is the market value of equity divided by the book value of equity.

LEVERAGE: LEVERAGE is the total long-term debt divided by total assets, which is shown to be negatively associated with future crash risk (Kim and Zhang, 2011).

ROA: Return on assets which is calculated through dividing annual operational earning by total company asset.

g. Empirical model

To investigate the effect of business strategies on future crash risk, we regress current period crash risk on strategy and other control variables measured using data from the preceding year as follows:

$$CRASH_{i,t} = \gamma_0 + \gamma_1 CRASH_{t-1} + \gamma_2 STRATEGY_{t-1} + \gamma_3 TURN_{t-1} + \gamma_4 RET_{t-1} + \gamma_5 SDRET_{t-1} + \gamma_6 SIZE_{t-1} + \gamma_7 MTB_{t-1} + \gamma_8 LEVERAGE_{t-1} + \gamma_9 ROA_{t-1} + \varepsilon_{i,t} \quad (9)$$

Where CRASH risk is proxied by NCSKEW and DUVOL measures following Eqs. (2) and (3) above. The independent variables are calculated using data from the preceding year consistent with the crash risk literature. We first control for the lag value of CRASH to account for the potential serial correlation of NCSKEW or DUVOL for the sample firms.

In order to test H2 we run the following regression for the prospector and defender group separately.

$$CRASH_{i,t} = \gamma_0 + \gamma_1 CRASH_{t-1} + \gamma_2 TVE_{t-1} + \gamma_3 LRV_{t-1} + \gamma_4 TURN_{t-1} + \gamma_5 RET_{t-1} + \gamma_6 SDRET_{t-1} + \gamma_7 SIZE_{t-1} + \gamma_8 MTB_{t-1} + \gamma_9 LEVERAG_{t-1} + \gamma_{10} ROA_{t-1} + \varepsilon_{i,t} \quad (10)$$

4. Results

In this section we discuss our empirical results concerning the association between firm level business strategy and sock price crash risk. Our models include the standard controls used in the literature.

a. descriptive statistics

Table (1), presents descriptive statistics for our key variables of interest.

This table mainly includes information about measures of central tendency such as maximum, minimum, average and median, as well as information on measures of dispersion such as standard deviation, skewness and kurtosis. The number of observations for each variable is 999.

The mean values of the crash risk measure, NCSKEW and DUVOL, are 0.0091 and -0.006 respectively.

The results of the study on the values of skewness and kurtosis for NCSKEW indicate that the distribution has kurtosis and skewness more than normal distribution and therefore, the normality of Skewness and Kurtosis is not expected, which is indicated by the Jarck-Bra test.

The sample firms of average TVE and LRVTB are -1.541 and -1.565 respectively with a somewhat high

standard deviation (3.013 and 2.691 respectively). The average change in monthly trading volume (as a percentage of shares outstanding) is 35.7%. The average firm in our sample has a firm-specific weekly return of 3.1%, market-to-book ratio of 2.18, a weekly return volatility of 0.12, a leverage of 0.58. The average of ROA is 0.11.

Table1: Descriptive Statistic of Research Variables

Variables	Mean	Median	Min	Max	SD	Skew	kurt	Jarck-Bra	
Crash risk measures	Central indices				Dispersion indices				
	SKEW	0.009	0.28	-6.91	6.40	1.93	-1.00	5.52	434.5
	DUVOL	-0.0006	-0.04	-0.77	1.42	0.27	1.05	5.55	455.5
Business Strategy Measures	STRATEGY	-	-	-	-	-	-	-	-
Equity Overvaluation Measures	TVE	-1.54	-1.19	-10.3	63.31	3.01	9.21	217.62	1931502.0
	LRVTB	-1.56	-1.66	-48.2	4.15	2.69	-4.55	93.19	342070.8
Control Variables	TURN	0.35	0.14	0.000	4.93	0.55	3.31	18.09	-
	RET	0.03	0.02	-0.07	0.29	0.04	1.29	5.55	-
	SIGMA	0.12	0.10	0.00	0.69	0.08	1.90	9.42	-
	SIZE	14.22	14.05	10.03	19.73	1.60	0.58	3.70	11313.8
	LEVER	0.58	0.60	-1.58	2.70	0.26	0.60	15.77	549.7
	MTB	2.18	1.96	121.51	154.32	7.13	-5.98	319.03	2321.1
	ROA	0.11	0.09	-0.93	1.07	0.15	-0.09	9.09	78.4

In this study, Im – Pesaran – Shin (IPS test) statistics was used for testing variables’ stationary. In this test null hypothesis which was non-stationary or unit-root was rejected so all variables are stationary. Based on the results, IPS values and also level of significance shows that all variables are 95% stationary so that level of significance is lower than 0.05 in all of them. So, integration test is not needed and there is no problem with fake regression.

In order to test the heteroscedasticity, we use Breusch-Pagan (BP) test. The results of Breusch-Pagan test indicate that the model is heteroskedastic. The Prob (F-Statistic) is less than 5% therefore the Null Hypothesis should be rejected. To remove heteroscedasticity, we use generalized least squares (GLS). When heteroscedasticity is present, the variance of the estimated values resulting from generalized least squares (GLS) is less than ordinary least squares (OLS). The lower variance suggests that the (GLS) procedure provides more reliable estimates

when heteroscedasticity is present. Another assumption of regression is the independence of the residuals from each another. To investigate this assumption, the Breusch -Godfrey test has been used in this research. The results indicate that null hypothesis of no serial autocorrelation is accepted.

b. The Results of the Hypothesis

Using F Limer and then Hausman test, we determine the appropriate model for doing the regression and then implement the regression. The results of the Limer test for the companies surveyed are summarized in Table 2 by the research hypothesis, As the table shows, the results of Chow test is indicating that "Panel regression model", is preferred to " Pooled regression model". The p-value of the test is less than the error level of 5 and 10%, and the null hypothesis is rejected.

Table2: F Limer Test

Model	Variable	Statistic	prob
Hypothesis 1	SKEW	1.22	0.06*
	DUVOL	1.20	0.08*
Hypothesis 2	SKEW	1.22	0.07*
	DUVOL	1.26	0.04**

Note: statistically significant ***p < 0.01, **p < 0.05, *p < 0.10

Using the Hausman's test we compared the random effects model to the fixed effects models, the results are shown in the table 3, the table shows that the fixed effects model was consistent when compared to the panel regression model for the companies surveyed in all two models examined.

Table3: Hausman's Test

Model	Variable	Statistic	Prob
Hypothesis 1	SKEW	103.61	0.00
	DUVOL	104.96	0.00
Hypothesis 2	SKEW	101.07	0.00
	DUVOL	106.3	0.00

Table 4, presents the GLS regression results of estimating to test our first hypothesis on the association between Business Strategies and Crash Risk (H1).

The results suggest that managers have incentive to disclose less firm-specific information and even to withhold some bad news. Also, these results support

the Hypothesis (H1), and are in line with results from existing theoretical and empirical literature.

We correct for heteroscedasticity and use a firm-level clustering procedure that accounts for serial dependence across years for a given firm (Petersen, 2009).

Results with basic controls suggest that firm-level business strategies are positively associated with one-year-ahead crash risk proxied by NCSKEW (Column1) and DUVOL(Column2). The positive and significant coefficient on STRATEGY for NCSKEW crash measure supports H₁ but for DUVOL measure is insignificant. The coefficient on STRATEGY is 0.121 for the NCSKEW crash measure, with associated t-statistics of 2.089.

Table 4 also show that the coefficients on the control variables are largely consistent with those reported in the prior studies. First, the effect of return volatility (Std.) on NSKWE is significantly negative (-1.944, t= -3.037), this suggests that firms with lower volatility are more likely to experience crashes, we find the

significantly positive coefficient on the lagged terms of SIZE for NSKEW (0.345, t= 4.371), this means Larger firms are more prone to crash risk, largely in line with the results reported in Habib et al. and negative coefficient on the lagged term of MTB and ROA (-0.009, t=-2.511; -1.434, t=-2.898).

In this section, we test our second hypothesis to find the relationship between firm-level business strategies and market-level equity overvaluation.

Table 4: Regression Analysis on the Association between Business Strategies and Crash Risk

Variables	NSKEW			DUVOL		
	Coefficient	t-statistic	Prob	Coefficient	t-statistic	Prob
NSKEW (-1)	-0.076	-2.885	0.004	-	-	-
DUVOL (-1)	-	-	-	-0.090	-2.780	0.006
STRATEGY (-1)	0.121	2.089	0.037	0.015	1.090	0.276
TURN (-1)	0.094	1.794	0.073	0.004	0.365	0.715
RET (-1)	-0.690	-0.664	0.507	0.178	1.142	0.254
SDRET (-1)	-1.944	-3.037	0.003	-0.064	-0.583	0.560
SIZE (-1)	0.345	4.371	0.000	-0.027	-2.171	0.030
LEVER (-1)	-0.479	-1.088	0.277	0.123	5.979	0.000
MTB (-1)	-0.009	-2.511	0.012	0.001	3.028	0.003
ROA (-1)	-1.434	-2.898	0.004	0.430	6.821	0.000
C	-4.143	-3.242	0.001	0.241	1.326	0.185
Adjusted R2	0.12			0.70		
Observations	999			999		

Table 5: Regression Analysis on the Association between Overvalued Equity and Crash risk

Variables	NSKEW			DUVOL		
	Coefficient	t-statistic	Prob	Coefficient	t-statistic	Prob
NSKEW (-1)	-0.057	-1.990	0.047	-	-	-
DUVOL (-1)	-	-	-	-0.032	-0.900	0.368
TVE (-1)	0.538	16.763	0.000	0.054	3.368	0.001
LRVTB (-1)	0.676	17.218	0.000	0.081	4.387	0.000
DTURN (-1)	-0.098	-1.451	0.147	-0.017	-1.186	0.236
RET (-1)	-2.405	-3.620	0.000	0.149	0.751	0.453
SDRET (-1)	-1.672	-2.801	0.005	0.021	0.172	0.863
SIZE (-1)	-0.166	-2.781	0.006	-0.097	-4.465	0.000
LEVER (-1)	0.241	1.575	0.116	0.053	1.272	0.204
MTB (-1)	-0.003	-2.145	0.032	0.001	1.380	0.168
ROA (-1)	0.003	1.072	0.104	0.044	1.272	0.302
C	4.477	4.823	0.000	1.549	4.467	0.000
Adjusted R2	0.20			0.07		
Observations	999			999		

Table 5 presents regression results for H_2 . Columns (1) and (2) reveals that the coefficient on lagged OVERVALUATION (TVE and LRVTB) is positive and statistically significant for both the crash proxies. The coefficient on TVE is significant for NSKEW and DUVOL (coefficient 0.538 and 0.054, with associated t-statistic of 16.763 and 3.368 respectively). Also, the coefficient on LRVTB is significant for NSKEW and DUVOL (coefficient 0.676 and 0.081, with associated t-statistic of 17.218 and 4.387 respectively). The results show that future crash is statistically higher for the companies with extreme overvaluation. The results are consistent with our hypothesis that equity overvaluation has a positive impact on crash risk for firms with a prospector business strategy.

c. Two-step system generalized method of moments (GMM)

Our empirical methodology includes the use of panel data and also a system GMM estimator.

We use a dynamic generalized method of moments (GMM) estimator in our analysis. The GMM estimator has the following advantages: (1) it allows to include firm fixed effects to account for the firm's unobserved heterogeneity; (2) it considers the impact of previous stock price crashes on the current crash in a firm; (3) it accounts for simultaneity by using a combination of variables from a firm's history as valid instruments (Wintoki et al., 2012).

By using this estimator, we avoid problems associated with unobserved heterogeneity and potential endogeneity of repressors. The system GMM estimator is also considered as more efficient than other instrumental variable techniques in controlling for the possible endogeneity of explanatory variables. Therefore, we use the two-step system GMM approach adopted by Arellano and Bover (1995) and Blundell and Bond (1998) to validate our interpretation of the results documented in Table 3 and 4.

Table 6 reports diagnostics results for serial correlation tests, Hansen test of over-identifying restrictions, and a Difference Hansen test. Given that errors in levels are serially uncorrelated, we expect significant first-order serial correlation, but insignificant second-order correlation in the first-differenced residuals. Test results reported Table 6 show the desirable statistically significant AR (1) and statistically insignificant AR (2). Moreover, statistically insignificant Hansen test of over-identifying restrictions tests indicate that the instruments are valid in the two-step system GMM estimation. Results in Table 6 suggest that the relationship between business strategy and stock price crash risk remains robust after accounting for the endogenous relationship between strategy and crash risk. For example, the estimated coefficients (and p value) is 0.051 ($p < 0.01$) for NCSKEW and 0.058 ($p < 0.01$) for the DUVOL measures of crash risk. Overall, Two-step system GMM estimate provides strong

evidence that the prospector business strategy is associated with firm level stock price crash risk, and the diagnostic tests, including the first-order and

second-order serial correlation tests and Hansen test of over-identifying restrictions are supportive.

Table 6: GMM Model – Strategy and Crash Risk

Variables	NSKEW			DUVOL		
	Coefficient	t-statistic	Prob	Coefficient	t-statistic	Prob
SKEW(-1)	0.051	4.670	0.000	-	-	-
DUVOL(-1)	-	-	-	0.058	3.641	0.000
STRATEGY(-1)	0.267	4.682	0.000	0.026	3.074	0.002
DTURN(-1)	0.059	0.987	0.324	0.023	2.273	0.023
RET(-1)	3.583	3.183	0.002	-0.865	-4.716	0.000
SIGMA(-1)	-9.731	-11.015	0.000	1.627	11.395	0.000
SIZE(-1)	0.899	9.971	0.000	-0.124	-7.018	0.000
LEVER(-1)	-0.043	-0.098	0.922	0.222	4.225	0.000
MTB(-1)	-0.005	-1.093	0.275	0.003	2.483	0.013
ROA(-1)	-1.513	-3.527	0.000	0.337	3.757	0.000
AR(1)	-5.30		0.000	-5.16		0.00
AR(2)	-1.21		0.22	-0.26		0.71
Hansen (p-value)	0.20			0.16		
Observations	999			999		

5. Discussion and Conclusions

In previous chapters, we explored the association between business strategy, overvaluation and stock price crash risk. We use the Miles and Snow strategy typology that focuses on the organization's rate of change regarding its products and markets. Using this measure, we first investigate whether companies' business strategies influence future stock price crash risk and examine equity overvaluation moderates this relation.

We also find that firms following innovator business strategies are more prone to equity overvaluation and the combination of these two further increases future crash risk. In addition, we show that overvalued firms on average have higher price crash risk. This may cause suboptimal risk-sharing between firm managers and the investors.

To test our hypotheses, we used firm-year observations from 111 companies listed in Tehran Stock Exchange during the period of 2009-2017.

The most important limitation of the research is as follows: The lack of adjustment of financial statements items due to inflation, which may affect the results of the research. The present study has been approved by using the data of 111 companies from 8 industries admitted to Tehran Stock Exchange and investment,

leasing and insurance companies have been excluded from the statistical society due to their specific nature of activity, so these results are in the hands of ready cannot be generalized to all companies.

References

- 1) Alexander Bleck, Xuewen Liu., *Market transparency and the accounting regime*, Journal of Accounting Research, 2007, 45(2).
- 2) Ansari, A., & Riasi, A, An Investigation of Factors Affecting Brand Advertising Success and Effectiveness. International Business Research, 2016, 9(4), P. 1-11.
- 3) Arellano, M., Bover, O., Another look at the instrumental variable estimation of error-components models. J. Econom, 1995, 68 (1), P. 29-51
- 4) A.Van Buskirk, Volatility Skew, Earnings Announcements, and the Predictability of Crashes, SSRN Electronic Journal, 2011.
- 5) Baker, M., Stein, C., Wurgler, J., When does the market matter? Stock prices and the investment of equity-dependent firms. Q. J. Econ, 2003, 118 (3), P. 969-1006.
- 6) Ball, R., Market and political/regulatory perspectives on the recent accounting scandals.

- Journal of Accounting Research, 2009, 47, P. 277-323
- 7) Balsam, S., Fernando, G.D., Tripathy, A., The impact of firm strategy on performance measures used in executive compensation. *J. Bus. Res.*, 2011, 64 (2), P. 187-193.
 - 8) Bentley, K.A., Newton, N.J., Thompson, A.M., Business Strategy and Internal Control over Financial Reporting, *Journal of Practice & Theory*, 2015.
 - 9) Bentley, K.A., Omer, T.C., Sharp, N.Y., Business strategy, financial reporting irregularities, and audit effort. *Contemp. Account. Res.*, 2013, 30 (2), P. 780-817.
 - 10) Blundell, R., Bond, S., Initial conditions and moment restrictions in dynamic panel data models. *J. Econom.*, 1998, 87 (1), P. 115-143.
 - 11) Callen, J.L., Fang, X., Institutional investor stability and crash risk: monitoring versus short-termism? *J. Bank. Finance*, 2013, 37 (8), P. 3047-3063.
 - 12) Callen, J. L., & Fang, X., Short interest and stock price crash risk, *Journal of Banking and Finance*, 2015, P. 181-194.
 - 13) Chen, J., Hong, H., Stein, J.C., Forecasting crashes, trading volume, past returns, and conditional skewness in stock prices. *J. Finance. Econ.*, 2001, 61(3), P. 345-381.
 - 14) Dent, J. F. Strategy, organization and control: Some possibilities for accounting research. *J. Accounting, Organizations and Society*, 1990, 15 (1-2), P. 3-25.
 - 15) Dimson, E., Risk measurement when shares are subject to infrequent trading. *J. Financ. Econ.*, 1979, 7 (2), P. 197-226.
 - 16) Francis, B., Hasan, I., Li, L., Abnormal real operations, real earnings management, and subsequent crashes in stock prices, *R. Quant. Finance Account*, 2016, 46 (2), P. 217-260.
 - 17) Habib, A., Jiang, H., Hasan, M., Stock Price Crash Risk: Review of the empirical literature, 2016, Massey University and Curtin University.
 - 18) Hutton, A.P., Marcus, A.J., Tehranian, H., Opaque financial reports, R2, and crash risk. *Journal of Financial Economics*, 2009, 94 (1), P. 67-86
 - 19) Jap Efendia, Anup Srivastavab, Edward P. Swansonb, why do corporate managers misstate financial statements? The role of option compensation, and other factors, *Journal of Financial Economics*, 2007, P. 667-708.
 - 20) Jensen, M., Agency costs of overvalued equity. *Financ. Manage.*, 2008, 34, P. 5-19.
 - 21) Jin, L., Myers, S.C., R2 around the world: new theory and new tests, *Journal of Financial Economics*, 2006, 79 (2), P. 257-292.
 - 22) Kim, J. B. & Zhang, L. Accounting conservatism and stock price crash risk: Firm-level evidence. *Contemporary Accounting Research*, 2016, 33(1), P. 412-441.
 - 23) Kim, J.B., Li, Y., Zhang, L., CFOs versus CEOs: equity incentives and crashes. *J. Financ. Econ.*, 2011, 101 (3), P. 713-730.
 - 24) Kim, J.B., Li, Y., Zhang, L., Corporate tax avoidance and stock price crash risk: firm-level analysis. *J. Financ. Econ.*, 2011, 100 (3), P. 639-662.
 - 25) Lakonishok, J., Shleifer, A., Vishny, R.W., Contrarian investment, extrapolation, and risk. *J. Finance*, 1994, 49 (5), P. 1541-1578.
 - 26) Langfield-Smith, K, Management control systems and strategy: A critical review. *Journal of Accounting, Organizations and Society*, 1997, 22 (2), P. 207-32.
 - 27) Mc. Nichols, M. F., and G. P. Wilson., Evidence of earnings management from the provision for bad debts. *Journal of Accounting Research*, 1988, P. 1-31.
 - 28) Miles, R.E., Snow, C.C., *Organizational Strategy, Structure, and Process*, *J. Administrative Science Quarterly*, 2003.
 - 29) Miles, R.E., Snow, C.C., *Organizational Strategy, Structure, and Process*, *The Academy of Management Review*, 1978. Doi:10.2307/257544.
 - 30) Petersen, M.A., Estimating standard errors in finance panel data sets, comparing approaches. *Rev. Financ. Stud.*, 2009, 22 (1), P. 435-480.
 - 31) Rajagopalan, N., Strategic orientations, incentive plan adoptions, and firm performance: evidence from electric utility firms. *Journal of Strategic Management*, 1998, 18(10), P. 761-785.
 - 32) Rhodes, K.M., Robinson, D.T., Viswanathan, S., Valuation waves and merger activity, the empirical evidence. *J. Financ. Econ.*, 2005, 77 (3), P. 561-603.
 - 33) Riasi, A., & Pourmiri, S., Effects of online marketing on Iranian ecotourism industry: Economic, sociological and cultural aspects.

- Management Science Letters, 2015, 5(10), P. 915-926.
- 34) Riasi, A., & Amiri Aghdaie, S. F, Effects of a Hypothetical Iranian Accession to the World Trade Organization on Iran's Flower Industry, *Journal of Sustainable Development*, 2013, 10(1), P. 99-110.
- 35) Singh, P., Agarwal, N.C., The effects of firm strategy on the level and structure of executive compensation. *Can. J. Admin. Sci.* 19(1), P. 42-56.
- 36) Skinner, D.J., Sloan, R.G., Earnings surprises, growth expectations, and stock returns or don't let an earnings torpedo sink your portfolio, *Rev.Account. Stud.*, 2002, 7 (2-3), P. 289-312.
- 37) Wintoki M., Linck J., Netter J. Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, 2012, P. 581-606.

Notes

¹ Companies following the third viable strategy, analyzers, have attributes of both prospectors and defenders and thus lie between prospectors and defenders on the strategy continuum.