CORPORATE STRATEGY, EARNINGS MANIPULATION, AND SHORT SELLING

A Thesis

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ABSTRACT

Earnings manipulation has perplexed many investors and regulators for decades. Factors such as CEO's characteristics, macro environment, behavioral biases, and regulation rules are discussed in the literature. In this paper, corporate strategy aggressiveness is proposed to be one of the factors that leads to earnings manipulation. Short interest ratio is used to indicate how the market perceive and react to company's earnings manipulation probability. Based on the data from Russell 2000 constituents during 2015 to 2019, my hierarchical regression results indicate that firms with the aggressive strategy are more likely to be engaged in earnings manipulation activities, resulting in a higher short interest ratio. The findings are significant when the model uses a binary variable instead of a continuous variable to measure the corporate strategy aggressiveness in the robust test. This paper will interest investors that focus on fundamental investing and researchers who study accounting, corporate strategy, and financial market.

Keywords: corporate strategy, accounting quality, short selling, financial market, hierarchical regression

BIOGRAPHICAL SKETCH

Xingbang Su was born in Sichuan Province, China, on January 20, 1996. He received his undergraduate degree in Finance from Central University of Finance and Economic, China, in 2018. Prior to his study for MS of Applied Economics and Management at Cornell in 2019, he spent one year doing research in the National Institute for Financial Research at Tsinghua University. He will join the asset management industry as a buy-side analyst in the Fall of 2021.

This thesis is dedicated to my parents and family.

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CHAPTER 1 INTRODUCTION

Corporate strategy has been playing a critical role in guiding the direction of a firm. The manager chooses a strategy and all shareholders of the firm work together to make sure this strategy succeeds. No matter which industry this firm engages in and what strategy the firm adopts, the core of a corporate strategy is to promote growth of the firm. More importantly, firm growth is one of the common considerations for project investment decisions. From the financial market perspective, high growth usually comes with high stock price, which benefits company further and thus forms a virtuous cycle for company's development since the company can go for the secondary issuance at a high price to raise capital for future growth. From the corporate governance perspective, during the last decades the popularity of stock compensation has further enhanced manager's incentives to seek for higher growth—and more and more companies link managerial compensation with stock price performance. According to Murphy (2013), options on average accounts for 20% of the compensation for S&P 500 CEOs in 2011 and restricted stocks represent another 36%. Stock price, now therefore, not only matters for company's future funding, but also determines manager's compensation. Seeking opportunities for strong growth and thus boosting stock price becomes an important rent-seeking focus of managers.

However, many studies have shown that high growth is unlikely to persist (Parker et al. 2010; Dillon et al. 2014; and Daunfeldt and Halvarsson 2015). Moreover, Dobbs and Koller (1998) have found that market participants often extrapolate company's past high growth record to the future and even expect a higher growth rate, causing a phenomenon named 'expectation treadmill'. Since high growth is difficult to sustain, and that the growth expectation becomes higher, when the growth rate fails to meet the expectation, company's stock price usually tumbles. Poor performance

of stock price is usually perceived as the incapability of management team by the investors, thus potentially lowering the compensation of management team and more seriously, leading to the dismissal, which is detrimental to manager's career. But if the firm keeps the aggressive corporate strategies and maintains persistent high growth at the same time through manipulating financial statement, the worries can be eliminated, at least for the short term. The Association of Certified Fraud Examiners (ACFE) points out that auditors rarely find fraud—internal audits detect fraud 15% of the time, while external audits detect fraud in only 4% of audits. One reason is that the audit rules are not designed to detect fraud but to determine if a company's financial statement is fairly stated and if appropriate internal controls are in place. It could take decades for the fraud to be finally detected and revealed. When that happens, the manager might not even be in the company anymore. Therefore, managers have strong incentives to make aggressive investment decisions to achieve higher growth in the short run, and in the long run, to maintain such 'unrealistic' growth rates through earnings manipulation. Moderate accounting manipulation is allowed within the accounting standards, but if managers go beyond the red line, earnings manipulation might become accounting fraud, which suggests that detecting earnings manipulation could be helpful in preventing accounting fraud in a pre-emptive manner. Examples of earnings manipulation attributed to accounting fraud are abundant: Waste Management in 1998, Enron in 2001, WorldCom in 2002, HealthSouth in 2003, AIG in 2005, Lehman Brothers in 2008, Satyam in 2009, etc., Enron, once regarded as a corporate giant and traded at the highest price of $90.75 per share, began engaging in earnings manipulation in 1998, but got caught at the end of 2001 when its stock price plummeted to a record low of $0.26 per share. It concealed the financial losses by changing accounting rules, reporting profits that were yet to be earned, and transferring assets to off-the-book corporations. WorldCom, once one of the world's largest telecommunication

giants, attempted to use accruals and fake accounts to inflate revenue by over $3 billion and state a $1.4 billion profit instead of an actual loss. HealthSouth, once one of the largest healthcare services in the U.S., began to report exaggerated profits to attract more investors in 1996 and got caught as late as 2002. Fraud cases in the history show that the fraud often takes long time to detect, which gives manager incentives to engage in earnings manipulation.

Based on the cases and the rationale behind these fraud cases, I propose my first hypothesis in this paper: managers are inclined to adopt aggressive corporate strategy, which is positively associated with a high earnings manipulation probability. Since investors are rational, they will try to determine if a company is suspected of earnings manipulation and exploit the potential fraud for trading profits by shorting these red flag firms. Therefore, the second hypothesis is proposed by the paper: earnings manipulation probability would be detected by the market, and it is positively related with short interest ratio.

To study the hypothesis empirically, I use sample firms from Russell 2000 components from 2015 to 2019 and following Miles et al. (1978) and Bentley et al. (2013)'s studies on corporate strategy aggressiveness, I construct a corporate strategy indicator, which consists of the ratio of R&D expenses to revenue, the ratio of Selling & General, and Administrative Expenses to revenue, the 2-year CAGR of revenue, and the ratio of stock compensation to revenue for senior management team, to represent the extent of corporate strategy aggressiveness. To measure the probability of earnings manipulation, following Dechow et al. 2011, this paper uses past earnings manipulation annual data from SEC's Accounting and Auditing Enforcement Releases (AAERs) for the period between 1990 and 2014, and builds a logistic model to generate the earnings manipulation

regression model, which is then applied to the sample firms in this paper to get their probabilities of earnings manipulation. Finally, using probability of earnings manipulation as the intermediate variable, my hierarchical regression model includes short interest ratio to indicate how the market perceive and reacts to corporate strategy as well as the earnings manipulation possibility. My findings show that empirically, a more aggressive corporate strategy will lead to a higher possibility of earnings manipulation, and the market is more likely to detect the probability and to react by increasing short position. Even after a binary variable instead of continuous variable measuring the aggressiveness of corporate strategy is introduced during the robust test, my findings are still significant.

The rest of the paper is organized as follows: Chapter 2 discusses literature review; Chapter 3 proposes the empirical hypothesis; Chapter 4 describes empirical strategy which includes the empirical method, regression variable definition, data descriptive statistics, and Pearson correlation test; Chapter 5 presents the empirical result; Chapter 6 focuses on robust test; Chapter 7 summarizes this paper.

CHAPTER 2 LITERATURE REVIEW

2.1 Corporate Growth

Higgins (1977) first introduces the concept ‘sustainable growth’, and discovers that given the financial policies, which include payout ratio and capital structure, the sustainable growth of a company is determined. This implies that a firm cannot maintain a high growth rate for a long time if financial policies are not relaxed or become bolder.

Other literature mainly focusses on the characteristics of firms with high growth. Studying the

innovation characteristics is one of the topics. Bianchini, Pellegrino, and Tamagni (2016) find that innovation activities lead to expanding revenues, and that internal innovation turns out to be the main driver of revenue growth. Using vector auto-regression model, Deschryvere (2014) discovered that only continuous innovators exhibit a positive correlation with revenue growth based on Finnish firm-level data. Besides innovation factor, some researchers work on the demographic characteristics of the firm. Henrekson and Johansson (2010) propose that younger and smaller firms tend to generate high growth. Bianchini et al. (2016) discover that high growth firms tend to have higher leverage than their counterparts.

As for the persistence of growth, Daunfeldt and Halvarsson (2015) discovers that high growth cannot be sustained since those firms are “one-hit wonders”. Gabrielsson et al. (2014) finds that few firms in Scania region exhibit sustained high growth. Dillon et al. (2014) studied the firms in the northern part of Belgium during 2000 to 2009 and found that majority of the firm cannot maintain high growth overtime. Parker et al. (2010) proposed that in the short term, firms might show fast growth, but in the medium and long term, few firms can maintain such fast growth.

2.2 Stock Compensation and Corporate Strategy

Plenty of literature has discussed the incentives resulting from stock compensation. Based on a sample of oil and gas producers, Rajgopal and Shevlin (2001) discovered stock compensation is positively related with future exploration risk taking, and negatively correlated with oil price hedging. Chen et al. (2005) focused on the banking industry and found that stock compensation could induce risk-taking activities under alternative risk measures and model specifications. Other researchers focus on some financial metrics that reflect risk taking activities indirectly. Bhargava

(2011) found that stock compensation is negatively associated with R&D expenses and long-term investments that benefit the company and shareholders in the long run, while stock compensation is also positively associated with total assets, intangible assets, and market-to-book value, all of which can be indicators for aggressive and risky activities. Brisley (2021) discovered that companies with stock compensation are associated with deterioration in performance and valuation. Strobl (2014) argues stock-based compensation leads to overinvestment. Considering the interrelation between earnings result and stock compensation, Bauan and Shaw (2006) show that the use of stock compensation is positively related to the propensity of meeting or exceeding analysts' quarterly earnings forecasts. Moreover, they found that firms that have more stock compensations are more often to report earnings surprises. Bauan and Shaw shed a light on the incentives that drive management team to report 'surprised' growth and earnings.

For the study on corporate strategy, Miles et al. (1978) and Bentley et al. (2013) proposed four factors reflecting the aggressiveness of corporate strategy: R&D/Revenue, historical growth rate of revenue, SG&A/Revenue, and noncurrent asset/total asset. Based on their study and the increasing popularity of stock compensation, this paper uses R&D expenses to revenue, the ratio of SG&A expenses to revenue, the 2-year CAGR of revenue, and the ratio of stock compensation as four factors to indicate the aggressiveness of corporate strategy.

Linking corporate strategy aggressiveness with earnings manipulation probability and applying the model to Russell 2000 small caps firms, which are seldom studied by previous research, is one of the contributions of my paper.

2.3 Earnings Manipulation

The issue of earnings manipulation and accounting fraud under compensation incentives has been extensively discussed in the academic literature. Uygur (2013) show that in banking industry, stock options are significantly and positively associated with the earnings management, and in addition, larger and poorer performing banks would engage in earnings management more through provision accounts. Also focusing on banking industry, Cheng et al. (2005) show that bank managers with stock compensation incentives are more likely to engage in earnings manipulation, especially when capital ratios are close to regulatory requirement level. Chen et al. (2020) found that CEO's stock compensation raises the likelihood of financial reporting fraud. Burns and Kedia (2006) show that among all other compensation components such as equity, restricted stock, long-term incentive payouts, and salary plus bonus, stock compensation have the stronger association with financial reporting fraud. Bergstresser and Philippon (2004) found that firms that use stock option as compensations are more likely to manipulate earnings through discretionary accruals. Through investigating the cases at the end of 1990s market bubble, Efendi et al. (2007) found that the likelihood of financial misreporting is most significant when CEO has sizable holdings of stock compensation. Perols and Lougee (2011) focused on the characteristics, and found that a higher likelihood for earnings manipulation is associated with records of continuously beating analyst earnings forecasts. Therefore, following previous research, stock compensation is used as a component of my corporate strategy indicator variable to predict the earnings manipulation probability.

Besides identifying corporate strategy aggressiveness is one of the factors that contributes to earnings manipulation, this paper further investigates how the market would perceive and capture

the earnings manipulation probability through the study on short selling, which is another contribution to current research and literature.

2.4 Short Selling

Short selling occurs when an investor borrows a security that he/she does not own and sells it on the open market, betting on and profiting from a drop in the security's price. Since short selling is costly at first but can be very profitable if the judgement is correct, it has been an important investing strategy and short sellers have the incentive of studying each firm's fundamental for profit opportunities. Since accruals management is one of the most common way of earnings manipulation (Beneish 1999; Dechow et al. 2011), Cao, Dhaliwal, and Kolasinski (2006) find that firms with high accruals are usually targeted by short sellers and short selling plays an important role in the pricing of accruals. Similarly, Hirshleifer, Teoh, and Yu (2011) demonstrate that accrual anomalies are heavily exploited by short sellers and short selling is positively associated with accruals. Besides the correlation, other studies show that short sellers usually increase their positions before the earning restatement. Desai et al. (2006) document that the increase timing is several months prior to the restatement and the increase is more pronounced for firms with high accruals. In addition, Karpoff and Lou (2010) discover stable abnormal short interest ratio increases 19 months prior to the manipulation is publicly revealed, and the increase is greater when the manipulation is severer. Beneish, Lee, and Nichols (2013) demonstrate that high accrual firms usually have lower return, while Drake, Rees, and Swanson (2011) show firms with high short interest ratio subsequently earn lower returns, both of which collectively suggest that short interest ratio is positively associated with accruals. Based on these studies on the ex-ante feature of short selling, in advance of earnings manipulation, gets revealed. This paper proposes that investors can perceive and capture the probability of earnings manipulation and accumulate short position to

gain profits. However, different from previous study, this paper suggests the source of such phenomenon is the corporate strategy aggressiveness, and the earnings manipulation probability plays an intermediate role in the mechanism.

CHAPTER 3 EMPIRICAL HYPOTHESIS

Considering the literature review above, this paper will evaluate the relationship between the corporate strategy aggressiveness and short interest ratio, with earnings manipulation probability as the intermediate variable.

3.1 Corporate Strategy and Earnings Manipulation

With external factors such as higher and overoptimistic market expectations, managers are thriving to generate high growth. Since persistent high growth is difficult to achieve, managers are inclined to engage in earnings manipulation to avoid stock price tumbles and lower stock compensation due to missed expectations. Hence, this paper proposes the following research hypothesis:

Hypothesis 1: A more aggressive corporate strategy will lead to a higher probability of earnings manipulation.

3.2 Corporate Strategy and Short Selling

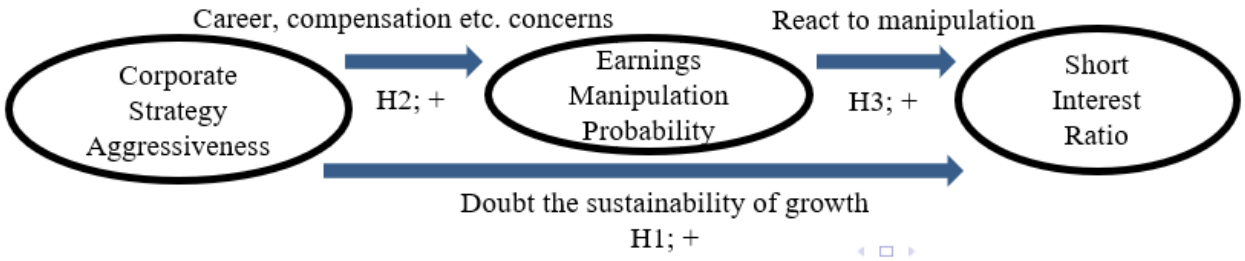
Under the assumption and empirical evidence that the market is an efficient market, if a company has been taking aggressive strategies and enjoying high growth for an unusually long time-thus having the suspicion of engaging in earnings manipulation or even accounting fraud-investors will either 1) start to doubt the sustainability of high growth and build short positions to trade against the trend (contrarian investing); or 2) start to perceive the risk that the company might engage in earnings manipulation or even accounting fraud to gain the ‘unrealistic’ growth, and take trading

strategies to gain profit by shorting the company (fundamental investing); both of these reflect investor's doubt on growth sustainability as well as financial statement solidarity, and will lead to a higher short selling ratio. Hence, the second and third hypothesis are proposed by this paper:

Hypothesis 2: A more aggressive corporate strategy will lead to a higher short interest ratio.

Hypothesis 3: Aggressive corporate strategies are perceived by investors as high probability of earnings manipulation, which serves as the incentive for investors to sell short, and thus, are positively related with short interest ratio. Therefore, earnings manipulation probability plays an intermediate role in the relationship between aggressive corporate strategy and short interest ratio. The logic diagram of my hypothesis is:

Figure 1: Logic of the Hypothesis



CHAPTER 4 EMPIRICAL STRATEGY AND DATA

4.1 Variables and Data

Corporate Strategy Aggressiveness

Since a firm with aggressive strategies often shows features such as high revenue growth, high expenses, and high stock compensation, following Miles et al. (1978) and Bentley et al. (2013)'s study on corporate strategy aggressiveness, I construct an indicator to measure the aggressiveness

of corporate strategy (Table 1), which is composed of 1) the ratio of R&D expenses to revenue; 2) the ratio of SG&A expenses to revenue; 3) the 2-year CAGR of revenue; and 4) the ratio of stock compensation to revenue for senior management. Except for the first and fourth component where there are three and two groups respectively due to large variation among firms, each of the other two components is classified into five groups based on firm value. Firms in the lowest value group get the value of 1, indicating least aggressive, while firms in the highest value group get the value of 5 (3 for the first component and 2 for the fourth component) indicating most aggressive. Values on these four metrics add up to the total value that indicates the aggressiveness of the company. My assumption here is that each metric has the same weight and there is substitutability between variables. Since typically five-year high growth is difficult to maintain, samples in my paper are on a five-year time frame from 2015 to 2019 to better reflect the aggressiveness. Data are collected from Capital IQ and cover all Russell 2000 constituents during 2015 to 2019.

Table 1: Corporate Strategy Aggressiveness Indicator

Corporate Strategy Aggressiveness Indicator	R&D/revenue
	SG&A/revenue
	the 2-year CAGR of revenue
	Stock compensation/revenue for management team

Probability of Earnings Manipulation.

The general strategy to generate earnings manipulation probability of the sample firms is to analyze the financial characteristics of firms that engage in the earnings manipulation activities in the past. I will use the firm's financial data as independent variables and to use a binary indicator of earnings manipulation as dependent variable in a logistic regression model, after which the logistic model is applied to the sample firm and thus generates the earnings manipulation probability (Dechow et al. 2011).

Past Earnings manipulation annual data are collected from SEC's Accounting and Auditing Enforcement Releases (AAERs)[1] provided by the University of California-Berkeley Center for Financial Reporting and Management (CFRM)[2] for the period between 1990 and 2014. The releases disclose the law enforcement issue that deal with earnings manipulation cases. There are 146,045 cases collected and 964 of them were reporting earnings manipulation. Table 2 presents the distributions of earnings manipulation case in the sample by year during 1990 to 2014. As shown in Table 2, there were 964 cases of earnings manipulation in total during 1990 to 2014, and the observed frequency increased above 1% during the late 1990s to early 2000s and decreased afterwards. This might be because during Internet Bubble period there were many firms that adopted aggressive strategies, which cannot boost further high growth, and engaged in frauds such as earnings manipulation activities. This observed pattern again aligns with this paper's hypothesis on the positive relationship between corporate strategy aggressiveness and earnings manipulation probability.

Table 2: Distributions of Earnings Manipulation Firms by Year during 1990-2014[3]

Year	Total Number of Firms	Number of Fraud Firms	Percentage
1990	4582	15	0.33%
1991	4713	27	0.57%
1992	4970	26	0.52%
1993	5377	30	0.56%
1994	5684	23	0.40%
1995	6230	22	0.35%
1996	6745	33	0.49%
1997	6789	42	0.62%
1998	6716	56	0.83%
1999	6828	73	1.07%

[1] Data can be found at: https://www.sec.gov/divisions/enforce/friactions.htm
[2] See DECHOW, P.M., GE, W., LARSON, C.R. and SLOAN, R.G. (2011), Predicting Material Accounting Misstatements*. Contemporary Accounting Research, 28: 17-82
[3] Based on AAER's disclosure.

2000	6752	86	1.27%
2001	6362	81	1.27%
2002	6067	77	1.27%
2003	5981	69	1.15%
2004	5934	58	0.98%
2005	5863	45	0.77%
2006	5908	33	0.56%
2007	5868	30	0.51%
2008	5612	26	0.46%
2009	5367	31	0.58%
2010	5389	26	0.48%
2011	5404	21	0.39%
2012	5630	19	0.34%
2013	5647	11	0.19%
2014	5627	4	0.07%
Total	146045	964	0.66%

There are also two other sources for identifying past earnings manipulation cases:

1) The Government Accountability Office (GAO) Financial Statement Restatement Database[4]: This database starts to collect financial statement restatement/manipulation cases from 1997 and has relatively large number of cases. The reason I did not choose it is that this database also consists of other insignificant statement restatements, which are not defined as earnings manipulation.
2) Stanford Law Database on Shareholder Lawsuits[5]: Shareholder lawsuits might include some other reasons such as corporate governance failure, or even price drop, and might have no connection to earnings manipulation activities this paper defines. That's why this database is not chosen.

Using AAERs has both advantages and disadvantages, but disadvantages are limited. The

[4] Financial Statement Restatement Database: https://www.gao.gov/products/gao-03-395r
[5] Stanford Securities Class Action Clearing House: https://securities.stanford.edu/

advantage is that since the reason behind SEC's enforcement is usually solid and the probability of the firm really engaging in earnings manipulation is relatively high, Type I error rate is low[6]. The disadvantage of this database is that SEC might have selection bias and some firms that are doing earnings manipulation might not be caught. Although this disadvantage is material, this disadvantage is not unique to AAERs cases since other database also faces the same problem. Moreover, in the Empirical Result Chapter, I will deal with Type I and Type II error for the logistic regression.

This paper selects the following variables in Table 3 to identify earnings manipulation in the logistic regression and the motivations behind it are stated after the table.

Table 3: Variables in Logistic Model to Detect Earnings Manipulation Probability[7]

Variable	Abbreviation	Predicted Sign	Calculation
Earnings Manipulation Indicator	prob_em	NA	1 if the firm engages in earnings manipulation; 0 otherwise
RSST Accruals	rsst_acc	+	(Change in working capital + Change in net noncurrent operating assets + Change in net financial assets) / Average total assets; where working capital = [Current Assets – Cash & Equivalent]- [Current Liabilities – Current Portion of Long-term Debt]; Net Noncurrent Operating Asset = [Total Assets –

[6] Type I error is to identify non-manipulation as manipulation; Type II error is to identify manipulation as non-manipulation.

[7] See DECHOW, P.M., GE, W., LARSON, C.R. and SLOAN, R.G. (2011), Predicting Material Accounting Misstatements*. Contemporary Accounting Research, 28: 17-82

			Current Assets – Long-term Investment] – [Total Liabilities – Current Liabilities – Long-term Debt]; Net Financial Assets = [Short-term Investments + Long-term Investments] – [Long-term Debt + Current Portion of Long-term Debt + Preferred Stock]
Change in Account Receivables	ch_rec	+	Change in Account Receivables/Average total assets
Change in Inventory	ch_inv	+	Change in Inventory/Average total assets
Percent of Soft Assets	soft_assets	-	(Total Assets – PP&E – Cash & Equivalent)/Total Assets
Change in Cash Sales	ch_cs	-	% Change in in Cash Sales; cash sales = sales – account receivables
Change in Return on Assets	ch_roa	+	Return on Assets = Earnings / Average total assets

The first measure *RSST Accruals* refers to the measure proposed by Richardson et.al (2005) to examine accruals. On top of conventional accruals calculation based on working capital (Sloan 1996), they add NCO (net noncurrent operating assets) and FIN (net financial assets) since they found that firms are also manipulating statement through fixed assets and external debt. Dechow, Sloan, and Sweeney (1996) found that accounts receivable is the most common way of manipulating earnings, especially through techniques such as trade-loading and early revenue recognition. Due to the subjective estimation feature of accounts receivable, this paper includes

Change in Accounts Receivables as the second measure variable. Another common technique of earnings manipulation is subjective estimation of inventory. For example, when a firm writes down its inventory value based on discretionary judgement, or change the accounting method to Last-in, First-out (LIFO) liquidation, the net income and cash flow could be distorted under both cases. The third measure *Change in Inventory* is included to account for such case. The inclusion of the fourth measure *Percent of Soft Assets* is based on the finding of Barton and Simko (2002): the likelihood of reporting positive earning surprises is positively correlated with the percent of net operating assets. Managers might have the incentive of manipulating short-term earnings if the firm has greater soft assets. According to Beneish (1999), managers are more likely to engage in earnings manipulation when firm's fundamental becomes worse. The fifth measure *Change in Cash Sales* is selected to detect if the sales are deteriorating when taking accruals out. Moreover, through survey and interview, Graham, Harvey, and Rajgopal (2005) discovered that smoothing and increasing earnings growth is one of the factors that drives earnings manipulations. Therefore, *Change in Return on Assets* is chosen by this paper to reflect such incentive.

Logistic regression on those variables mentioned above is then performed and the results are presented in Chapter 5—Empirical Results. The logistic model generated would be applied to the Russell 2000 constituents (sample in this paper) to indicate their probability of earnings manipulation.

Short Interest Ratio and Control Variable

As discussed in the Literature Review Chapter, in reaction to probabilities of earnings manipulation, investors are likely to short the stock. Therefore, to measure if the investors perceive the earning manipulation practice or how much the firm engages in earning manipulation, short

interest ratio, which is the short interest divided by share outstanding, is selected as a proxy variable. A high short interest ratio indicates that earnings manipulation probability is high, and the probability gets captured by the investor. Since revealing earnings manipulation might take several years after aggressive accounting practices are implemented, short positions usually accumulate with time. Therefore, this paper will use 5-year average of short interest ratio on the last trading day of each year from 2015 to 2019. The data are collected from Capital IQ and cover all Russell 2000 constituents.

$$Short\ Interest\ Ratio = \frac{Short\ Interest}{Shares\ Outstanding}$$

Considering large firms are usually more closely followed by investors and more easily get caught when engaging in earnings manipulation, to account for the size effect, total asset of the sample firm is incorporated in the model as a control variable. Moreover, since firms with lower return on assets (ROA) are more likely to engage in earnings manipulation to improve performance, ROA is added as another control variable to my model. 5-year average data are from Capital IQ and cover all Russel 2000 constituents from 2015 to 2019.

All variables (dependent, independent, and control variables) as well as their metrics and abbreviations in the final hierarchical regression are in Table 4.

Table 4: Variables and The Proxies

Variable	Role	Proxy	Abbrev.
Aggressiveness of corporate strategy	Independent Variable	5-year average of each metric added up; higher value indicates more aggressive	ACS

Probability of earnings manipulation	Intermediate Variable	Probability comes from applying logistic model generated from historical earnings manipulation data to sample firms	PEM
Short interest ratio	Dependent Variable	5-year average of annual average SIR from 2015 to 2019	SIR
Return on Assets	Control Variable	5-year average of annual return on assets (earnings/total asset) during 2015 to 2019	ROA
Total Assets	Control Variable	5-year average of total assets	SIZE

4.2 Regression Methods

To analyze the impact of corporate strategy aggressiveness on earnings manipulation probability and short interest ratio, two empirical methods: Ordinary Least Square regression and hierarchical regression are adopted. Hierarchical regression is a random coefficient regression method that can be used to analyze the nested empirical hypothesis or nested data. Under hierarchical regression, data are analyzed with a series of regression-like hierarchically nested models in which parameters from one level of analysis are analyzed at the next level of analysis (Nezlek and Zyzniewski, 1998). This paper chooses hierarchical regression method over OLS because:

1) Previous studies (Goldstein, 1987; Burstein, Kim & Delandshere, 1989; Draper, 1995) have shown that hierarchical regression can provide a natural setting where researchers can express and compare theories about structural relationships among variables at each level of the sampling hierarchy.

2) Combined techniques of maximum-likelihood and Bayesian procedures to estimate parameters are incorporated in hierarchical regression, which makes hierarchical regression yield better calibrated uncertainty assessments in cases where theories are nested or structural.

Since this paper adopts a nested hypothesis where earnings manipulation probability plays as an intermediator between corporate strategy aggressiveness and short interest ratio, hierarchical regression can better reflect such a three-level structural theory.

Basically, the first step in any hierarchical regression model is the specification of the Level 1 model: a dependent variable is predicted as a function of a linear combination of one or more level 1 variables as follows:

$$Y_{ij} = \beta_{0j} + \beta_{1j} * X_1 + \beta_{2j} * X_2 + \cdots + \beta_{kj} * X_k + r_{ij}$$

where β_{0j} represents the intercept of firm j, β_{1j} represents the coefficient of explanatory variable X_1 of firm j, and the r_{ij} represents the error term. In this paper, the dependent variable is short interest ratio, and the explanatory variable is corporate strategy aggressiveness.

The next step is to specify the Level 2 model: more explanatory variables are added to the Level 1 model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} * X_1 + \beta_{2j} * X_2 + \cdots + \beta_{kj} * X_k + \theta_{1j} * Z_1 + \cdots + r_{ij}$$

where θ_{1j} represents the coefficient of newly added explanatory variable Z_1. In this paper, the variable earnings manipulation probability is added, making both the corporate strategy aggressiveness and earnings manipulation probability the explanatory variables, and short interest ratio the dependent variable.

To assess the significance of the hierarchical model, after adding earnings manipulation probability as the intermediate variable, it is expected to see that 1) the R-square of the third model significantly increases compared with the second model, suggesting the model fits better after intermediate variable is added; 2) the correlation coefficient of the explanatory variable corporate strategy aggressiveness in the third model significantly decreases, suggesting that the intermediate variable earnings manipulation probability also plays a role in the relationship between corporate strategy aggressiveness and short interest ratio. If these two changes happen, it suggests that the intermediate effect exists, and the earnings manipulation probability is indeed an intermediator.

4.3 Descriptive Statistics

In the descriptive statistics section, this paper counts the maximum (Max), minimum (Min), mean (Mean), median (Median), and standard deviation (std) of the sample data. Descriptive statistics are shown in Table 5. The total sample size is 1988.

Table 5: Descriptive Statistics

Variable	Observation	Mean	Median	Max	Min	Std.
ACS	1988	7.28	7.00	12.00	4.00	1.98
PEM	1473	2.48	0.96	152.50	0	13.12
SIR	1988	3.23%	1.62%	19.98%	0%	0.04
ROA	1983	-8.58%	1.34%	62.94%	-818.73%	0.42
SIZE	1988	2119.27	790.58	113850.4	0	5103.67

The mean aggressiveness of corporate strategy is 7.25, indicating that the sample firms show moderate aggressiveness on average. For the earnings manipulation probability, the value larger

than 1 indicates the firm is more likely to engage in earnings manipulation activities than historical cases. In my sample, probability of earnings manipulation has an average of 2.48, and a median of 0.96, which indicates that half of the sample firm are less likely to engage in earnings manipulation compared with historical cases. The huge difference between average value and median value is largely due to a large variation in firms' probability of earnings manipulation. The average and median short interest ratio is 3.23% and 1.62% respectively, representing low short selling pressure. Median ROA is 1.34%, while median total assets size is 790.58 (million USD).

4.4 Pearson Correlation Test

Pearson Correlation Test is also conducted for rigorous concern. Logarithm of ACS and SIZE are used instead due to their relatively large value compared with other variables. The results are shown in Table 6. With other variable unchanged, the correlation coefficient between log (ACS) and PEM is 0.0676, indicating that aggressive company strategy is positively related with earning manipulation probability at the significant level of 0.01—the more aggressive the strategy is, the higher probability the earning manipulation is. In addition, holding other variable constant, the ACS and SIR have a correlation coefficient of 0.0621 at the significant level of 0.01, indicating that the more aggressive the strategy is, the higher the short interest ratio is. Moreover, with other variables constant, the intermediate variable—PEM is significantly correlated with SIR, with the 0.0579 correlation coefficient. This indicates that the higher the earnings manipulation probability is, the easier the probability gets captured by the investors, thus leading to a higher short interest ratio.

Table 6: Pearson Correlation Test Results

Variable	Log (ACS)	PEM	SIR	ROA	Log (SIZE)

Log (ACS)	1.0000				
PEM	0.0676**	1.0000			
	(.0094)				
SIR	0.0621**	0.0579*	1.0000		
	(.0056)	(.0263)			
ROA	0.1170***	0.0102**	0.1223***	1.0000	
	(.0000)	(.6971)	(.0000)		
Log (SIZE)	-0.0345	0.0228	0.2041***	0.4763***	1.0000
	(.1244)	(.3828)	(.0000)	(.0000)	

Note: ***P < 0.001, **P < 0.01, *P < 0.05 denote significance on the 0.1%, 1% and 5% level, respectively.

CHAPTER 5 EMPIRICAL RESULTS

5.1 Logistic Regression on Historical Earnings Manipulation Cases

To assess the relation between manipulation detection variables and earnings manipulation probability, this paper adopts the following logistic regression model to evaluate whether the variables in this paper as defined in Chapter 4 are significant in predicting earnings manipulation:

$$prob\_em_{it} = \alpha + \beta_1 * rsst\_acc_{it} + \beta_2 * ch\_rec_{it} + \beta_3 * ch\_inv_{it} + \beta_4 * soft\_assets_{it} + \beta_5 * ch\_cs_{it} + \beta_6 * ch\_roa_{it} + \epsilon_{it} \quad (1)$$

where $prob\_em_{it}$ is the dependent binary variable--probability of earnings manipulation for firm i at year t, as described in Table 3 at Chapter 4; $rsst\_acc_{it}$, ch_rec_{it}, ch_inv_{it}, $soft\_assets_{it}$, ch_cs_{it}, and ch_roa_{it} are explanatory variables and represent RSST accruals, change in account receivable, change in inventory, percent of soft assets, change in cash sales, and change in return on assets respectively for firm i at year t, as described in Table 3 at Chapter 4. ϵ_{it} is the error term.

Logistic regression result is shown in Table 7. The correlation coefficient of predictor *RSST Accruals* is 0.487 with a significance level of 0.1%, indicating that one unit increase in accruals is

correlated with one unit probability increase in earnings manipulation. This result aligns with previous studies. The predictor *Change of Account Receivable* has a coefficient of 1.657, significant at the level of 0.1%, suggesting that the increase in account receivable is positively correlated with probability of earnings manipulation. The coefficient of *Change in Inventory* is significant at the level of 5%, with a value of 1.241, showing that inventory change is positively related with earning manipulation probability. Results also show that firms with more soft assets are more likely to engage in earnings manipulation, and the correlation coefficient is 1.791 which is significant at the level of 0.1%. The result is in accordance with Barton and Simko (2002). *Change in Cash Sales* has the coefficient of 0.053 and the significant level of 5%. The positive correlation is different from my prediction in Table 3. This might be because large change in cash sales usually indicate material change in sales terms which is the most common way of earnings manipulation. The correlation coefficient of *Change in Return on Assets* is -0.28 with a significant level of 0.1%, which is different from my prediction in Table 3, suggesting that large changes in ROA are correlated with lower earnings manipulation probability.

Table 7: Logistic Regression of Predictors on Earnings Manipulation Probability

Dependent Variable	**prob_em**
Variable	
constant	**-6.068*****
	(0.000)
rsst_acc	**0.487*****
	(0.000)
ch_rec	**1.657*****
	(0.000)
ch_inv	**1.241***
	(0.020)

soft_assets	**1.791*** **
	(0.000)
ch_cs	**0.053***
	(0.015)
ch_roa	**-0.280****
	(0.005)

Note: ***P < 0.001, **P < 0.01, *P < 0.05 denote significance on the 0.1%, 1% and 5% level, respectively.

Following Dechow et al. 2011, the predicted probability is derived by inserting the predicted value from the logistic regression to the following equation:

$$Probability = \frac{e^{(Predicted\ Value)}}{(1 + e^{(Predicted\ Value)})}$$

The probability then is divided by the unconditional expectation, which is equal to the number of earnings manipulation firms (964) divided by the total number of firms (146,045), of earnings manipulation to generate a F-score. F-score of 1.00 indicates that the firm has the same earnings manipulation probability as the historical sample. The greater the F-score is than 1.00, the higher probability of earnings manipulation is. Since the model is prone to Type I and Type II error, Table 8 presents the sensitivity of the Logistic Model and evaluate Type I and Type II error rates for the cutoff F-score value of 1.00.

Table 8: Type I & Type II Error Rates of the Logistic Model

F-score Cut-off at 1.00	Logistic Model Predicted Value		
Observed	Earnings Manipulation	No Earnings Manipulation	Total
Earnings Manipulation	**679**	285	964
No Earnings Manipulation	64,997	**80,084**	145,081
	65,676	80,369	**146,045**

Earnings Manipulation	**70.44%**	29.56%	0.66%
No Earnings Manipulation	44.80%	**55.20%**	99.34%
Correct Classification		55.30% (1)	
Sensitivity		70.44% (2)	
Type I errors		44.80% (3)	
Type II errors		29.56% (4)	

Notes:

(1). Correct Classification is calculated as: [(679+80369)/146045]

(2). Sensitivity is calculated as: 679/964

(3). Type I errors are calculated as: 64997/145081

(4). Type II errors are calculated as: 285/964

The results indicate that we correctly classify 679 of the 964 firms (sensitivity equal to 70.44%). A Type II error is when the model incorrectly classifies an earnings manipulation firm as a non-manipulation one. The Type II error rate is 29.56% (285/964). A Type I error occurs when the model incorrectly classifies a non-manipulation firm as an earnings manipulation one. Under the F-score cutoff of 1.00, the model incorrectly classifies 64,997 non-manipulation firms out of 145,081 total cases, indicating that the Type I error rate is 44.80%. From the position of short sellers the prediction accuracy is important. Short selling under Type I error could produce losses to the short seller since stock price might actually be rising due to fundamentals. Type II errors are less costly in money terms since these would be viewed as missed opportunities to the short seller. In the later hierarchical regression, this model is applied to the Russell 2000 sample data in this paper.

5.2 Hierarchical Regression on Corporate Strategy Aggressiveness, Earnings Manipulation Probability, and Short Interest Ratio

The empirical results are shown in Table 9. There are three empirical models for the exploration of relationship among variables. Logarithm of ACS and SIZE are used instead due to their

relatively large value compared with other variables.

Model I (block 1) is constructed to test if the aggressive corporate strategy is positively linked with earnings manipulation probability. It includes aggressiveness of corporate strategy (ACS) as the independent variable and probability of earnings manipulation (PEM) as the dependent variable, with size effect total assets (SIZE) and return on assets (ROA) as control variables:

$$PEM_{it} = \beta_0 + \beta_1 * \log(ACS_{it}) + \beta_2 * \log(SIZE_{it}) + \beta_3 * ROA_{it} + \gamma_{it}$$

where PEM_{it} = Probability of Earnings Manipulation for firm i at time t; ACS_{it} = Aggressiveness of Corporate Strategy for firm i at time t; $SIZE_{it}$ = Total Asset for firm i at time t; ROA_{it} = Return on Assets for firm I at time t. This model is not a part of the hierarchical regression but used as a comparison to contrast with hierarchical model results.

Model II (block 2) is the Level 1 model of the hierarchical regression and is constructed to explore if aggressive corporate strategy is positively linked with high short interest ratio. It includes aggressiveness of corporate strategy (ACS) as independent variable and short interest ratio (SIR) as dependent variable, with control variables same as model I:

$$SIR_{it} = \beta_0 + \beta_1 * \log(ACS_{it}) + \beta_2 * \log(SIZE_{it}) + \beta_3 * ROA_{it} + \gamma_{it}$$

where SIR_{it} = Short Interest Rate for firm I at time t; ACS_{it} = Aggressiveness of Corporate Strategy for firm i at time t; $SIZE_{it}$ = Total Asset for firm i at time t; ROA_{it} = Return on Assets for firm i at time t.

Since hierarchical regression is a model comparison analysis with gradually added variables, we need to account for other variables that might play as an intermediate role other than the main predictor variables. Therefore, Model III (block 3), which is the Level 2 model of the hierarchical

regression, is constructed to test if the aggressive corporate strategy affects the short interest ratio through earnings manipulation probability. Besides variables in Model II, Model III adds earnings manipulation probability (PEM) as another independent variable. The econometric model is stated below:

$$SIR_{it} = \beta_0 + \beta_1 * \log(ACS_{it}) + \beta_2 * \log(SIZE_{it}) + \beta_3 * ROA_{it} + \beta_4 * PEM_{it} + \gamma_{it}$$

The critical procedure is to see if the R-square increases and the coefficient of corporate strategy (ACS) aggressiveness significantly decreases after adding earnings manipulation probability (PEM) as the intermediate variable to Model III. If so, earnings manipulation probability (PEM) indeed plays an intermediate role between corporate strategy aggressiveness (ACS) and short interest ratio (SIR).

Table 9: Hierarchical Regression Results

Variable	**Model I: (DV: PEM)**	**Model II: (DV: SIR)**	**Model III: (DV: SIR)**
Control Variable			
ROA	0.0001	0.0021	0.0021
	(.973)	(.403)	(.403)
log (SIZE)	0.0049*	0.0110***	0.0109***
	(.023)	(.000)	(.000)
Direct Effect			
log (ACS)	0.0435***	0.0215**	
	(.000)	(.004)	
F-value	9.88***	32.32***	
Adj. R-squared	0.0094	0.0453	
Intermediate Effect			
log (ACS)			0.0198**
			(.009)
PEM			0.0413*
			(.003)
F-value			26.53***
Adj. R-squared			0.0490

Model III-Model II	
Adj. R-squared Diff.	0.0037
F-value	8.785***
P-value	0.003**

Note: ***P < 0.001, **P < 0.01, *P < 0.05 denote significance on the 0.1%, 1% and 5% level, respectively.

Hypothesis 1: A more aggressive corporate strategy will lead to a higher earnings manipulation probability.

From Model I in Table 9 where the corporate strategy aggressiveness is the independent variable and the earnings manipulation probability is the dependent variable, we can know that this model is significant at the level of 0.001, which indicates that the model fits the data well. Moreover, the correlation coefficient of corporate strategy aggressiveness (logarithm) is 0.04 with the significance level of 0.001. This means that corporate strategy aggressiveness is positively correlated with earnings manipulation probability. Out of the incentives on stock compensation or external pressure such as investor expectation, a firm is likely to engage in earnings manipulation to maintain unsustainable growth after a series of aggressive strategies have been taken. In this model, with other variables constant, one unit increase in the extent of corporate strategy aggressiveness will lead to 0.04 unit increase in the probability of earnings manipulation, which, therefore, proves the Hypothesis 1 proposed by this paper.

Hypothesis 2: A more aggressive corporate strategy will lead to a higher short interest ratio.

From Model II where the corporate strategy aggressiveness is the independent variable and the short interest ratio is the dependent variable, we can see that Model II is significant at the level of 0.001 and fits our sample well. In addition, corporate strategy aggressiveness has a correlation coefficient of 0.02, which is significant at 0.01 level. After controlling for other variables, this

indicates that corporate strategy aggressiveness is positively correlated with short interest ratio. Under the commonly held belief that high growth propelled by aggressive strategies cannot persist, investors will pay close attention to those 'aggressive' firms and further short those firms when investors believe these firms will miss analyst's expectation, thus leading to a high interest ratio. In our model, with other variables held unchanged, one unit increase in the aggressiveness of corporate strategy will lead to a 0.02 unit increase in the short interest ratio. Therefore, the Hypothesis 2 of this paper is proved.

Hypothesis 3: Higher probability of earnings manipulation resulted from aggressive corporate strategies will be captured by investors and is positively related with short selling ratio, thus playing an intermediate role in the relationship between corporate strategy and short interest ratio.

Model III, to which I add earnings manipulation probability as another independent variable based on Model II, is still significant at the level of 0.001. The correlation coefficient of corporate strategy aggressiveness becomes 0.019 and is significant at the level of 0.01, while the correlation coefficient of earning manipulation probability is 0.04 with a significant level of 0.01. The coefficient of corporate strategy aggressiveness decreases by 0.001 from 0.02 in Model II to 0.019 in Model III. In addition, the adjusted R-squared has increased by 0.0037, which is significant at the level of 0.01, compared with Model II. Both significant coefficient change and adjusted R-square change suggest that earnings manipulation probability plays an intermediate role in the relationship between corporate strategy aggressiveness and short interest ratio. To sustain a 'unrealistic' high growth and to meet market expectation, after aggressive corporate strategies and high growth, firms are likely to engage in earnings manipulation measures. Since investors know the dynamics, they will incorporate this risk into their investment strategies by shorting the stock

of these firms, thus leading to a high short interest ratio. This again proves the Hypothesis 3 in this paper.

Although my results are significant and support my three hypotheses from an academic perspective, the correlation coefficients of both corporate strategy aggressiveness (ACS) and earnings manipulation probability (PEM) are around 1%, which is less helpful and applicable in a practical sense. Further screening and modifications could be done to improve the correlation coefficients so that the result can be more helpful from the practical perspective.

CHAPTER 6 ROBUST TEST

Dummy variable *dummy_ACS* is created to conduct robust test on the above results in this Chapter. The corporate strategy aggressiveness is further categorized into two groups: 1) being aggressive where *dummy_ACS* gets the value of 1 if it has a score equal and greater than 9; and 2) being less aggressive where *dummy_ACS* gets the value of 0 if the score is less than 9. To enhance the empirical results in previous Chapter, the robust test is expected to show that the significant correlation among corporate strategy aggressiveness (ACS), earnings manipulation probability (PEM), and short interest ratio (SIR) still holds even if the independent variable corporate strategy aggressiveness (ACS) is replaced by a dummy variable *dummy_ACS,* which indicates being aggressive when equal to 1.

The robust test results are shown in Table A.1. The correlation coefficient of *dummy_ACS* in Model I where earnings manipulation probability is the dependent variable is 0.0118 with a significant level of 0.001. This indicates that aggressive corporate strategy is positively related with probability of earnings manipulation. The Hypothesis 1 still holds under the robust test. In the Model II, *dummy_ACS* has a correlation coefficient of 0.006 which is significant at the level of

0.01, which suggests that aggressive corporate strategy significantly and positively correlates with short interest ratio, showing that Hypothesis 2 still holds under the robust test. After adding earnings manipulation probability as an intermediate variable based on Model II, Model III shows that the correlation coefficient of *dummy_ACS* has decreased by 0.001 and the adjusted R-squared has increased by 0.0038 compared with Model II. The adjusted R-square increase is significant at the level of 0.01. This indicates that probability of earnings manipulation still plays an intermediate role in the relationship between aggressiveness of corporate strategy and short interest ratio under the robust test, which again proves Hypothesis 3.

Therefore, even if we replace the original continuous aggressiveness of corporate strategy independent variable with a discrete dummy variable, the hypothesis proposed by this paper still hold, which indicates the empirical results in the previous Chapter is robust.

CHAPTER 7 CONCLUSION

Using financial data of Russell 2000 components from 2015-2019, this paper studies the relationship between corporate strategy aggressiveness and short interest ratio with earnings manipulation probability as an intermediate variable. After controlling for return on assets and total assets, this paper discovers that 1) a more aggressive corporate strategy is associated with higher probability of earnings manipulation: since firms are difficult to generate persistent high growth through aggressive strategy, with external factors such as higher and overoptimistic market expectation and internal factors such as incentives from executive stock compensation, firms are more likely to engage in earnings manipulation activities; 2) higher earnings manipulation probability is positively related with higher short interest ratio: investors are closely following stocks on the market to find out profit opportunities, and the higher probability of earnings

manipulation is more likely to be perceived and captured by the market, which thus leads to a higher short interest ratio as investors would short the stock in reaction to the earnings manipulation; 3) Within the mechanism of aggressive corporate strategy positively affecting short interest ratio, the earnings manipulation probability plays an intermediate role: investors are inclined to short the stocks which show high earnings manipulation probability resulted from aggressive corporate strategies. After the robust test where I introduce a binary variable instead of a continuous variable in the original model measuring the corporate strategy aggressiveness, the conclusions still hold.

The conclusions have important implications for both investors, shareholders, and market regulators. For investors, it suggests that a second thought on the persistency of growth brought by aggressive strategies should be given before believing in firm's seemingly plausible aggressive plans. Moreover, detecting red flag firms with high probability of earnings manipulation, especially those firms with aggressive strategies, is a recommended factor when determining investment strategies. For shareholders, this paper suggests that aligning stock price with executive's compensation is prone to earnings manipulation activities, and that introducing other performance measurement metrics which restricts executive's risky behavior is also critical.

But I believe this paper is more meaningful for regulators than a hedge fund investor. That's because the probability of Type I error is 44.8%, which is too high for an investor to adopt a short strategy and shorting a non-manipulation firm is more costly for an investor. But for market regulators, a 50-50 chance of catching the manipulated firms suggests monitoring the probability of earnings manipulation based on a firm's growth strategy contributes to preventing accounting

fraud from happening and protecting investors in a pre-emptive manner. Hence, the discussion of the relationship between corporate strategy aggressiveness and short interest ratio with earnings manipulation probability is not only crucial but also practical.

APPENDIX

Table A.1 Robust Test Results

Variable	**Model I: (DV: PEM)**	**Model II: (DV: SIR)**	**Model III: (DV: SIR)**
Control Variable			
ROA	0.0013	0.0027	0.0027
	(.741)	(.282)	(.291)
log (SIZE)	0.0057*	0.0115***	0.0113***
	(.014)	(.000)	(.000)
Direct Effect			
dummy_ACS	0.0118***	0.0063**	
	(.001)	(.003)	
F-value	5.84***	32.50***	
Adj. R-squared	0.0073	0.0455	
Intermediate Effect			
dummy_ACS			0.0058**
			(.007)
PEM			0.0413**
			(.03)
F-value			26.67***
Adj. R-squared			0.0493
Model III-Model II			
Adj. R-squared Diff.			0.0038
F-value			8.81**
P-value			0.003*

Note: ***P < 0.001, **P < 0.01, *P < 0.05 denote significance on the 0.1%, 1% and 5% level, respectively.

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