Measuring Firm Size in Empirical Corporate Finance

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Abstract

In empirical corporate finance, firm size is commonly used as an important, fundamental firm characteristic. However, no paper comprehensively assesses the sensitivity of empirical results in corporate finance to different measures of firm size. This paper fills this hole by providing empirical evidence for "measurement effect" in "size effect". In particular, this paper studies the influences of employing different proxies (total assets, total sales, and market capitalization) of firm size in 20 prominent areas in empirical corporate finance research. We highlight several empirical implications. First, in most areas of corporate finance, the coefficients of firm size measures are robust in sign and statistical significance. However, when studying firm performance and capital structure, researchers should pay extra attention because firm size proxies (e.g., market cap) can be mechanically correlated. Second, the coefficients on regressors other than firm size often change sign and significance when we use different size measures. We observe this phenomenon in almost all areas except dividend policy and executive compensation. Unfortunately, this may suggest that some previous studies are not robust to different firm size proxies. Researchers should either check robustness with all the important firm size measures or provide a rationale of using any specific measure. Third, the goodness of fit measured by R-squared also varies with different size measures, suggesting some measures are more relevant than others in different situations. Fourth, different proxies capture different aspects of "firm size" and thus have different implications in corporate finance. Therefore, the choice of size measures needs both theoretical and empirical justification. Our empirical assessment provides guidance to empirical corporate finance researchers who must use firm size measures in their work.

JEL Classifications: G3, G30, G31, G32, G34, G35, C23, C58, J31, J33.

Key Words: Firm size measures; Total assets; Total sales; Market capitalization; Empirical corporate finance.

I. Introduction

The studies of firm size date back to a seminal article, Coase (1937), which raises the questions of how firm boundaries affect the allocation of resources and what determines firm boundaries. A large body of research follows the topic, and both questions have received much attention in theoretical studies in economics and finance (e.g., Williamson (1975, 1986), Klein, Crawford, and Alchian (1978), and Grossman and Hart (1986)). Empirical researchers in corporate finance also consider firm size an important and fundamental firm characteristic, and, in many situations, observe the "size effect" - firm size matters in determining the dependent variables. For example, in capital structure, Frank and Goyal (2003) show that pecking order is only found in large firms; Rajan and Zingales (1995) discover that leverage increases with firm size. In mergers and acquisitions, Moeller, Schlingemann, and Stulz (2004) find that small firms have larger abnormal announcement returns; Vijh and Yang (2012) document that for cash offers, targetiveness (probability of being targeted) decreases with firm size, but for stock offers, they find an inverted-U relation between them.

Although firm size matters in empirical corporate finance, the existing literature is silent on the rationale of using a certain measure of firm size, and no paper provides a comprehensive assessment of the sensitivity of empirical results in corporate finance to different measures of firm size. To the best of our knowledge, Vijh and Yang (2012) provide a list of firm size proxies and corresponding coefficients of firm size proxies in the literature of takeover likelihood models. The list indicates that the sign and significance of the coefficients of firm size in different papers are sensitive to firm size measures. While Vijh and Yang (2012) suggest that firm size measures should receive more attention, they do not compare the results based on the same regression or

conduct the assessment of firm size measures in broad corporate finance literature other than targetiveness models.

Following Coles and Li (2012) for the coverage of the 20 subfield specifications, we study the influences (sign sensitivity, significance sensitivity, and R-squared sensitivity) of employing different measures of firm size in those 20 areas.[1] For each area, we employ three firm size measures: total assets, total sales, and market value of equity, and also their natural logarithm terms. We choose these three measures because they are the most popular firm size proxies in corporate finance according to our survey of 100 research papers; however, other measures, such as number of employees and net assets also appear in empirical work.

When it comes to the representative specifications, we build on Coles, Daniel, and Naveen (2006), Comment and Schwert (1995), Core and Guay (1999), DeAngelo, DeAngelo, and Stulz (2006), Graham, Li, and Qiu (2012), Harford (1999), Harford, Mansi, and Maxwell (2008), Lemmon, Roberts, and Zender (2008), Linck, Netter, and Yang (2008) and Mehran (1995). We choose the same papers as those in Coles and Li (2012) for brevity and data availability. On one hand, our project is modest. Our empirical models resemble the corresponding benchmark specifications in these papers using our data sample with year fixed effect and industry fixed effect[2]. This allows an even-handed comparison between our results and those in the original papers and between results based on different firm size measures. On the

[1] For a comprehensive empirical assessment of empirical corporate finance, Coles and Li (2012) provide fruitful results and shed light on our assessment of firm size proxies in different corporate finance research areas. With a different goal, Coles and Li (2012) assess firm, manager, and time fixed effects by identifying the relative importance of manager attributes and firm attributes in 20 prominent areas in empirical corporate finance.

[2] We introduce industry fixed effect because some benchmark papers employ 2-digit SIC controls (e.g. Coles, Daniel, and Naveen (2006)) and others include industrial firms (e.g. DeAngelo, DeAngelo, and Stulz (2006)) or manufacturing firms (e.g. Mehran (1995)). Broadly speaking, the industry fixed effects are widely documented in the empirical corporate finance research.

other hand, our research thrust is ambitious, in data collection and analysis for a large number of regression specifications across a wide spectrum of subfields in corporate finance.

Although all firm size measures are significantly correlated, they are theoretically *and* empirically different.[3] Furthermore, because size is a firm fundamental variable, any small difference may have critical impact on the dependant variable and other independent variables in empirical study.[4] Our results confirm this "measurement effect" in "size effect" in empirical corporate finance. First, when we employ different measures of firm size, we find the coefficients of these measures are usually robust in sign and statistical significance. However, when studying firm performance and capital structure, researchers should pay extra attention because firm size proxies (e.g., market cap) can be mechanically correlated. Second, the coefficients on regressors other than firm size often change sign and significance. We observe sign changes and significance changes in almost all the areas except dividend policy and executive compensation. Unfortunately, this may suggest that some previous studies are not robust to using different firm size proxies. Researchers should either use all the important firm size measures as robustness checks or provide rationale of using any specific measure. Great caution must be exercised when some right-hand-side variables are collinear with the different firm size measures. Third, the goodness of fit measured by R-squared varies with different firm size measures. Some measures appear more relevant than others in different situations. Fourth, the empirical results indicate that different size proxies capture different aspects of "firm size" and thus have different implications. The choice of these firm size measures can be a theoretical and empirical question. The sensitivity of empirical results to different size measures not only

[3] The correlation coefficients range from 0.50 to 0.92 in our sample.

[4] According to our results, the firm size measures are consistently one of the most significant independent variables in all the subfields of corporate finance.

provides guidance for researchers who must use firm size proxies in empirical corporate finance research but also sheds light on future research that might incorporate measurement effect into other research fields such as empirical asset pricing and empirical accounting.

The outline of the article is as follows. Part II is the discussion of research motivation, literature review, and the measures of firm size. In Part III we describe our data and the sample. Part IV provides discussion of empirical results. Part V concludes.

II. Framework for Analysis and Literature Review

Coase (1937) states that firms are formed with boundaries to substitute markets with the driving force of saving transaction costs such as contracting and monitoring fees. For the effects of firm boundaries on firm behavior, Williamson (1975, 1986), Klein, Crawford, and Alchian (1978), and Grossman and Hart (1986) provide theoretical insights, while some recent works such as Holmstrom and Kaplan (2001), Robinson (2008), and Seru (2010) present empirical evidence that links the theory of firm and corporate finance to firm activities such as capital allocation. Specifically, Bolton and Scharfstein (1998) review the relationship between corporate finance and the theory of firm and organizations.

As for the determinants of firm size, Kumar, Rajan, and Zingales (1999) review the literature comprehensively and classify the theories into four categories: technological theories (Lucas (1978), Rosen (1982), Kremer (1993), etc.); organizational theories (Williamson (1975, 1986), Klein, Crawford and Alchian (1978), Grossman and Hart (1986), Rajan and Zingales (1998b, 2001), Holmstrom (1999), Holmstrom and Roberts (1998), etc.); regulatory theories (Ringleb and Wiggins (1990), Hopenhayn (1992), etc.); and financial theories (Rajan and Zingales (1998a), etc.).

It is worth noting that Kumar, Rajan, and Zingales (1999) also provide empirical evidence that the utility sector, R&D intensive industries, capital intensive industries, high wage industries and industries that need little external financing feature large firms.[5]

Several papers also investigate whether the measures of firm size are interchangeable in microeconomics and industrial organization, and these works are more associated with our purpose to evaluate the effects of employing different firm size measures in empirical research. Smyth, Boyes, and Peseau (1975) first demonstrated that measures of firm size are only interchangeable when more rigorous technical conditions than correlation are met. Smyth, Boyes, and Peseau (1975) show empirical results that economies of scale are sensitive to different firm size measures. Jackson and Dunlevy (1982) employ an asymptotically valid procedure to test the null hypothesis of orthogonal least squares suggested by Smyth, Boyes, and Peseau (1975). However, these works play little role in the existing corporate finance literature and financial researchers usually use firm size measures without examining correlations and other interrelationships among different firm size measures. The empirical results in this paper support that the measures of firm size are indeed not interchangeable.

From the review above, we find that the overall assessment of firm size measures in empirical corporate finance has largely been ignored in the existing literature. However, this topic deserves attention. In most prominent areas of empirical corporate finance research, finance scholars employ firm size as an important firm characteristic. And in many situations, finance scholars have observed the "size effect" - firm size matters in determining the dependent variables. For example, it is well recognized that top-management compensation level increases with firm size (Jensen and Murphy (1990), Core, Holthausen, and Larcker (1999), etc.). Baker and Hall (2004) find that CEO marginal products increase substantially with firm size. Gabaix

[5] Such evidence also motivates us to use industry fixed effect in our empirical investigations.

and Landier (2008, 2014) show that small differences in CEO talent can result in substantial differences in CEO pay through the effect of firm size, with the fact that larger firms usually have more skilled managers (Himmelberg and Hubbard (2000)).

Although the majority of the literature takes for granted that the choice of firm size measures is not a vital concern, we doubt the existence of selection bias of empirical results in some papers. Recent works (e.g. Vijh and Yang (2012, Appendix 2)) find that the sign and significance of the coefficients of size proxies in the literature of mergers and acquisitions are sensitive to different firm size measures. While Vijh and Yang (2012) indicate that firm size measures should receive more attention, they are silent on the assessment of firm size measures based on the same regression and the comprehensive assessment in broad corporate finance literature other than targetiveness models. In addition, Vijh and Yang (2012) have little to say on the sensitivity of the coefficients of regressors other than firm size when different firm size measures are employed. These limitations in the existing literature motivate us to investigate the effects of different size measures comprehensively.

For the purpose to conduct a comprehensive empirical assessment of firm size measures in different sub-fields of empirical corporate finance, we follow Coles and Li (2012) for the coverage of 20 prominent research areas in corporate finance: financial policy (book leverage, market leverage, and cash holdings), payout policy (dividend dummy), investment policy (CAPEX, R&D, and firm risk), diversification (Herfindahl index and business segments), firm performance (Tobin's Q and ROA), mergers and acquisitions and corporate control (bidder, target, and poison pills), managerial compensation and incentives (delta, vega, and pay level), and board of directors (board size, board independence, and CEO duality).

We employ three firm size measures: total assets, sales, and market value of equity. These measures are the most popular firm size proxies in empirical corporate finance research according to our survey. In the survey, we investigate 100 empirical papers from top finance, accounting, and economics journals that use firm size measures on the topics of empirical corporate finance. We collect total 100 papers through *Google Scholar* by searching subfield key words and the results are listed by descending number of citations. We only choose the papers that appear in top journals and use firm size measures in empirical studies. The papers are distributed in extensive areas in corporate finance including capital structure, debt policy, payout policy, cash holdings, corporate investment and financial constraints, cross listings, CEO turnover, CEO compensation, board of directors, law and finance, ownership structure, mergers and acquisitions and corporate control (see the Appendix for the detailed information of the sources for these papers.). We find that these three firm size proxies are used in 85 papers out of the 87 papers that use single measures, and the remaining 13 papers use multiple measures for robustness checks. Among these 87 papers, 49 papers use total assets, 20 papers use market capitalization, 16 papers use sales, and 2 papers use number of employees. We are aware that other measures, such as number of employees and net assets, also appear, though infrequently, in empirical finance works, but for conciseness we only use these three measures.

It is interesting that *Forbes Global 2000* uses four measures (assets, sales, profits, market cap) to rank all the large companies in the world, and *Fortune 500* uses two measures (sales and profits). Both of them employ sales and profits, but profits seldom appear as a proxy for firm size in academic research.

Every firm size measure exhibits advantages and disadvantages, and no measure can capture all characteristics of firm size. Generally speaking, total assets measure total firm

resources; market capitalization involves firm growth opportunities and equity market condition; total sales measure product market competition and is not forward looking. In addition, researchers can use the number of employees, total profits, and net assets when the main measures are not available or irrelevant (e.g., market cap for private firms and total sales for start-up firms). Moreover, Hart and Oulton (1996) argue that net assets can be negative but sales positive. They also point out that the number of employees does not include the number of part-time workers, but these days part-time workers play an important role. Because every measure has pros and cons, Hart and Oulton (1996) suggest in practice which measure to use depends on data availability. In addition, we think the choice of firm size measures also depends on the purpose of the specific study. For example, Prowse (1992) applies different firm size measures as the research purpose changes from the ownership of equity to the ownership of asset.

In sum, we find that the existing literature has little to say about the rationale of using a certain measure of firm size for specific corporate finance research, and no paper provides a comprehensive assessment of the sensitivity of empirical results in corporate finance to different measures of firm size. This hole in the literature motivates us to find evidence for "measurement effect" in "size effect", and provide a general guideline to researchers who must use firm size, whether as key variable or control variable, in their empirical corporate finance studies.

III. The Data

We extract the data from multiple sources. Corporate governance data are from RiskMetrics Governance, director data are from RiskMetrics Directors, stock daily returns and prices are from CRSP, company diversification data are from Compustat Segment, corporate bond data are from Compustat Ratings, institutional holdings data are from Thomson Reuters,

Executive data, up to five top executives per firm, are from ExecuComp, M&A deals and corporate control data are from SDC, and all other financial items are from Compustat Fundamentals. We restrict the observations to only those which match North American data from CRSP and Compustat for firms with fiscal years 1993-2006. In line with conventional tradition, we exclude data from the financial and utility sectors. See Table 1 for summary statistics for all the variables featured in our representative specifications from corresponding benchmark papers.

Specifically, we report data properties and bivariate scattergrams of the alternative firm size measures in logarithm numbers for the regressions of firm performance (Tobin's Q and ROA) as an example. Table 2 Panel A reports summary statistics of firm size measures for both raw numbers and logarithm numbers. Panel B presents the Pearson correlation coefficients of firm size measures across raw numbers and logarithm numbers. Figure 1 shows bivariate scattergrams of alternative firm sizes measured in logarithm numbers that we employ in the regressions. We find that the correlation coefficients among log (assets), log (sales), and log (equity value of markets) are between 0.77 and 0.92, and those among raw numbers are between 0.64 and 0.81. The highest correlation coefficient is between log (assets) and log (sales) (0.92), and the lowest correlation coefficient is between sales and log (equity value of markets) (0.50). These correlations indicate that although all the size measures are significantly correlated, they are different and some are more correlated than others.

IV. Methodology and Empirical Results

We adopt the empirical methodologies in the benchmark papers by employing conventional short-panel techniques for basic empirical analysis. For each specification, we apply both basic OLS regressions and industry fixed effect regressions. Time fixed effects are

included in every regression. We use industry fixed effect because some benchmark papers employ 2-digit SIC controls (e.g. Coles, Daniel, and Naveen (2006)), and others only include industrial firms (e.g. DeAngelo, DeAngelo, and Stulz (2006)) or manufacturing firms (e.g. Mehran (1995)). The industry fixed effects and time fixed effects are widely used in the empirical corporate finance research.

We report our results in Table 3 through Table 22 for 20 separate fields and summarize the results in Table 23 and Figure 2. We discuss the results in each field as follows.

1. Firm Performance

We use Tobin's Q and ROA (return on assets) as measures of firm performance. For Tobin's Q, the representative specification is based on Mehran (1995, Table 4, Panel A, Column 4), which applies the log of total assets as the measure of firm size. Table 3 reports the results when we use Tobin's Q as the dependent variable. Industry fixed effect models are employed to be consistent with Mehran (1995) whose sample includes only manufacturing firms. When we use the log of market value of equity, we observe higher R^2 because market capitalization is in the nominator of Tobin's Q; thus, these results suffer from mechanical correlation. Total assets and sales have the same R^2: 0.22 for OLS and 0.28 for industry fixed effect respectively. The coefficients of all size measures are positive and significant at 1% level, while the coefficient of firm size in Mehran (1995) is negative. This is not surprising. Although the negative relation reflects that small firms have high growth opportunities, this only happens beyond some point as the true relation between firm size and performance can be curvilinear, which suggests quadratic functional form. Neither too small nor too big is optimal, and this is one of the reasons why we observe firm growth and firm divesture in the real world. Another reason might stem from the

time trends of Tobin's Q and ROA in our data sample (1993-2006), while the benchmark paper uses cross-sectional data (the averages of 1979-1980). We also find that for Tobin's Q, the sign of business risk (measured by standard deviation of percentage change in operating income) is sensitive to different firm size measures. In addition, the coefficient of the percentage of managers' equity compensation turns insignificant when we use the log of market value of equity.

For ROA as the dependent variable, the representative specification refers to Mehran (1995, Table 4, Panel B, Column 4), which also applies the log of total assets as the measure of firm size. In Table 3, we find that when market value of equity is used as firm size matter, R^2 increases sharply for both OLS and industry fixed effect regressions, while the R^2s are similar if we use total assets or sales. We further find that the size proxy log of assets is not significant in the industry fixed effect regression. In addition, unlike the results for Tobin's Q, the sign and significance of the coefficients of business risk are robust. However, the sign of the percentage of managers' equity compensation and managers' delta both change to negative when firm size is market value of equity, which suggests scholars should be especially careful about the firm size measured by market value of equity for studies of firm performance.

2. Board Structure

Board structure has received much attention as an important topic in corporate governance; the existing literature covers three prominent board characteristics: independence, i.e. the proportion of outside directors (Weisbach (1988), Byrd and Hickman (1992), Brickley, Coles and Terry (1994), etc.); size (Jensen (1993), Yermack (1996), Coles, Daniel, and Naveen (2008), etc.); and leadership, i.e. separation of CEO and Chairman of the Board (COB) (Baliga, Moyer, and Rao (1996) and Brickley, Coles, and Jarrel (1997), etc.).

We use Linck, Netter, and Yang (2008) for the examination of board structure, more specifically, board independence as in Linck, Netter, and Yang (2008, Table 4, Column 2). This benchmark paper uses the market value of equity as the firm size measure. We denote the proportion of non-executive board members as the dependent variable and report the results in Table 6. The positive sign of firm size indicates that big firms tend to have more outside directors. The sign and significance of coefficients of firm size are robust for both OLS and industry fixed effect models to different firm size measures. While the R^2s are similar, we observe that the sign and significance are sensitive for debt (total long term debt divided by total assets) and R&D (R&D expenditures divided by total assets) when we employ different firm size proxies. Fama and Jensen (1983) suggest that outside directors who bring valuable expertise and connections are beneficial to firms with complex operating or financial structures, thereby leading to larger and more independent boards, and the pros of effective monitoring should dominate the monitoring costs that go hand in hand with firm complexity. Thus, Linck, Netter, and Yang (2008) predict that, as a proxy for growth opportunities, R&D expenditures, which increase monitoring and advising costs, are negatively related to board size and independence. However, debt proportion should be positively related to board size and independence since debt proportion is a proxy for firm complexity and advising benefits. In our results, the coefficient of debt is positive as predicted but only significant when log of market value of equity is used. The coefficient for R&D is positive for OLS regression but negative for industry fixed effect regression, suggesting the results of industry fixed effect regressions are consistent with the prediction. However, the significance is sensitive when we apply different firm size measures in the industry fixed regressions.

The representative specification of board size refers to Linck, Netter, and Yang (2008, Table 4, Column 1), and we report the results in Table 5. The dependent variable is the number of directors on the board. The positive sign of firm size is also consistent with Linck, Netter, and Yang (2008), indicating that board size increases with firm size. The sign and significance of coefficients of firm size are robust to different size measures in both OLS and industry fixed effect regressions. The R^2s are quite similar. Once again, the abnormal results reside in debt and R&D with sensitivity of sign and significance of their coefficients if different firm size measures are used.

We refer to Linck, Netter, and Yang (2008, Table 4, Column 3) for the study of board leadership (CEO duality). The dependent variable is the logit-transformed dummy variable that equals 1 if the CEO and COB positions are combined and 0 otherwise. The regressions are based on logistic models with and without industry fixed effect. Table 7 shows that the R^2s are quite similar. The positive sign of firm size suggests CEO duality increases with firm size. Different firm size measures do not change the sign and significance of firm size coefficients. The sensitivity of R&D still exists in our results of board leadership, suggesting scholars should pay special attention to this issue in the extensive study of board governance. Standard deviation of stock returns, which is a proxy for information asymmetry that increases monitoring and advising costs, also has sensitive significance for different firm size measures.

3. Dividend Policy

We choose DeAngelo, DeAngelo, and Stulz（2006, Table 3, Column 1） as the benchmark paper for our analysis of payout policy. DeAngelo, DeAngelo, and Stulz（2006） apply the market value of equity as the size proxy. The dependent variable is a dummy variable

that equals 1 if the firm pays out dividends and 0 otherwise. The regressions are based on logistic models with and without industry fixed effect. We report the results in Table 8. All results are robust.

4. Financial Policy

We examine capital structure (book leverage and market leverage) and cash holdings in this section. We investigate both book leverage and market leverage because Frank and Goyal (2009) find firm size have different effects on book leverage and market leverage. The benchmark paper we select for capital structure is Lemmon, Roberts, and Zender (2008), which uses the log of sales as the measure of firm size. The benchmark specification for book leverage refers to Lemmon, Roberts, and Zender (2008, Table II, Panel A, Column3). We report the results for book leverage in Table 9. All firm size measures are significant, and the sign is positive when we use total assets and sales, but the sign turns out to be negative when we use market value of equity. This change might be due to mechanical correlation as leverage is one minus equity ratio. The other obvious change is that the sign and significance of the cash flow volatilities is sensitive if we apply different firm size measures. The R^2 is lower for the log of sales in the industry fixed effect regressions.

We refer to Lemmon, Roberts, and Zender (2008, Table II, Panel A, Column 6) for the study of market leverage. Results are in Table 10. Similar with the results of book leverage, the sign of the coefficient of firm size is positive when we use total assets and sales, but the sign turns negative when we use market value of equity. In addition, the sign and significance of the cash flow volatilities is also sensitive to different size measures. The goodness of fit is lower with a difference of about 0.03-0.04 for the log of sales in the industry fixed effect regressions.

The coefficient of dividend payer is not significant if we use the log of total assets in the pooled OLS regression.

The analysis for cash holdings is based on Harford, Mansi, and Maxwell (2008, Table 3, Column 1), which applies the natural log of total assets as firm size measure and the natural log of cash/sales ratio as the dependent variable. We report the results in Table 11. In pooled OLS regressions, only the coefficient of firm size measured by the log of sales is significant, while all of the firm size coefficients are significant in the industry fixed effect model. The sign of firm size is negative if the log of sales is used, consistent with the conventional wisdom that small firms have financial constraints and limited access to external financing and higher marginal probability of bankruptcy. But when we use the log of assets and the log of market value of equity, the signs are positive in the industry fixed effect regressions. The significance of inside ownership, pay sensitivity, and institutional ownership is sensitive, especially in the industry fixed effect model. In addition, both the sign and the significance of cash flow are sensitive to different size measures. We do not observe obvious differences of goodness of fit across the regressions.

5. Compensation Policy

We build on Coles, Daniel, and Naveen (2006) for vega (the sensitivity of managerial wealth to stock volatility) and delta (the sensitivity of managerial wealth to stock price, i.e. the pay-performance sensitivity). For vega, we use the same independent variables as in Coles, Daniel, and Naveen (2006, Table 3, Panel A, Column 2), who apply the log of sales as firm size. We consider industry fixed effect because Coles, Daniel, and Naveen (2006) employ 2-digit SIC control. The empirical results are reported in Table 12. The sign is positive for different firm size

proxies, consistent with Coles, Daniel, and Naveen (2006). The sign and sensitivity are not robust for the coefficients of market-to-book ratio and book leverage level. The R-squared does not change.

We refer to Coles, Daniel, and Naveen (2006, Table 3, Panel A, Column 2) for delta and report the results in Table 13. The sign of firm size is positive when we apply different measures of firm size, indicating larger firms have larger pay-performance sensitivity. The results for other regressors are robust except for the firm risk. We find that the coefficient of firm risk is significant in the OLS regressions, but when we add industry fixed effect, it is no longer significant, though the sign remains positive. The goodness of fit remains the same across different regressions.

For executive pay level (i.e. total compensation), we refer to Graham, Li, and Qiu (2012, Table 4, Panel A, Column 1). Graham, Li, and Qiu (2012) use the log of assets as firm size proxy. We report the results in Table 14. The sign is positive for different firm size measures, consistent with the fact that larger firms lead to higher top-management pay levels. The results are robust for the coefficient of stock return but not for the lagged stock return. In addition, the results on lagged ROA are robust but not for ROA. Thus, we should pay special attention to whether lagged terms or current terms should be used as asset performance in determining executive pay level. We also find the significance for coefficients of stock return volatility and gender changes slightly across different regressions. We do not observe obvious differences in goodness of fit.

6. Investment Policy

We refer to Coles, Daniel, and Naveen (2006) for the studies of investment policy (CAPEX, R&D and firm risk). As for firm size measures, Coles, Daniel, and Naveen (2006) use

the log of sales. In Table 15, we use the R&D (the research and development expenditures scaled by assets) as the dependent variable, and independent variables are based on Coles, Daniel and Naveen (2006, Table 3, Panel A, Column 1). The coefficients of different firm size measures are all significantly negative, which means small firms tend to invest in riskier projects, but large, mature firms are less involved in risky investments. The results for several regressors are not robust, especially for cash compensation and stock return. Another obvious change lies in R-squared, which is sharply lower if we use the log of sales.

For the examination of CAPEX (net capital expenditures scaled by assets), we refer to Coles, Daniel, and Naveen (2006, Table 3, Panel B, Column 1). We report the results in Table 16. Theoretically, CAPEX corresponds to safer investment policy compared with R&D and leverage, but we still have significantly negative coefficients for firm size except for that the coefficient is not significant when we use the log of market value of equity as the firm size measure in the pooled OLS regressions. Also, the coefficient of vega is significant only in this regression. Another change is that when we employ the log of sales as firm size proxy, the coefficient of stock return becomes insignificant, and the R-squared is higher.

In Table 17 we report the results for firm risk (stock return volatility). We use the independent variables in Coles, Daniel, and Naveen (2006, Table 9 Column 1). The coefficients of different firm size measures are all significantly negative, indicating small firms have high stock return variances. We find that the coefficients are not robust for vega, cash compensation, market to book ratio, book leverage, and tenure. These results indicate that the choice of firm size is vital in determining firm risk measured by stock return volatility.

7. Diversification

We focus on the Herfindahl index and business segments for the studies of diversification. We refer to Coles, Daniel, and Naveen (2006) as the benchmark paper. The Herfindahl index is defined as the sum of the square of segment sales divided by the square of firm sales. Our choices of explanatory variables resemble those in Coles, Daniel, and Naveen (2006, Table 4, Panel A, Column 1). Table 18 reports the results. The sign of firm size is significantly negative, implying large firms have high levels of diversification, consistent with the fact that large firms have better capability to diversify revenue concentration across different business segments. The models with industry fixed effect produce robust results, with the exception that the coefficient of lagged delta turns insignificant when we use the log of sales. But when it comes to the results of OLS regressions without industry fixed effect, more regressors, such as lagged vega, lagged delta, cash compensation, and stock return, have changes in the sign and/or significance of their coefficients.

In addition, we examine the number of operating business segments that also capture the diversification. We use the same explanatory variables as in Coles, Daniel, and Naveen (2006, Table 4, Panel A, Column 1). The dependent variable is the logarithm of the number of business segments. We report the results in Table 19. As expected, our results show that firm size has a positive effect on the number of business segments. When we use different size measures for the regressions without industry fixed effect, the coefficients of lagged vega, ROA, and stock return are not robust.

8. Corporate Control

We use Probit specifications to study the mergers and acquisitions and corporate control. We cover three topics in this session: propensity to bid, propensity to be a target, and poison pill

adoption as an antitakeover device. For the propensity to bid, we use the bidder dummy as the dependent variable, which is 1 if a firm announces a bid in a specific year and 0 otherwise. The explanatory variables resemble those in Harford (1999, Table III, Column 1). Harford (1999) uses the log of total assets as the measure of firm size. As shown in Table 20, the coefficient is significantly positive for each firm size measure, consistent with the results in Harford (1999). The positive sign of firm size implies large firms tend to announce bids as these firms have higher absolute levels of cash holdings or market capitalization to participate in mergers and acquisitions activities. However, we find that the results for other regressors are not robust whether industry fixed effects are employed or not: the significance and/or sign changes for abnormal returns, noncash working capital, market-to-book ratio, and price-to-earnings ratio. The main changes reside in the usage of market value of equity. Also the R-squared is higher when we employ the market value of equity for the industry fixed effect regressions.

For the examination of the propensity to be a target, we use the independent variables in Comment and Schwert (1995, Table 3, Column 1). The dependent variable is a target dummy, which is 1 if a company is announced to be a target of a successful M&A deal in a specific year and 0 otherwise. Comment and Schwert (1995) use the log of total assets as the measure of firm size. In contrast to Comment and Schwert (1995), in our results (Table 21), the coefficient is significantly positive for each firm size measure across different regressions, suggesting that larger firms are more likely to be targeted in M&A. The sign and/or significance change for sales growth and leverage when we use the log of sales no matter whether the industry fixed effect is used. In addition, the R-squared is smaller when we use the log of sales. Furthermore, the market-to-book ratio becomes insignificant when we use the log of assets.

We also use Comment and Schwert (1995) as the benchmark paper to study poison pill adoption as an antitakeover device. The dependent variable is equal to 1 if a firm has the poison pill in place in a specific year and 0 otherwise. The independent variables resemble those in Comment and Schwert (1995, Table 3, Column 4). In contrast to Comment and Schwert (1995), in our results in Table 22 the coefficient of each firm size measure is significantly negative, suggesting larger firms are less likely to adopt poison pill. When the log of sales is used, the sign of the coefficient of share law changes from negative to positive. The coefficient of leverage level is only significant in the regressions without industry fixed effect when we use the log of assets, and it is also significant in the regressions with industry fixed effect when we use the log of sales. The usage of log of market value of equity leads to insignificant coefficient of leverage. The goodness of fit is lower when we use the log of sales in the industry fixed effect regressions.

V. Summary, Guidelines, and Limitations

We summarize our results in Table 23, and hereby provide a general guideline to researchers who may use firm size, whether as key variable or control variable, in their empirical corporate finance studies.

First, in most areas of corporate finance, the coefficients of firm size measures are robust in sign and statistical significance. However, when studying firm performance and capital structure, researchers should pay extra attention because market capitalization, as a size proxy, can be mechanically correlated.

Second, the coefficients on regressors other than firm size often change sign and significance. We observe sign changes and significance changes (change from significant to insignificant) in almost all the areas except dividend policy and delta (Table 23 Panel C).

Unfortunately, this may suggest that some previous studies are not robust to using different firm size proxies. Researchers should either use all the important firm size measures as robustness checks or provide a rationale of using any specific measure. Great caution must be exercised when some right-hand-side variables are collinear with the different firm size measures.

Third, the goodness of fit measured by R-squared also varies when we use different firm size measures (Fugure2). For example, the changes in R-squared for the regressions on corporate control variables can be up to 40% if different firm size measures are employed.

Fourth, different size proxies capture different aspects of "firm size", and thus have different implications in corporate finance. For example, market cap is more market oriented and forward looking, and reflects the ownership of equity only, while total assets measures the firm's total resources. Total sales are more related to product market and are not forward looking. The choice of these firm size measures can be a theoretical and empirical question.

Our research has limitations in four dimensions. First, we do not employ all possible measures of firm size; we use the three measures we think of as the most popular ones. There exist some alternative size measures such as the number of employees, total profits, and net assets when the main measures are not available or irrelevant (e.g., market cap for private firms and total sales for start-up firms). Second, we might omit some important representative papers in specific sub-fields due to data and time constraints. Third, some linear models will lose power if the true relation between firm size and the dependent variable is non-linear (such as quadratic form). Fourth, most of our empirical results are based on year fixed effects and industry fixed effects, while introducing other considerations, such as firm fixed effects or manager fixed effects, might change our results and result in different implications.

Appendix: A survey of 100 empirical corporate finance papers that use firm size measures

Paper Sources by journal:

Sources	# of Articles
Journal of Finance	34
Journal of Financial Economics	50
Review of Financial Studies	8
Journal of Political Economy	1
Quarterly Journal of Economics	1
Journal of Accounting and Economics	4
Journal of Accounting Research	1
The Accounting Review	1

By field:

Sources	# of Articles
Capital Structure	9
Debt Policy	5
Dividend Policy	6
Cash Holdings	12
Corporate Investment	6
Cross Listings	5
CEO Turnover	6
Executive Compensation	12
Board of Directors	8
Law and Finance	7
Ownership Structure	11
Mergers and Acquisitions	13

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Table 1: Summary Statistics

Table 1 presents summary statistics for the samples of the panel data from 1993 to 2006. Please refer to the corresponding benchmark papers for the variable definitions. All dollar values are stated in 2006 dollars.

	Mean	Median	Stdev
Linck, Netter, and Yang (2008) : Board of Directors			
LogAssets	7.86	7.69	1.48
LogSales	7.86	7.70	1.50
LogMVE	7.99	7.85	1.65
Board size	9.52	9.00	2.57
Board independence	0.68	0.71	0.17
Board leadership	0.80	1.00	0.40
Debt	0.19	0.18	0.15
LogSegments	0.82	1.10	0.69
FirmAge	23.62	25.67	11.33
MTB	2.15	1.67	1.44
R&D	0.04	0.01	0.06
RETSTD	0.43	0.37	0.21
CEO_Own	0.005	0.00	0.03
Director_Own	0.04	0.01	0.08
FCF	0.08	0.06	0.10
Performance	0.04	0.003	0.18
Lag(CEO_Chair)	0.80	1.00	0.40
Lemmon, Roberts, and Zender (2008) : Leverage			
LogAssets	7.86	7.68	1.48
LogSales	7.40	7.36	1.65
LogMVE	7.98	7.85	1.65
Book Leverage	0.23	0.22	0.19
Initial book leverage	0.21	0.19	0.19
Market Leverage	0.21	0.16	0.21
Initial market leverage	0.20	0.15	0.20
Profitability	0.14	0.14	0.12
Cash Flow Volatility	0.05	0.03	0.06
Tangibility	0.3	0.25	0.21
Dividend Payer	0.56	1.00	0.50
Harford, Mansi, and Maxwell (2008) : Cash Holdings			
LogAssets	7.86	7.68	1.48
LogSales	7.49	7.43	1.64
LogMVE	7.98	7.85	1.65
Cash Holdings	-2.83	-2.80	1.70
Gindex	7.32	8.00	4.61
Inside Ownership	0.002	0.001	0.004

Delta	0.22	0.04	0.59
Institutional ownership	10.62	0.00	25.00
Leverage	0.21	0.16	0.20
Cash flow	0.07	0.04	0.11
Working capital	0.07	0.06	0.15
CF Volatility	0.40	0.04	1.62
R&D	0.04	0.01	0.07
CapEx	0.04	0.03	0.05
Acquisition	0.03	0.00	0.06
Dividend indicator	0.57	1.00	0.49
Bond indicator	0.58	1.00	0.49
DeAngelo, DeAngelo, and Stultz (2006) : Payout policy			
LogAssets	7.84	7.65	1.47
LogSales	7.84	7.67	1.50
LogMVE	7.96	7.84	1.65
Dividend payout	0.60	1.00	0.49
RE/TE	0.04	0.00	0.20
TE/TA	0.06	0.04	0.06
Sales growth	0.07	0.07	0.22
Mehran (1995) : Firm Performance			
LogAssets	7.84	7.65	1.47
LogSales	7.84	7.67	1.50
LogMVE	7.96	7.84	1.65
Tobin's Q	2.15	1.68	1.43
ROA	14.48	14.09	9.44
% of managers' equity compensation	0.58	0.61	0.23
% of shares held by all outside blockholders	0.18	0.00	0.31
% of outside directors	0.68	0.70	0.17
Std of % change in operating income	0.44	0.34	0.36
Graham, Li, and Qiu (2012) : Executive Pay Level			
LogAssets	7.84	7.65	1.47
LogSales	7.83	7.67	1.50
LogMVE	7.96	7.84	1.65
Tobin's Q	2.16	1.66	1.52
Stock Return	0.16	0.09	0.56
ROA	0.14	0.14	0.13
Stock Volatility	4.42	3.42	3.56
Director	0.33	0.00	0.47
Tenure	3.40	0.00	7.83
CEO	0.18	0.00	0.38
Female	0.05	0.00	0.21

Coles, Daniel, and Naveen (2006): Delta and Vega			
LogAssets	7.84	7.65	1.47
LogSales	7.83	7.67	1.50
LogMVE	7.96	7.84	1.65
Vega	0.05	0.01	0.11
Delta	0.22	0.04	0.59
Tobin's Q	2.16	1.66	1.52
Book Leverage	0.23	0.22	0.19
R & D	0.04	0.01	0.08
CAPEX	0.04	0.03	0.05
Firm Risk	0.35	0.32	0.17
Cash Compensation	0.85	0.60	0.90
Tenure	3.40	0.00	7.83
Surplus Cash	0.06	0.04	0.11
Coles, Daniel, and Naveen (2006): Investment Policy			
LogAssets	7.84	7.65	1.47
LogSales	7.40	7.36	1.65
LogMVE	7.96	7.68	1.65
R & D	0.04	0.01	0.07
Delta	0.41E-3	0.03E-3	1.00E-3
Vega	0.18E-2	0.02E-2	0.55E-2
Cash Compensation	0.07E-2	0.05E-2	0.11E-2
Tobin's Q	2.17	1.67	1.52
Surplus Cash	0.07	0.04	0.11
Sales Growth	0.10	0.08	0.28
Stock Returns	0.01	0.00	0.58
Book Leverage	0.23	0.22	0.18
Tenure	0.34	0.00	0.79
Firm Risk	2.74	2.67	0.93
CAPEX	0.05	0.03	0.05
Coles, Daniel, and Naveen (2006): Diversification			
LogAssets	7.84	7.65	1.47
LogSales	7.39	7.35	1.65
LogMVE	7.96	7.84	1.65
Herfindahl Index	0.75	0.92	0.28
Vega	0.41E-3	0.03E-3	1.00E-3
Delta	0.18E-2	0.02E-2	0.55E-2
Cash Compensation	0.05	0.05E-2	0.32
Tobin's Q	2.17	1.67	1.53
ROA	0.84	0.14	3.61
Stock Return	0.01	0.09E-2	0.59
Sales Growth	0.10	0.08	0.28
Dividend Cut	0.27	0.00	0.44

CEO Turnover	0.16	0.00	0.37
Book Leverage	0.23	0.22	0.18
Tenure	0.34	0.00	0.79
Harford (1999) : Bidder			
LogAssets	7.42	7.35	1.60
LogSales	7.40	7.36	1.66
LogMVE	8.00	7.87	1.66
Bidder Dummy	0.12	0.00	0.33
Abnormal Return	1.08	0.09	55.38
Sales Growth	0.11	0.08	0.30
Liquidity	0.07	0.07	0.15
Leverage	0.23	0.22	0.18
Tobin's Q	2.21	1.69	1.57
Price-to-Earnings	-2.84	0.00	15.12
Comment and Schwert (1995): Target and Poison Pill			
Target Dummy	0.02	0.00	0.15
LogAssets	7.84	7.65	1.48
LogSales	7.40	7.35	1.65
LogMVE	7.96	7.84	1.65
Poison Pill	0.62	1.00	0.49
Control Share Law	0.17	0.00	0.38
Business Combination Law	0.69	1.00	0.46
Abnormal Return	1.09	0.08	56.15
Sales growth	0.10	0.08	0.28
Liquidity	0.07	0.07	0.15
Leverage	0.23	0.22	0.18
Tobin's Q	2.17	1.67	1.52
Price-to-earnings	-2.80	0.00	15.19

Table 2: Firm Size Measures for Firm Performance Regression

Panel A: Summary Statistics

This table presents summary statistics of firm size measures that we use for the regressions of Tobin's Q and ROA. "Assets", "sales" and "mve" denote total assets, total sales and market value of equity respectively.

Variable	N	Mean	Std Dev	Minimum	Maximum
assets	24654	8770	23551	31.84900	304594
sales	24573	8454	21804	1.85700	345977
mve	24654	12101	32051	4.47700	460768
logassets	24654	7.84046	1.47500	3.46101	12.62674
logsales	24651	7.83529	1.50195	0.61896	12.75413
logmve	24654	7.96366	1.64680	1.49895	13.04065

Panel B: Correlation

For any two measures of firms size, the first line reports the Pearson correlation coefficient, the second line denotes the Probability > |r| under H0: Rho=0. The third line refers to the number of observations.

	assets	sales	mve	logassets	logsales	logmve
assets	1.00000	0.81404	0.63721	0.63003	0.56457	0.51323
		<.0001	<.0001	<.0001	<.0001	<.0001
	24654	24573	24654	24654	24651	24654
sales	0.81404	1.00000	0.68019	0.58832	0.61690	0.50236
	<.0001		<.0001	<.0001	<.0001	<.0001
	24573	24573	24573	24573	24573	24573
mve	0.63721	0.68019	1.00000	0.56215	0.51807	0.63654
	<.0001	<.0001		<.0001	<.0001	<.0001
	24654	24573	24654	24654	24651	24654
logassets	0.63003	0.58832	0.56215	1.00000	0.92067	0.85239
	<.0001	<.0001	<.0001		<.0001	<.0001
	24654	24573	24654	24654	24651	24654
logsales	0.56457	0.61690	0.51807	0.92067	1.00000	0.77113
	<.0001	<.0001	<.0001	<.0001		<.0001
	24651	24573	24651	24651	24651	24651
logmve	0.51323	0.50236	0.63654	0.85239	0.77113	1.00000
	<.0001	<.0001	<.0001	<.0001	<.0001	
	24654	24573	24654	24654	24651	24654

Table 3: Firm Performance-Tobin's Q

The explanatory variables in this table resemble those in Table 4, Panel A, Column 4 in Mehran (1995). The dependent variable is Tobin's Q. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
% of managers' equity compensation	0.793*** 20.89	0.793*** 21.19	0.017 0.48	0.696*** 18.75	0.663*** 18.01	0.019 0.57
Managers' delta	0.317*** 23.05	0.315*** 23.02	0.082*** 6.46	0.281*** 21.02	0.269*** 20.19	0.075*** 6.15
% of shares held by all outside blockholders	0.283*** 5.49	0.288*** 5.58	0.203*** 4.34	0.345*** 6.92	0.354*** 7.11	0.215*** 4.76
% of outside directors	-0.388*** -7.60	-0.400*** -7.82	-0.595*** -12.89	-0.360*** -6.93	-0.409*** -7.83	-0.518*** -11.04
R&D/sales	5.447*** 33.12	5.544*** 33.44	4.703*** 31.44	4.683*** 26.32	4.784*** 26.87	4.107*** 25.49
(Inventory+PPE)/assets	-0.302*** -6.75	-0.299*** -6.72	-0.599*** -14.82	-0.640*** -9.64	-0.652*** -9.84	-0.414*** -6.88
Long-term debt/assets	-0.198*** -35.08	-0.196*** -34.95	-0.158*** -31.00	-0.210*** -36.24	-0.209*** -36.18	-0.151*** -28.57
Std of % change in operating income	0.052* 1.95	-0.067** 2.46	0.391*** 16.15	-0.092*** 3.37	0.130*** 4.74	0.428*** 17.46
Size-Log of total assets	0.030*** 4.77			0.043*** 6.35		
Size-Log of sales		0.037*** 5.84			0.076*** 11.02	
Size-Log of market value of equity			0.370*** 72.36			0.398*** 73.87
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.22	0.22	0.35	0.28	0.28	0.41
N	24,582	24,579	24,582	24,582	24,579	24,582

Table 4: Firm Performance-ROA (Return on Assets)

The explanatory variables in this table resemble those in Table 4, Panel B, Column 4 in Mehran (1995). The dependent variable is ROA (return on assets). Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
% of managers'	2.091***	1.228***	-1.873***	1.905***	0.876***	-1.411***
equity compensation	8.09	4.82	-7.42	7.65	3.57	-5.86
Managers' delta	0.967***	0.689***	-0.235***	0.851***	0.514***	-0.159*
	10.31	7.39	-2.58	9.48	5.78	-1.84
% of shares held by all	1.732***	1.839***	1.416***	1.844***	1.966***	1.251***
outside blockholders	4.93	5.24	4.18	5.50	5.91	3.90
% of outside directors	2.001***	1.390***	0.789***	1.859***	0.932***	1.018***
	5.75	4.00	2.37	5.32	2.67	3.06
R&D/sales	-21.478***	-20.036***	-24.454***	-24.464***	-22.892***	-26.97***
	-19.17	-17.76	-22.63	-20.47	-19.26	-23.59
(Inventory+PPE)/assets	6.807***	6.304***	5.165***	9.387***	9.347***	10.46***
	22.34	20.83	17.70	21.06	21.13	24.50
Long-term debt/assets	-1.165***	-1.196***	-1.024***	-1.149***	-1.162***	-0.887***
	-30.35	-31.39	-27.74	-29.49	-30.11	-23.60
Std of % change in	-6.094***	-5.430**	-4.280***	-6.546***	-5.671***	-4.863***
operating income	-33.32	-29.37	-24.48	-35.82	-31.04	-27.99
Size-Log of	0.181***			0.049		
total assets	4.21			1.06		
Size-Log of sales		0.379***			0.889***	
		8.91			19.31	
Size-Log of market			1.629***			1.829***
value of equity			44.15			47.81
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.17	0.17	0.23	0.25	0.26	0.32
N	24,582	24,579	24,582	24,582	24,579	24,582

Table 5: Board of Directors-Board Size

The explanatory variables in this table resemble those in Table 4, Column 1 in Linck, Netter, and Young (2008). The dependent variable is board size, defined as the number of directors on the board. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Log(MVE)	0.597***			0.554***		
	52.86			46.01		
Log(Assets)		0.657***			0.624***	
		58.15			50.73	
Log(Sales)			0.635***			0.605***
			57.57			48.15
Debt	1.273***	0.514***	1.011***	0.756***	0.100	0.253**
	12.98	5.27	10.41	7.42	0.99	2.50
Log(Segments)	0.204***	0.149***	0.147***	0.307***	0.246***	0.225***
	9.31	6.83	6.73	13.29	10.68	9.60
FirmAge	-0.079***	-0.062***	-0.049***	-0.050***	-0.040***	-0.025**
	-7.23	-5.75	-4.55	-4.62	-3.76	-2.31
FirmAge^2	0.003***	0.002***	0.002***	0.002***	0.002***	0.002***
	12.06	10.16	8.59	9.36	8.14	6.54
MTB	-0.279***	-0.032***	-0.034***	-0.277***	-0.061***	-0.074***
	-23.54	-3.13	-3.28	-23.57	-5.98	-7.19
R&D	-2.521***	-1.732***	0.054	-0.002	0.577**	1.115***
	-9.66	6.72	0.21	-0.01	2.06	3.95
RETSTD	-1.411***	-1.831***	-1.806***	-1.009***	-1.412***	-1.333***
	-15.65	-20.85	-20.53	-11.02	-15.85	-14.83
CEO_Own	-1.754***	-1.717***	-2.308***	-1.559***	-1.578***	-1.852***
	-2.90	-2.88	-3.86	-2.70	-2.76	-3.22
Director_Own	-3.362***	-3.072***	-3.466***	-3.189***	-2.931***	-3.406***
	-17.30	-16.03	-18.27	-16.90	-15.70	-18.37
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.39	0.40	0.40	0.45	0.46	0.45
N	21,758	22,758	21,255	21,758	21,758	21,755

Table 6: Board of Directors-Board Independence

The explanatory variables in this table resemble those in Table 4, Column 2 in Linck, Netter, and Young (2008). The dependent variable is board independence, defined as the proportion of non-executive board members. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Log(MVE)	0.015***			0.017***		
	17.03			18.00		
Log(Assets)		0.018***			0.020***	
		20.27			20.97	
Log(Sales)			0.019***			0.025***
			21.17			25.91
Debt	0.016**	-0.005	0.008	0.027***	0.006	0.009
	2.17	-0.63	1.06	3.57	0.86	1.18
Log(Segments)	0.024***	0.022***	0.022***	0.017***	0.015***	0.012***
	15.06	13.77	13.61	10.33	8.89	6.85
FirmAge	-0.007***	-0.007***	-0.007***	-0.004***	-0.004***	-0.003***
	-9.28	-8.74	-8.20	-5.57	-5.20	-4.11
FirmAge^2	0.0002***	0.0002***	0.0002***	0.0001***	0.0001***	0.0001***
	12.01	11.29	10.58	7.95	7.39	6.07
MTB	-0.012***	-0.005***	-0.005***	-0.010***	-0.004***	-0.004***
	-12.59	-6.52	-6.13	-11.50	-4.91	-5.22
R&D	0.116***	0.134***	0.202***	-0.054**	-0.037*	0.006
	5.39	6.25	9.27	-2.41	-1.68	0.28
RETSTD	-0.055***	-0.066***	-0.067***	-0.023***	-0.035***	-0.030***
	-8.31	-10.01	-10.03	-3.38	-5.20	-4.58
CEO_Own	-0.302***	-0.293***	-0.311***	-0.211***	-0.206***	-0.199***
	-6.68	-6.52	-6.93	-4.88	-4.78	-4.64
Director_Own	0.647***	0.663***	0.657***	0.644***	0.658***	0.670***
	45.64	46.97	47.20	46.74	47.95	49.71
FCF	0.150***	0.153***	0.133***	0.125***	0.127***	0.098***
	11.05	11.33	9.77	9.34	9.56	7.39
Performance	-581.307***	-702.407***	-647.593***	-617.460***	-706.805**	-786.459***
	-6.65	-8.02	-7.51	-7.28	-8.33	-9.37

Lag(CEO_Chair)	0.054***	0.051***	0.052***	0.050***	0.047***	0.045***
	21.01	19.99	20.12	20.12	19.09	18.20
Age	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	-16.78	-16.70	-16.53	-14.29	-14.25	-14.03
Tenure	0.000	0.000	0.000	0.000	0.000	0.000
	0.70	0.60	0.63	0.35	0.20	-0.16
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.23	0.24	0.24	0.31	0.32	0.32
N	21,708	21,708	21,708	21,708	21,708	21,708

Table 7: Board of Directors-Board Leadership

The explanatory variables in this table resemble those in Table 4, Column 3 in Linck, Netter, and Young (2008). The dependent variable is board leadership, a log-transformed dummy that equals 1 if the CEO and Chairman of the Board are combined and 0 otherwise. Models (1)-(3) are based on logistic regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Logistic	(2) Logistic	(3) Logistic	(4) Logistic Industry FE	(5) Logistic Industry FE	(6) Logistic Industry FE
Log(MVE)	0.324***			0.305***		
	520.326			390.963		
Log(Assets)		0.406***			0.396***	
		785.862			611.320	
Log(Sales)			0.365***			0.415***
			664.551			659.980
MTB	-0.230***	-0.086***	-0.091***	-0.221***	-0.095***	-0.105***
	297.455	52.101	59.008	242.113	56.232	68.293
R&D	0.130	0.822***	1.670***	-0.063	0.456	0.953***
	0.194	7.667	29.891	0.034	1.760	7.667
RETSTD	-0.664***	-0.755***	-0.742***	-0.231**	-0.323***	-0.180
	38.689	53.991	51.959	4.101	7.946	2.292
Performance	-4490.8***	-6921.2***	-5396.9***	-5628.1***	-7561.1***	-7745.6***
	17.200	-41.894	25.010	24.236	43.212	46.183
Age	-0.004***	-0.004***	-0.004***	-0.003***	-0.003***	-0.003***
	34.440	29.469	28.006	21.052	18.749	16.106
Tenure	0.000	0.000	0.000	-0.001	-0.002	-0.002
	0.002	0.002	0.030	0.249	0.481	0.606
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.09	0.11	0.10	0.15	0.16	0.16
N	23,750	23,750	23,750	23,750	23,750	23,750

Table 8: Payout Policy-Dividend Dummy

The explanatory variables in this table resemble those in Table 3, Column 1 in DeAngelo, DeAngelo, and Stulz (2006). The dependent variable equals 1 if the firm pays out dividend and 0 otherwise. Models (1)-(3) are based on logistic regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Logistic	(2) Logistic	(3) Logistic	(4) Logistic Industry FE	(5) Logistic Industry FE	(6) Logistic Industry FE
RE/TE	1.120***	1.229***	1.394***	1.045***	0.985***	1.214***
	73.831	91.419	114.726	56.581	52.267	74.823
TE/TA	-7.040***	-6.819***	-9.217***	-4.946***	-4.721***	-6.940***
	-1109.875	-1011.415	-1913.596	-452.294	-409.500	-874.909
Rrofitability	1.608***	1.168***	0.818***	1.320***	0.785***	0.491***
	211.333	111.596	53.953	117.566	41.197	16.069
Sales growth	-0.801***	-0.744***	-0.850***	-0.687***	-0.641***	-0.758***
	-335.184	-290.140	-375.478	-212.541	-182.770	-258.087
Log(Assets)	0.255***			0.284***		
	1086.849			987.380		
Log(Sales)		0.250***			0.320***	
		1092.687			1232.935	
Log(Market Capitalization)			0.172***			0.201***
			676.817			680.229
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.30	0.30	0.28	0.44	0.45	0.42
N	24,573	24,573	24,573	24,573	24,573	24,573

Table 9: Book Leverage

The explanatory variables in this table resemble those in Table II, Panel A, Column 3 in Lemmon, Roberts, and Zender (2008). The dependent variable is book leverage, defined as the ratio of total debt to book assets. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry Fixed Effect	(5) Industry Fixed Effect	(6) Industry Fixed Effect
Initial book lev.	0.209***	0.264***	0.211***	0.188***	0.235***	0.192***
	36.46	65.78	36.78	32.95	57.40	33.64
Log(Assets)	0.008***			0.009***		
	11.83			12.71		
Log(Sales)		0.002***			0.007***	
		4.61			12.14	
Log(Market Value of Equity)			-0.001**			-0.002***
			-2.02			-3.18
Market-to-book	-0.014***	-0.012***	-0.012***	-0.019***	-0.015***	-0.016***
	-16.92	-20.80	-13.01	-22.99	-25.31	-18.64
Profitability	-0.122***	-0.134***	-0.135***	-0.098***	-0.134***	-0.101***
	-9.78	-18.26	-10.79	-7.86	-18.24	-8.11
Tangibility	0.040***	0.088***	0.048***	0.091***	0.120***	0.085***
	7.53	23.00	8.92	12.10	22.74	11.23
Industry median lev.	0.295***	0.325***	0.309***	0.355***	0.369***	0.342***
	28.31	39.54	29.71	9.35	14.46	8.96
Dividend payer	0.049***	0.019***	0.057***	0.040***	0.013***	0.048***
	23.21	12.32	27.13	18.41	7.97	22.49
Cash flow vol.	0.127***	-0.108***	0.047	0.191***	-0.065***	0.097***
	4.18	-7.24	1.56	6.23	-4.46	3.18
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.24	0.23	0.23	0.32	0.27	0.31
N	25,680	56,590	25,680	25,680	56,590	25,680

Table 10: Market Leverage

The explanatory variables in this table resemble those in Table II, Panel A, Column 6 in Lemmon, Roberts, and Zender (2008). The dependent variable is market leverage, defined as total debt/ (total debt market equity). Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry Fixed Effect	(5) Industry Fixed Effect	(6) Industry Fixed Effect
Initial market lev.	0.211***	0.265***	0.216***	0.204***	0.240***	0.204***
	36.49	67.68	37.83	34.77	59.19	35.05
Log(Assets)	0.007***			0.008***		
	10.49			11.02		
Log(Sales)		0.010***			0.011***	
		19.20			20.86	
Log(Market Value of Equity)			-0.017***			-0.018***
			-24.39			-25.02
Market-to-book	-0.035***	-0.035***	-0.024***	-0.035***	-0.034***	-0.025***
	-41.23	-61.33	-26.27	-41.76	-60.02	-27.94
Profitability	-0.380***	-0.286***	-0.387***	-0.341***	-0.275***	-0.328***
	-29.68	-39.86	-30.65	-26.64	-38.17	-25.85
Tangibility	0.056***	0.058***	0.072***	0.138***	0.106***	0.119***
	10.26	15.39	13.34	17.79	20.53	15.49
Industry median lev.	0.343***	0.393***	0.364***	0.564***	0.540***	0.514***
	32.05	48.27	34.47	14.45	21.51	13.27
Dividend payer	0.030***	-0.001	0.049***	0.023***	-0.003**	0.042***
	14.02	-0.75	23.32	10.55	-2.04	19.41
Cash flow vol.	-0.109***	-0.150***	-0.288***	-0.018	-0.138***	-0.219***
	-3.46	-10.23	-9.29	-0.57	-9.53	-6.99
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.39	0.38	0.40	0.45	0.42	0.46
N	25,680	56,590	25,680	25,680	56,590	25,680

Table 11: Cash holdings

The explanatory variables in this table resemble those in Table 3, Column 1 in Harford, Mansi, and Maxwell (2008). The dependent variable is the natural log of cash/sales ratio. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry Fixed Effect	(5) Industry Fixed Effect	(6) Industry Fixed Effect
Gindex	-0.063***	-0.067***	-0.063***	-0.065***	-0.068***	-0.064***
	-17.10	-18.66	-17.15	-18.97	-19.97	-18.89
Inside Ownership	9.764***	30.057***	10.730***	3.006	18.185***	4.252*
	3.69	11.73	4.07	1.27	7.74	1.79
Pay sensitivity	0.042***	0.085***	0.044***	0.031**	0.058***	0.033**
	2.58	5.31	2.70	2.09	4.02	2.27
Institutional	0.001*	0.001	0.001*	0.001*	0.001	0.001
ownership	1.95	1.34	1.95	1.69	1.14	1.60
Log(Assets)	0.011			0.079***		
	1.20			9.00		
Log(Sales)		-0.231***			-0.129***	
		-28.35			-14.81	
Log(Market Value			-0.000			0.061***
of Equity)			-0.01			7.27
Leverage	-1.446***	-1.514***	-1.446***	-1.195***	-1.269***	-1.042***
	-23.79	-25.38	-22.27	-20.63	-21.97	-16.67
Market-to-book	0.046***	0.043***	0.046***	0.050***	0.051***	0.031***
	5.66	5.32	5.37	6.79	6.95	3.97
Cash flow	0.007	0.362***	0.013	-0.271**	-0.070	-0.279**
	0.06	2.96	0.11	-2.38	-0.61	-2.45
Working capital	-1.042***	-1.390***	-1.068***	-0.981***	-1.333***	-1.027***
	-14.82	-20.86	-15.24	-12.77	-17.67	-13.44
CF volatility	6.588***	5.012***	6.537***	4.192***	3.210***	4.111***
	22.01	16.97	21.87	14.90	11.42	14.62
R&D	9.579***	8.567***	9.566***	6.625***	6.238***	6.637***
	42.84	38.63	42.75	29.68	27.95	29.69
CapEx	-2.286***	-2.632***	-2.303***	-1.907***	-2.225***	-1.959***
	-12.55	-14.76	-12.67	-10.81	-12.69	-11.11
Acquisition	-1.986***	-2.403***	-1.996***	-2.148***	-2.303***	-2.192***
	-14.69	-18.07	-14.79	-17.49	-18.79	-17.85

Dividend indicator	-0.370***	-0.259***	-0.365***	-0.410***	-0.307***	-0.403***
	-17.97	-12.85	-17.73	-20.89	-15.57	-20.50
Bond indicator	-0.199***	0.114***	-0.185***	-0.183***	0.070***	-0.167***
	-8.36	4.94	-7.71	-8.13	3.12	-7.36
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.46	0.48	0.46	0.57	0.58	0.57
N	19,899	19,899	19,899	19,899	19,899	19,899

Table 12: Vega

The explanatory variables in this table resemble those in Table 3, Panel A, Column 2 in Coles, Daniel, and Naveen (2006). The dependent variable is vega, defined as the dollar change in the value of the CEO's stock and option portfolio for a 1% change in standard deviation of returns. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Delta	0.071***	0.073***	0.070***	0.067***	0.067***	0.066***
	64.09	65.19	63.67	60.43	61.23	60.17
Cash Compensation	0.032***	0.035***	0.032***	0.037***	0.038 ***	0.037***
	39.67	42.17	39.71	44.12	45.08	44.44
Log(Assets)	0.021***			0.021***		
	41.00			38.01		
Log(Sales)		0.017***			0.020***	
		32.74			34.16	
Log(MVE)			0.021***			0.021***
			43.40			39.56
Market-to-Book	0.001***	0.002***	-0.008***	0.001**	0.001*	-0.008***
	2.93	3.04	-14.78	2.15	1.74	-13.69
Book Leverage	-0.022***	-0.004	0.003	-0.029***	-0.022***	-0.006
	-5.23	-1.04	0.63	-6.49	-4.88	-1.29
R&D	0.137***	0.181***	0.117***	0.093***	0.116***	0.079***
	11.43	14.69	9.78	6.95	8.59	5.91
CAPEX	-0.041***	-0.055***	-0.059***	-0.040***	-0.061***	-0.057***
	-3.00	-4.05	-4.39	-2.64	-4.06	-3.78
Firm Risk	0.047***	0.041***	0.061***	0.054***	0.057***	0.068***
	8.43	7.27	10.82	8.59	9.04	10.72
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.41	0.40	0.41	0.46	0.45	0.46
N	24,638	24,636	24,638	24,638	24,636	24,638

Table 13: Delta

The explanatory variables in this table resemble those in Table 3, Panel A, Column 3 in Coles, Daniel, and Naveen (2006). The dependent variable is delta, defined as the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Vega	2.141***	2.155***	2.143***	2.136***	2.155***	2.138***
	72.32	74.34	72.09	69.79	71.15	69.73
Tenure	0.015***	0.015***	0.015***	0.015***	0.015 ***	0.015***
	36.40	36.37	36.30	35.80	35.77	35.74
Log(Assets)	0.028***			0.026***		
	10.75			8.62		
Log(Sales)		0.029***			0.023***	
		11.02			7.57	
Log(MVE)			0.027***			0.025***
			10.34			8.39
Market-to-Book	0.078***	0.079***	0.067***	0.078***	0.078***	0.068***
	28.61	28.80	22.55	26.58	26.65	21.37
Surplus Cash	-0.243***	-0.268***	-0.255***	-0.231***	-0.247***	-0.241***
	-5.45	-5.99	-5.70	-4.87	-5.18	-5.08
Book Leverage	-0.198***	-0.181***	-0.165***	-0.144***	-0.136***	-0.116***
	-8.97	-8.29	-7.60	-5.86	-5.54	-4.77
R&D	-0.513***	-0.414***	-0.533***	-0.382***	-0.346***	-0.393***
	-7.21	-5.72	-7.50	-4.87	-4.39	-5.02
CAPEX	0.261***	0.254***	0.233***	0.299***	0.273***	0.275***
	3.66	3.56	3.27	3.66	3.35	3.37
Firm Risk	0.179***	0.186***	0.188***	0.042	0.042	0.053
	5.99	6.21	6.23	1.23	1.21	1.52
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.33	0.33	0.33	0.35	0.35	0.35
N	24,638	24,636	24,638	24,638	24,636	24,638

Table 14: Executive Pay Level

The explanatory variables in this table resemble those in Table 4, Panel A, Column 1 in Graham, Li, and Qiu (2012). The dependent variable is total executive compensation. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Lag(logassets)	1.276*** 79.14			1.289*** 69.37		
Lag(logsales)		1.209*** 72.82			1.260*** 66.15	
Lag(logmve)			1.275*** 78.92			1.239*** 68.56
Lag(Q)	0.632*** 32.17	0.732*** 36.58	0.106*** 5.00	0.613*** 28.84	0.693*** 32.44	0.151*** 6.58
Stock Return	0.592*** 13.51	0.542*** 12.16	0.654*** 14.91	0.576*** 12.29	0.543*** 11.50	0.636*** 13.53
Lag(Stock Return)	0.205*** 4.65	0.133*** 2.96	0.085* 1.93	0.111** 2.40	0.075 1.60	-0.037 -0.80
ROA	-0.477 -1.16	-0.278 -0.66	-1.064*** -2.58	-0.651 -1.53	-0.744* -1.73	-1.134*** -2.66
Lag(ROA)	-1.708*** -3.98	-4.549*** -10.39	-3.119*** -7.26	-1.819*** -4.13	-4.609*** -10.35	-3.323*** 7.52
Stock Return Volatility	0.063*** 8.64	0.080*** 10.60	0.031*** 4.35	0.039*** 4.98	0.035*** 4.37	0.015* 1.87
Lag(Director)	0.911*** 13.26	0.923*** 13.19	0.883*** 12.85	0.844*** 12.44	0.899*** 13.14	0.811*** 11.92
Tenure	0.017*** 5.50	0.019*** 6.04	0.013*** 4.24	0.023*** 7.45	0.023*** 7.51	0.021*** 6.79
CEO	2.958*** 37.78	2.926*** 36.70	3.008*** 638.40	2.978*** 38.80	2.927*** 37.81	3.019*** 39.23
Female	0.190* 1.91	0.067 0.66	0.194* 1.95	0.121 1.22	0.143 1.43	0.119 1.20
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.40	0.38	0.40	0.45	0.44	0.44
N	20,046	20,046	20,046	20,046	20,046	20,046

Table 15: R&D

The explanatory variables in this table resemble those in Table 3, Panel A, Column 1 in Coles, Daniel, and Naveen (2006). The dependent variable is the research and development (R&D) expenditures scaled by assets. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Vega	3.737***	5.964***	3.669***	2.505***	4.176***	2.466***
	11.38	18.54	11.15	8.35	13.80	8.22
Delta	-0.248***	-0.330***	-0.246***	-0.194***	-0.193***	-0.191***
	-3.97	-5.76	-3.92	-3.41	-3.60	-3.35
Cash	-2.172***	1.759***	-2.591***	-0.267	1.772***	-0.502
Compensation	-5.15	6.61	-6.16	-0.68	7.05	-1.28
Log(Assets)	-0.006***			-0.006***		
	-25.04			-23.12		
Log(Sales)		-0.016***			-0.015***	
		-86.31			-74.39	
Log(Mkt.Value			-0.006***			-0.005***
of Equity)			-23.22			-22.23
MKT-To-Book	0.004***	0.007***	0.006***	0.003**	0.006***	0.006***
	14.37	31.74	21.28	13.29	29.07	19.73
Surplus Cash	0.282***	0.187***	0.286***	0.209***	0.126***	0.212***
	74.70	65.85	75.42	57.08	44.61	57.72
Sales Growth	-0.035***	-0.024***	-0.035***	-0.031***	-0.022***	-0.031***
	-23.47	-23.12	-23.47	-22.59	-22.48	-22.51
Stock Return	-0.359***	-0.001	-0.288***	-0.278***	-0.000	-0.205***
	-5.79	-1.31	-4.64	-4.93	-0.18	-3.63
Book Leverage	-0.019***	-0.022***	-0.027***	-0.013***	-0.009***	-0.020***
	-9.29	-13.74	-12.98	-6.39	-5.24	-9.66
Tenure	-0.001***	-0.001**	-0.001***	-0.001***	-0.001**	-0.001**
	-3.54	-2.00	-3.14	-2.65	-2.23	-2.38
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.33	0.27	0.33	0.46	0.37	0.46
N	24,518	52,935	24,518	24,518	52,935	24,518

Table 16: CAPEX

The explanatory variables in this table resemble those in Table 3, Panel B, Column 1 in Coles, Daniel, and Naveen (2006). The dependent variable is CAPEX, defined as net capital expenditure scaled by assets. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Vega	-0.410	-0.322	-0.703**	0.194	0.132	-0.082
	-1.39	-1.19	-2.38	0.71	0.53	-0.30
Delta	0.353***	0.344***	0.344***	0.295***	0.276***	0.286***
	6.19	7.07	6.02	5.64	6.19	5.46
Cash	-0.015***	-0.017***	-0.016***	-0.149***	-0.016***	-0.015***
Compensation	-39.54	-43.28	-40.85		-42.81	-41.24
Log(Assets)	-0.001***			-0.003***		
	-3.51			-11.64		
Log(Sales)		-0.001***			-0.002***	
		-3.77			-11.31	
Log(Market Value			-0.000			-0.002***
of Equity)			-0.63			-7.17
MKT-To-Book	0.002***	0.003***	0.002***	0.001***	0.003***	0.002***
	8.18	13.85	7.47	5.92	15.41	7.90
Surplus Cash	-0.014***	-0.012***	-0.015***	0.024***	0.014***	0.024***
	-4.09	-5.01	-4.23	6.96	5.77	6.91
Sales Growth	0.018***	0.015***	0.018***	0.015***	0.013***	0.015***
	13.61	15.77	13.28	11.84	14.91	11.57
Stock Return	-0.390***	-0.000	-0.388***	-0.371***	0.000	-0.356***
	-6.15	-0.65	-6.12	-6.39	0.24	-6.11
Book Leverage	-0.009***	-0.009***	-0.011***	-0.013***	-0.016***	-0.016***
	-4.85	-6.56	-5.70	-6.71	-11.52	-8.42
Tenure	0.003***	0.002***	0.003***	0.002***	0.001***	0.002***
	8.61	6.45	8.68	6.19	4.86	-6.30
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.11	0.13	0.11	0.26	0.28	0.26
N	24,518	40,712	24,518	24,518	40,712	24,518

Table 17: Firm Risk

The explanatory variables in this table resemble those in Table 9, Column 1 in Coles, Daniel, and Naveen (2006). The dependent variable is firm risk, defined as stock return volatility. Models (1)-(3) are based on pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Lag(Vega)	-14.521***	-31.389***	-5.877	-16.621***	-19.674***	-10.005**
	-3.16	-9.03	-1.31	-4.06	-6.28	-2.51
Lag(Delta)	10.029***	8.551***	10.042***	6.931***	5.312***	6.993***
	11.57	13.61	11.85	8.96	9.42	9.27
Cash Compensation	-34.159***	-2.034	-15.928***	-35.654***	-3.129	-18.416***
	-6.07	-0.73	-2.91	-6.91	-1.23	-3.67
Log(Assets)	-0.136***			-0.136***		
	-40.80			-40.88		
Log(Sales)		-0.199***			-0.197***	
		-95.79			-95.43	
Log(Market Value of Equity)			-0.167***			-0.167***
			-52.93			-53.89
MKT-To-Book	-0.039***	-0.018***	0.037***	-0.018***	-0.010***	0.053***
	-12.13	-8.22	10.45	-5.96	-5.15	16.42
R&D	4.009***	2.563***	4.003***	3.528***	2.452***	3.475***
	52.49	56.75	53.80	45.48	55.13	45.97
CAPEX	0.551***	0.683***	0.618***	-0.146	0.172***	-0.105
	6.04	11.91	6.94	-1.64	3.13	-1.22
Book Leverage	-0.016	-0.066***	-0.169***	0.304***	0.211***	0.133***
	-0.59	-3.71	-6.30	11.27	12.22	5.07
Tenure	0.018***	-0.022***	-0.016***	-0.008	-0.009**	-0.006
	-3.26	-5.92	-2.94	-1.49	-2.49	-1.30
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.48	0.50	0.50	0.59	0.60	0.61
N	22,733	51,335	22,733	22,733	51,335	22,733

Table 18: Herfindahl Index

The explanatory variables in this table resemble those in Table 4, Panel A, Column 1 in Coles, Daniel, and Naveen (2006). The dependent variable is Herfindahl index, the sum of the square of segment sales divided by the square of firm sales. Models (1)-(3) are pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. All models use year fixed effects. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Lag(Vega)	-2.622	-7.378***	-3.472*	2.779	0.790	0.984
	-1.31	-4.97	-1.73	1.54	0.58	0.54
Lag(Delta)	0.546	0.903***	0.509	-0.857**	-0.238	-0.927***
	1.47	3.41	1.36	-2.55	-0.98	-2.74
Cash	0.038**	0.011	0.033*	-0.000	-0.023	-0.008
Compensation	2.02	0.62	1.76	-0.01	-1.40	-0.45
Log(Assets)	-0.043***			-0.057***		
	-30.77			-41.46		
Log(Sales)		-0.039***			-0.053***	
		-48.34			-64.93	
Log(Market Value			-0.039***			-0.049***
of Equity)			-29.03			-37.45
MKT-To-Book	0.029***	0.023***	0.046***	0.035***	0.026***	0.054***
	20.56	26.32	29.42	25.78	32.09	36.42
ROA	-0.008***	-0.006***	-0.007***	-0.005***	-0.003***	-0.004***
	-5.99	-5.01	-5.53	-4.25	-2.72	-3.60
Stock Return	-0.073	-0.007***	0.453	-1.634***	-0.007***	-0.877***
	-0.20	-3.61	1.23	-4.89	-3.75	-2.61
Sales Growth	0.059***	0.041***	0.059***	0.027***	0.021***	0.026***
	7.01	9.37	6.95	3.49	5.24	3.36
Dividend Cut	-0.089***	-0.084***	-0.091***	-0.062***	-0.053***	-0.065***
	-21.31	-29.94	-21.90	-16.06	-20.23	-16.71
CEO Turnover	0.005	-0.004	0.005	0.001	-0.004	0.001
	1.13	-1.38	1.12	0.35	-1.37	0.29
Book Leverage	-0.039***	-0.040***	-0.093***	-0.051***	-0.043***	-0.121***
	-3.24	-5.80	-7.94	-4.38	-6.43	-10.30
Tenure	0.004	0.000	0.005*	0.004*	0.002*	0.004*
	1.61	0.24	1.88	1.72	1.65	1.87
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.12	0.14	0.12	0.30	0.29	0.29
N	22,390	48,805	22,390	22,390	48,805	22,390

Table 19: Business Segments

The explanatory variables in this table resemble those in Table 4, Panel B, Column 1 in Coles, Daniel, and Naveen (2006). The dependent variable is the logarithm of the number of business segments. Models (1)-(3) are pooled OLS regressions without industry fixed effects, models (4)-(6) include industry fixed effects. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Pooled OLS	(2) Pooled OLS	(3) Pooled OLS	(4) Industry FE	(5) Industry FE	(6) Industry FE
Lag(Vega)	1.070	12.516***	2.796	-10.219**	-2.372	-6.802
	0.22	3.56	0.57	-2.35	-0.73	-1.54
Lag(Delta)	-2.876***	-2.580***	-2.836***	0.457	-0.226	0.539
	-3.27	-4.18	-3.20	0.58	-0.40	0.67
Cash	29.090***	15.488***	39.947***	10.277*	7.402***	24.145***
Compensation	5.00	5.76	6.87	1.91	2.96	4.45
Log(Assets)	0.127***			0.164***		
	37.05			47.98		
Log(Sales)		0.117***			0.148***	
		56.91			70.10	
Log(Market Value			0.112***			0.138***
of Equity)			33.35			41.81
MKT-To-Book	-0.081***	-0.050***	-0.124***	-0.094***	-0.053***	-0.143***
	-22.16	-23.87	-31.65	-26.94	-26.32	-38.06
ROA	0.357***	-0.223***	0.229***	0.587***	-0.226***	0.446***
	6.98	-8.76	4.43	12.09	-9.30	9.03
Stock Return	0.984	0.012**	-0.889	4.627***	0.009**	2.117***
	1.16	2.49	-1.05	6.04	2.05	2.74
Sales Growth	-0.150***	-0.073***	-0.137***	-0.120***	-0.044***	-0.106***
	-7.37	-7.03	-6.73	-6.51	-4.54	-5.70
Dividend Cut	0.228***	0.199***	0.239***	0.145***	0.121***	0.155***
	23.08	30.39	24.09	15.86	19.63	16.80
CEO Turnover	-0.012	0.000	-0.013	0.004	0.004	0.004
	-1.07	0.03	-1.11	0.36	0.61	0.35
Book Leverage	0.079***	0.118***	0.245***	0.109***	0.087***	0.307***
	2.80	7.39	8.83	3.95	5.49	11.12
Tenure	0.003	0.000	-0.006	0.001	-0.002	-0.004
	-0.53	0.66	-1.09	-0.15	-0.46	-0.70
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.18	0.20	0.18	0.35	0.33	0.34
N	22,395	49,470	22,395	22,395	49,470	22,395

Table 20: Bidder Dummy

The explanatory variables in this table resemble those in Table III, Column 1 in Harford (1999). The dependent variable is equal to 1 if a firm announces a bid in a certain year and 0 otherwise. Models (1)-(3) are based on Probit regressions without industry fixed effects, models (4)-(6) include industry fixed effects in Probit regressions. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Probit (Without Industry FE)	(2) Probit (Without Industry FE)	(3) Probit (Without Industry FE)	(4) Probit Industry Fixed Effect	(5) Probit Industry Fixed Effect	(6) Probit Industry Fixed Effect
Abnormal return	0.002*	0.002*	0.048**	0.002**	0.002*	0.063***
	3.715	2.790	6.244	4.646	3.547	9.718
Sales growth	0.511***	0.536***	0.158***	0.471***	0.517***	0.184***
	377.885	405.670	9.794	275.482	320.954	12.404
Noncash working	0.407***	0.179***	-0.018	0.448***	0.252***	0.079
capital	50.6207	10.733	-0.044	41.246	13.894	0.547
Leverage	-0.476***	-0.394***	-0.562***	-0.221***	-0.171***	-0.246***
	-92.447	-67.331	-53.649	-17.419	10.822	-8.372
Market-to-book	0.115***	0.113***	0.005	0.086***	0.083***	-0.035***
	580.212	566.234	0.342	276.339	262.665	-14.780
Price-to-earnings	0.001*	-0.000	0.004***	-0.001	-0.001*	0.002***
	2.891	-0.001	38.758	2.311	-3.223	9.365
Size(Assets)	0.143***			0.185***		
	697.303			919.980		
Size(Sales)		0.114***			0.172***	
		499.812			827.812	
Size(MVE)			0.184***			0.220***
			503.663			582.113
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.10	0.09	0.10	0.16	0.16	0.18
N	49,541	49,541	22,658	49,541	49,541	22,658

Table 21: Target Dummy

The explanatory variables in this table resemble those in Table 3, Column 1 in Comment and Schwert (1995). The dependent variable is equal to 1 if a firm is a target of a successful M&A deal in a certain year and 0 otherwise. Models (1)-(3) are based on Probit regressions without industry fixed effects, models (4)-(6) include industry fixed effects in Probit regressions. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Probit (Without Industry FE)	(2) Probit (Without Industry FE)	(3) Probit (Without Industry FE)	(4) Probit (Industry FE)	(5) Probit (Industry FE)	(6) Probit (Industry FE)
Poison Pill	0.098**	0.099***	0.105**	0.1937***	0.140***	0.203***
	4.391	7.234	4.984	13.116	12.539	14.212
Control share law	-0.200***	-0.304***	-0.196***	-0.240***	-0.316***	-0.236***
	-11.709	-39.660	-11.168	-12.764	-35.759	-12.263
Business	0.084	-0.058	0.087	0.138	-0.099	0.144
Combination law	0.501	-0.609	0.545	1.041	-1.559	1.124
Abnormal return	0.074*	0.028	0.065	0.058	0.035	0.049
	3.515	0.653	2.527	1.593	0.873	1.127
Sales growth	-0.197*	0.031	-0.203*	-0.250**	-0.035	-0.261**
	-3.589	0.128	-3.780	-5.480	-0.152	-5.875
Noncash working	0.139	0.103	0.156	0.519**	0.475***	0.511**
capital	0.597	0.624	0.739	4.823	8.182	4.667
Leverage	0.341**	0.119	0.457***	0.281*	0.091	0.391**
	5.350	1.120	9.721	3.208	0.051	6.106
Market-to-book	-0.031*	-0.042***	-0.089***	-0.027	-0.051***	-0.068***
	-2.804	-6.809	-17.834	-1.603	-8.392	-8.554
Price-to-earnings	0.001	0.001	0.002	0.002**	0.002*	0.002**
	1.120	0.323	1.874	4.272	3.565	5.125
Size(Assets)	0.115***			0.088***		
	44.355			18.953		
Size(Sales)		0.079***			0.081***	
		38.007			28.372	
Size(MVE)			0.123***			0.097***
			53.545			24.980
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.08	0.06	0.08	0.18	0.13	0.18
N	22,012	37,198	22,012	22,012	37,198	22,012

Table 22: Poison Pill

The explanatory variables in this table resemble those in Table 3, Column 4 in Comment and Schwert (1995). The dependent variable is equal to 1 if a firm applies poison pill in a certain year and 0 otherwise. Models (1)-(3) are based on Probit regressions without industry fixed effects, and models (4)-(6) include industry fixed effects in Probit regressions. We include year fixed effects in all models. ***, **, * denote significance at 1%, 5%, and 10% level respectively.

	(1) Probit (Without Industry FE)	(2) Probit (Without Industry FE)	(3) Probit (Without Industry FE)	(4) Probit (Industry FE)	(5) Probit (Industry FE)	(6) Probit (Industry FE)
Control share law	-0.032	0.109***	-0.038*	-0.065***	0.068***	-0.072***
	-2.414	45.390	-3.401	-7.779	14.961	-9.609
Business	0.421***	0.617***	0.419***	0.338***	0.558***	0.333***
Combination law	106.171	485.470	105.118	56.611	343.221	54.935
Abnormal return	0.079***	0.060***	0.086***	0.093***	0.058***	0.103***
	21.740	22.102	25.621	27.965	18.989	34.164
Sales growth	-0.209***	-0.204***	-0.200***	-0.231***	-0.243***	-0.219***
	-25.330	-42.595	-23.089	-27.111	-55.543	-24.329
Liquidity	-0.079	0.028	-0.103	-0.106	-0.109*	-0.124
	-1.314	0.320	-2.250	-1.521	-3.159	-2.093
Leverage	0.144**	0.011	0.061	0.200***	0.160***	0.089
	6.122	0.068	1.120	9.290	11.884	1.847
Market-to-book	-0.091***	-0.090***	-0.053***	-0.094***	-0.086***	-0.049***
	-178.796	-271.848	-51.396	-159.641	-212.118	-37.371
Price-to-earnings	0.005***	0.005***	0.004***	0.005***	0.007***	0.005***
	48.948	83.892	41.488	58.399	130.516	49.787
Size(Assets)	-0.079***			-0.099***		
	-119.842			-145.089		
Size(Sales)		-0.056***			-0.049***	
		-125.744			-69.445	
Size(MVE)			-0.091***			-0.113***
			-170.735			-213.785
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.05	0.06	0.06	0.19	0.16	0.19
N	22,012	37,198	22,012	22,012	37,198	22,012

Table 23: Summary of Results

Panel A: Sensitivity of Firm Size Coefficient Sensitivity Based on OLS

measures / field	Sign			Significance			R^2		
	Assets	Sales	Mkt Cap	Assets	Sales	Mkt Cap	Assets	Sales	Mkt Cap
Tobin's Q	+	+	+	<1%	<1%	<1%	0.22	0.22	0.35
ROA	+	+	+	<1%	<1%	<1%	0.17	0.17	0.23
Board Size	+	+	+	<1%	<1%	<1%	0.40	0.40	0.39
Board Independence	+	+	+	<1%	<1%	<1%	0.24	0.24	0.23
Board Leadership	+	+	+	<1%	<1%	<1%	0.11	0.10	0.09
Dividend Payout	+	+	+	<1%	<1%	<1%	0.30	0.30	0.28
Book Leverage	+	+	-	<1%	<1%	<5%	0.24	0.23	0.23
Market Leverage	+	+	-	<1%	<1%	<1%	0.39	0.38	0.40
Cash Holdings	+	-	-	>10%	<1%	>10%	0.46	0.48	0.46
Vega	+	+	+	<1%	<1%	<1%	0.41	0.40	0.41
Delta	+	+	+	<1%	<1%	<1%	0.33	0.33	0.33
Executive Pay Level	+	+	+	<1%	<1%	<1%	0.40	0.38	0.40
R & D	-	-	-	<1%	<1%	<1%	0.33	0.27	0.33
Capital Expenditure	-	-	+	<1%	<1%	>10%	0.11	0.13	0.11
Herfindahl Index	-	-	-	<1%	<1%	<1%	0.12	0.14	0.12
Business Segments	+	+	+	<1%	<1%	<1%	0.18	0.20	0.18
Firm Risk	-	-	-	<1%	<1%	<1%	0.48	0.50	0.50
Bidder	+	+	+	<1%	<1%	<1%	0.10	0.09	0.10
Target	+	+	+	<1%	<1%	<1%	0.08	0.06	0.08
Poison Pill	-	-	-	<1%	<1%	<1%	0.05	0.06	0.06

Panel B: Sensitivity of Firm Size Coefficient Based on Industry Fixed Effect

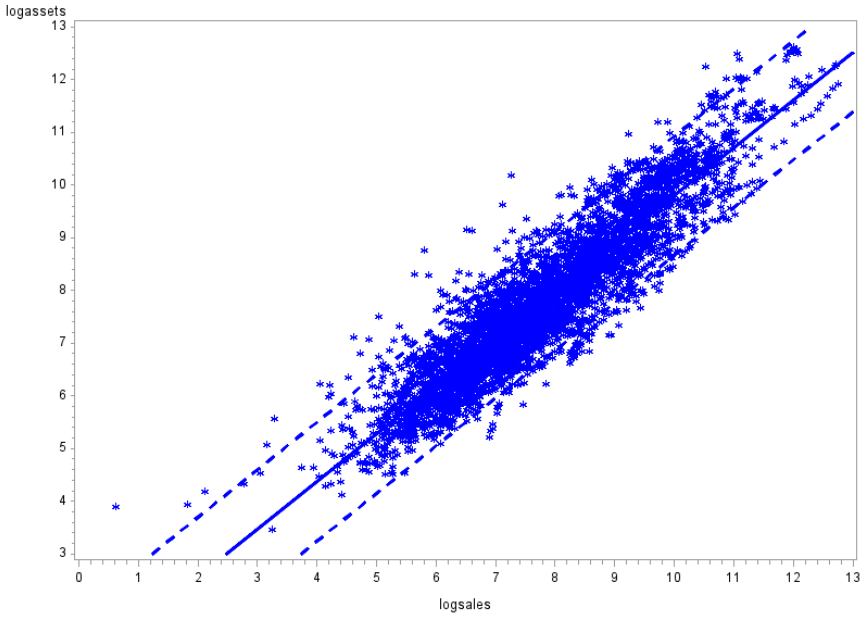
measures / field	Sign			Significance			R^2		
	Assets	Sales	MktCap	Assets	Sales	MktCap	Assets	Sales	Mkt Cap
Tobin's Q	+	+	+	<1%	<1%	<1%	0.28	0.28	0.41
ROA	+	+	+	>10%	<1%	<1%	0.25	0.26	0.32
Board Size	+	+	+	<1%	<1%	<1%	0.45	0.46	0.45
Board Independence	+	+	+	<1%	<1%	<1%	0.32	0.32	0.31
Board Leadership	+	+	+	<1%	<1%	<1%	0.16	0.16	0.15
Dividend Payout	+	+	+	<1%	<1%	<1%	0.44	0.45	0.42
Book Leverage	+	+	-	<1%	<1%	<1%	0.32	0.27	0.31
Market Leverage	+	+	-	<1%	<1%	<1%	0.45	0.42	0.46
Cash Holdings	+	-	+	<1%	<1%	<1%	0.57	0.58	0.57
Vega	+	+	+	<1%	<1%	<1%	0.46	0.45	0.46
Delta	+	+	+	<1%	<1%	<1%	0.35	0.35	0.35
Executive Pay Level	+	+	+	<1%	<1%	<1%	0.45	0.44	0.44
R & D	-	-	-	<1%	<1%	<1%	0.46	0.37	0.46
Capital Expenditure	-	-	-	<1%	<1%	<1%	0.26	0.28	0.26
Herfindahl Index	-	-	-	<1%	<1%	<1%	0.30	0.29	0.29
Business Segments	+	+	+	<1%	<1%	<1%	0.35	0.33	0.34
Firm Risk	-	-	-	<1%	<1%	<1%	0.59	0.60	0.61
Bidder	+	+	+	<1%	<1%	<1%	0.16	0.16	0.18
Target	+	+	+	<1%	<1%	<1%	0.18	0.13	0.18
Poison Pill	-	-	-	<1%	<1%	<1%	0.19	0.16	0.19

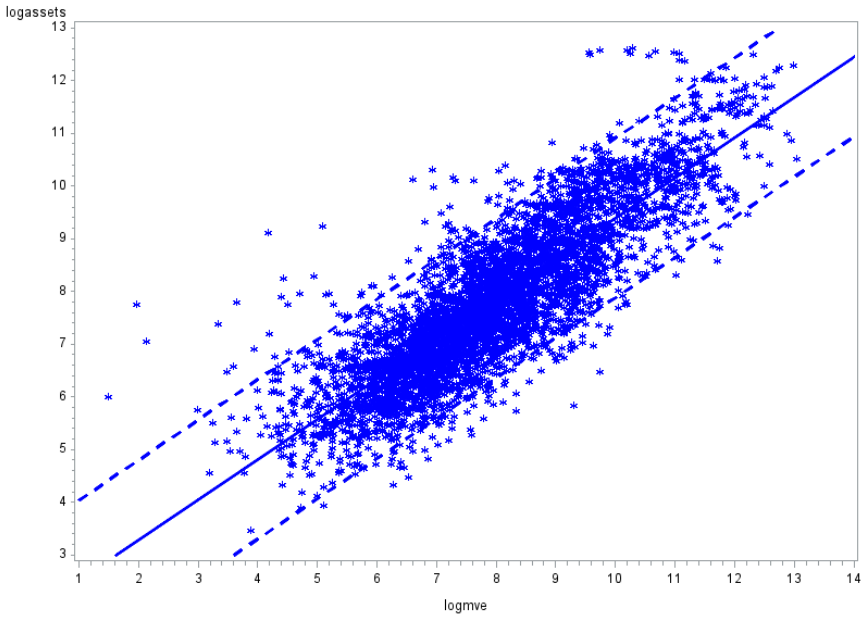
Panel C: Sensitivity of Regressor (Other than Firm Size) Coefficient

methods	OLS Regressions				Industry Fixed Effect Regressions			
sensitivity / field	Sign Sensitivity		Significance sensitivity		Sign Sensitivity		Significance sensitivity	
	Sign changes	# of var.	Sig. Changes	# of var.	Sign changes	# of var.	Sig. Changes	# of var.
Tobin's Q	Yes	1	Yes	2	Yes	1	Yes	1
ROA	Yes	2	Yes	1	Yes	2	Yes	1
Board Size	Yes	1	Yes	1	Yes	1	Yes	3
Board Independence	Yes	1	Yes	1	Yes	1	Yes	2
Board Leadership	No	0	Yes	1	Yes	1	Yes	2
Dividend Payout	No	0	No	0	No	0	No	0
Book Leverage	Yes	1	Yes	1	Yes	1	No	0
Market Leverage	Yes	1	Yes	1	Yes	1	Yes	1
Cash Holdings	Yes	0	Yes	2	No	0	Yes	4
Vega	Yes	2	Yes	1	Yes	1	Yes	2
Delta	No	0	No	0	No	0	No	0
Executive Pay Level	No	0	Yes	3	Yes	1	Yes	3
R & D	Yes	1	Yes	2	Yes	1	Yes	4
Capital Expenditure	No	0	Yes	2	Yes	2	Yes	2
Herfindahl Index	Yes	2	Yes	6	No	1	Yes	1
Business Segments	Yes	4	Yes	2	Yes	3	Yes	3
Firm Risk	Yes	2	Yes	3	Yes	2	Yes	4
Bidder	Yes	2	Yes	4	Yes	2	Yes	3
Target	Yes	2	Yes	5	Yes	2	Yes	5
Poison Pill	Yes	2	Yes	2	Yes	1	Yes	2

Figure 1-Bivariate Scattergrams of Alternative Firm Size Measures for Firm Performance

This figure depicts bivariate scattergrams of alternative firm size measures for firm performance data. The solid line represents the regression line; the dotted line represents 95% confidence limits for individual predicted values.





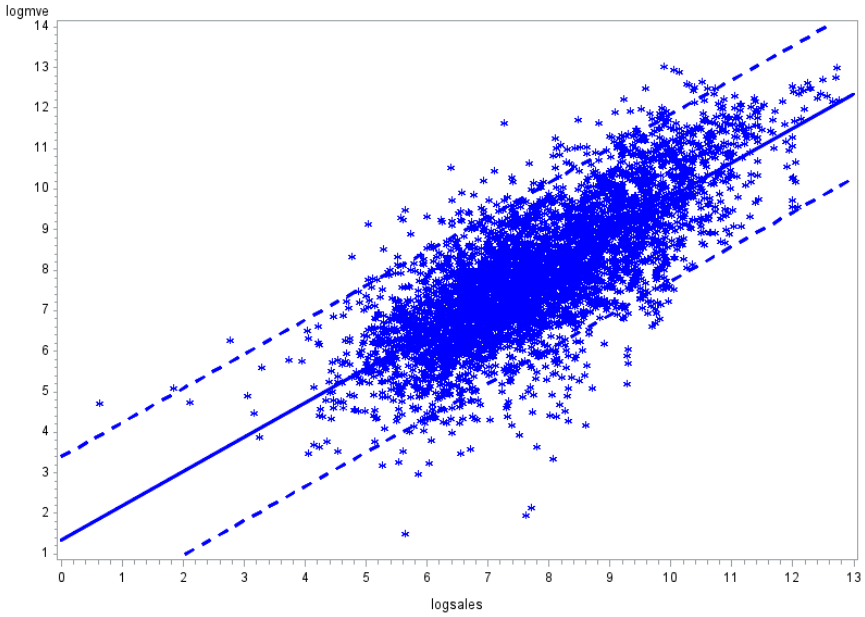

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Figure 2: Maximum Percentage Change of R Squared for Alternative Firm Size Measures

Figure 2 depicts the maximum percentage change of goodness of fit when we employ different measures of firm size in the regressions for 20 sub-fields in corporate finance.