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Managerial Ability, Hedging and Firm Value: A Multiyear Analysis

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Abstract

In this study, we examine the role (impact) of managerial ability on firm value and hedging by constructing an index of managerial ability from his past experiences and education and MA Score index. Using a multi-year data set and managerial ability proxies and controlling for firm and managerial fixed effects, we find that high ability CEOs are associated with higher firm value compared to firms managed by low managerial ability CEOs stressing the importance of CEO General Capital in firm level decisions. However, managerial ability is found not to have a significant impact on firm's hedging decisions. In addition, firm's hedging intensity run by high vs low managerial ability CEOs is documented to be very similar. While these results suggest that CEO managerial ability matters to firm value, it does not have any significant influence on his risk preference measured by derivative hedging.

Introduction

Becker (1962) in his seminal paper has emphasized on two types of human capital; one which is unique to the firm where he/she is employed and one which is general ability of the CEO i.e., his talent and skills which is transferable across industries and firms. The importance of CEO General Ability becomes more pronounced for our sample of Fortune 500 firms as many of them are multinational and conglomerates (Xuan, 2009). In this paper, we use two proxies for managerial ability; first is the MA Score Index devised by Demerjian et al. (2012), and for the second proxy, we construct a measure (General Ability, GA Index) based upon CEO past education and work experience (Custodio et al. 2013). Our two main managerial ability proxies can best be described as the general human capital as described in Becker (1962). Traditional models disregard managerial heterogeneity in corporate decision making and assumes their actions are homogenous (Berk and Stanton 2007; Bamber et al. 2010). But various studies have stressed the importance of CEO behavior and intangible benefit that CEO skills bring to the firm (Kaplan et al. 2012; Graham et al. 2012) and puts forward the point that CEO ability can provide firms a competitive advantage over other firms (Camerer, 2003; Camerer, et al. 2004; Costa-Gomez and Crawford, 2006). Thus, a growing strand of literature looks at the effect of managerial ability on firm corporate decisions i.e., investment policy (Bertrand and Schoar, 2003); financial policy (Pan, Wang, and Weisbach, 2014), and accounting choices (Bamber et al. 2010) among others. In this paper, we analyze if CEO managerial ability proxied by MA score index (Demerjian et al. 2012) and General ability index (GA Index) influences the firm hedging decision process and if it increase/decrease firm value. Other studies also have

stressed the importance of managerial skills in shaping corporate decisions. Krishnan & Wang (2014) find higher skilled CEOs helps lower audit fees while Beatty and Liao (2011) in their study of US banks find that banks which are managed well have better forecasting of loan losses. This study contributes to the previous literature in the following ways: Firstly, we investigate the effect of managerial ability on firm risk-taking behavior measured through derivatives usage in firms. As far as we know, no previous study has analyzed the effect of managerial ability on CEO risk-taking decisions proxied by derivative hedging. Studies in the past, have looked at the CEO managerial skills and risk taking by firms through risky investment decisions (Cremers and Petajisto, 2009), choice of positive NPV projects (Chemmanur et al. 2009), bank liquidity creation (Andreou et al. 2016), high innovative activity (Chen et al. 2015) etc. Secondly, evidence on corporate risk taking and managerial ability is ambiguous. Gormley and Matsa (2016), Wang et al. (2013) and Mishra (2014) among others have found a negative relation between managerial ability and hedging while Nuthall (2001, 2009), Chemmanur et al. (2009), and Cremers and Petajisto (2009) among others has found a positive relationship. The mixed results mentioned above motivates this study. Thirdly, we analyze the hedging intensity of high and low managerial ability CEOs to determine their risk-taking tolerance. This relationship also has not been determined in the previous literature. Fourthly, we construct a managerial ability index (GA index) using Principal Component Analysis based upon CEO's previous education and work experience. Custodio et al. (2013) also constructed an index, but our index is better and robust due to the following reasons. First, Custodio et al. (2013) ignored CEO past education experience while constructing the proxy. Since CEO's past education is paramount in building his/her general managerial skills, ignoring that information is a big error. Second, they ignored CEO tenure in constructing their MA index which is an error. Rajgopal et al. (2006) and Baik et al. (2011) find CEO tenure as a general managerial ability measure to determine firm level decisions. Our measure uses five aspects of the CEO's past professional and education experience: 1) if CEO got his MBA from an Ivy league school 2) if CEO got his undergraduate degree from an Ivy league school 3) if CEO is also the chairman of the board 4) CEO tenure 5) if the CEO has experience in a technical/financial firm. The General ability index (GA Index) is the first factor of the principal component analysis of the five measures described above. Finally, we look at the effect of managerial ability on firm performance proxied by Tobin's q. Previous studies have analyzed this relationship, but results were mixed. Demerjian et al. (2012, 2013), Leverty and Grace (2012) and Chemmanur et al. (2009) found a positive relation between managerial ability and firm performance while Mishra (2014) and Culver et al. (2001) found a negative relation between CEO skills and firm value.

Using a sample of Fortune 500 firms and using panel fixed effect regression from 2008 to 2012, we find the following results: managerial ability proxied by MA index (Demerjian et al. 2012) does not matter for firm hedging decisions, or in other words, CEO skills doesn't affect corporate risk taking proxied by total firm derivatives usage or individual derivatives (FX, IR or COMM) usage. Our results contradict the previous literature who have found a positive relation (Chemmanur et al. 2009) between hedging and firm risk taking and negative relation between derivative hedging and risk taking (Wang et al. 2013). Our results are robust and hold when we use GA index as the managerial ability

measure. Additionally, we find that hedging intensity of high and low ability CEOs (proxied by both MA Index and GA index) are similar supporting our previous result that CEO ability does not affect corporate risk taking through hedging by firms. Looking at the relation between managerial ability and firm value, we find that firms managed by higher managerial ability CEOs have more firm value compared to firms managed by low CEO skills. Our results support the findings of Leverty and Grace (2012) but contradict the results of Mishra (2014). These results hold also for our managerial ability measure (GA Index).

The remainder of the paper is organized as follows. Section 2 provides a brief description of the literature and hypothesis development. Section 3 describes the sample and methodology. Section 4 presents the results. Section 5 concludes the paper.

Literature Review/Hypothesis Development

Managerial ability and corporate risk taking

Managerial behavior is important for various corporate decisions (Bertrand and Schoar, 2003; Graham et al. 2012; Kaplan et al. 2012). Hambrick and Mason (1984) and Hambrick (2007) proposed the Upper Echelons theory which stresses the importance of CEO skills due to the complex nature of firm decision-making processes. Malmendier and Tate (2005, 2008) find that overconfident CEOs make value destroying M&As. The Human Capital theory by Eisfeldt and Papanikolaou (2013) states that human capital is an important valuable firm resource and firm's risk appetite varies depending upon these abilities. Building upon those theories, various measures for managerial ability have been used in the past, i.e., CEO tenure and media mentions (Milbourn, 2003), CEO overconfidence (Malmendier and Tate, 2005), CEO tenure (Rajgopal et al. 2006; Baik et al. 2011) among others. Due to the noise associated with using the above-mentioned measures (Francis, 2008), in this paper we are using the MA Score index (Demerjian, 2013). Additionally, we construct a measure of managerial ability based on CEO past education and work experience i.e., the general ability index (GA Index) as mentioned above. This measure is a better measure compared to Custodio et al. (2013) since they omitted CEO past education experience and CEO tenure, two aspects which are critical in making the index.

Previous studies have used various measures to proxy for firm risk taking by the CEOs and how managerial ability affects them. Cremers and Petajisto (2009) used investment activity to account for risk taking and found higher skilled CEOs take more risk as measured by risky investment choices compared to low-risk CEOs. On the other hand, Andreou et al. (2016) used bank liquidity creation as a proxy for corporate risk taking and found a positive relation. On the other hand, some studies see CEO intelligence and/or college education as negative to firm risk taking (Sjoberg and Drottz-Sjoberg, 1991; Boholm, 1998; Culver et al. 2001). Additionally, using a sample of listed companies in China, Wang et al. (2013) found a negative relation between corporate risk taking and CEO education level. Mishra et al. (2014) also find a negative relation between CEO ability and corporate risk taking due to his diverse skill sets. In this paper, we are using firm derivatives usage as a proxy for corporate risk taking. Previous literature has used various other measures of risk taking, i.e., acquisition intensity

(Sanders, 2001; Yim, 2013); R&D activity (Hoskisson et al. 1993; Coles et al, 2006) and degree of innovation (Li and Tang, 2010 and Greve, 2003) among others. As far as we know, no previous studies have analyzed how managerial ability affects corporate risk taking by CEOs using hedging by derivatives. Due to the mixed results regarding the relation between corporate risk taking and CEO ability, we develop the following two hypotheses:

H1: CEOs with higher managerial ability would take more risk or hedge less.

H2: CEOs with higher managerial ability would take less risk or hedge more with derivatives.

Managerial ability and firm value:

Bertrand and Schoar (2003), Choi et al. (2015), and Dejong and Ling (2013) among others have postulated in their paper the importance of managerial ability for firm's investment, operational and financing related activities. In line with that, Chang et al. (2010) find that CEO ability affects firm performance. But the previous studies on managerial ability and their effect on firm value is mixed. Demerjian et al. (2012) found a positive relation between firm value and managerial ability using ROA and stock return as proxies for firm performance. Finkelstein et al. (2009) also found higher managerial ability is associated with better firm performance. Leverty and Grace (2009) also found a statistically significant positive relationship between firm performance and managerial ability. The authors found that more able CEOs run firms more effectively, allocate resources efficiently, and reduce costs and maximize revenues. Also, Cheung et al. (2017) using S&P firms showed a positive relation between CEO ability and firm performance, but the relation is moderated by the presence of managerial discretion and monitoring quality. Various studies have documented a negative relation between managerial ability and firm value. Mishra (2014) show that high ability managers have more agency problems and thus engage in value destroying activities. Also, Culver et al. (2001) and Halek and Eisenhauer (2001) find higher ability CEOs reduce firm value due to their risk averseness causing them to pass value enhancing projects. Thus, the relation between managerial ability and firm value is mixed giving us two more hypotheses:

H3: CEOs with high managerial ability would run firms more efficiently resulting in higher firm value.

H4: CEOs with high managerial ability would run firms less efficiently resulting in lower firm value.

Sample Selection and Methodology

Hedging (Derivatives) Data Collection

Data for the analysis is obtained from the Fortune 500 list. We chose the Fortune 500 list for two reasons. First, most of the Fortune 500 companies are big and are more likely to use derivatives, compared to smaller firms as usage of derivatives is costly (Bodnar and Marston, 1998). Second, the Fortune 500 list encompasses companies from a wide array of industries, and so that would negate any industry bias. The initial sample consists of 500 companies out of which commercial banks, diversified financials, and insurance companies are omitted as their purpose of using derivative is

completely different (for investing and speculation) from non-financial firms (mainly hedging risk). That reduces the sample size to 434 companies. The gross notional derivative information is hand collected from the Mergent online database for all the 434 companies for 5 years, i.e., from 2008 to 2012 for a total of 2170 firm-year observations. The Mergent Online database has the 10k reports for all the fortune 500 companies grouped by year of filing. We used the 2008-2012 years which is during the financial crisis as during stressful times, managerial ability becomes more important than normal times. To search for derivatives, we used the terms “hedge”, “notional”, “swaps”, “foreign currency”, and “forwards” in the 10k reports. We use the notional amount of derivatives from the 10ks to account for the derivatives. Some of the previous literature has used fair value of derivatives as the dependent variable but using fair value has many problems. First, the total notional amount of derivatives is the aggregate number that the CEO has used for hedging which correctly depicts his risk-taking ability based on total prices at the time of putting up the hedge. Since the market value (fair value) of derivatives changes with the economy, it is not a reliable source for evaluating firm’s total financial risk and managerial ability. Second, very few firms reported fair value in their 10ks during the time of this study and so using fair value would result in loss of many observations. On the other hand, all firms reveal their total notional amount of derivatives in their 10ks. Thus, firms which do not report notional value of their derivatives in their 10ks (only fair values mentioned) are removed. In addition, private companies are excluded because they do not have public accounting data. Consistent with Geczy et al. (1997), firms involved in mergers and acquisitions (M&A) during the 5 years in this study, are also removed from our sample. This reduced the sample to 350 firms with 1630 total firm-year observations. In 10ks, firms report separately derivatives which are used for hedging, and which are used for trading or speculation. We only use derivatives data for hedging purposes for this paper. Also, for some companies using commodities, the 10ks had the notional amount of commodity hedged. For example, firm A had hedged 10mmBtu of natural gas and 45 million barrels of crude oil. In that case to find the derivatives amount in dollars, we multiply the total amount by the underlying price of the asset at that time. In addition, some companies had total number of contracts mentioned in their 10ks; to get the notional dollar amount, we multiply the number of contracts by the total contract unit from the CME website and the underlying price at that time. In case of foreign currency forwards or futures, all values are converted to the dollar values using the exchange rate at that time of the initiation of the contract.

Firm and managerial compensation data

The Thomson Reuters’ database and Google finance are used as the main sources to obtain firm financial data. CEO managerial compensation information is obtained from the ExecuComp database and proxy statements. Out of 350 companies, 10 companies did not have appropriate exercised and non-exercised options data in the ExecuComp database reducing the sample to 340 firms and a total of 1446 firm-year observations. The 332 firms of this study have made use of derivatives for commodity price fluctuations (commodity futures and swaps), interest rate risk (interest rate swaps and locks) and foreign currency risk (FX forwards and futures).

Methodology

Fixed effect regression analysis is used to regress the log of the derivatives divided by assets of the firm on MA Score index obtained from Demerjian et al. (2012) controlling for CEO compensation variables and firm level variables. Using fixed effect regression helps us to remove managerial fixed effect and thus the managerial ability can be effectively measured using the MA Score index and the GA index.

Construction of the General Ability Index (GA Index)

To construct the General Ability managerial ability index (GA Index), we use the Principal Component Analysis method as done by Custodio et al. (2013). In this paper, we use five aspects of the CEO's past education and work experience:

1. CEO Ivy School MBA dummy (X1): Dummy variable that is equal to 1 if the CEO has an MBA from an Ivy League School, 0 otherwise. A CEO who has an MBA from an Ivy League School has better education experience, and thus has more general skills to tackle firm investment decisions.
2. CEO Ivy League School undergraduate dummy (X2): Dummy variable that is equal to 1 if the CEO has undergraduate education from an Ivy League school, 0 otherwise. A CEO who has undergraduate education from an Ivy League School has better technical skills to handle corporate level decisions such as hedging.
3. CEO tenure (X3): Number of years, the CEO is in the current firm. Higher the CEO tenure, the more likely the CEO has better managerial ability and has various generic skills to deal with various organizational issues.
4. CEO/chairman dummy (X4): Dummy variable which is equal to 1 if the CEO is also the chairman of the board, 0 otherwise. A CEO, who is also the chairman, has probably more general human capital as chairman of the board has more responsibilities, duties to the shareholders/stakeholders.
5. CEO finance and technical career experience dummy (X5): Dummy variable equal to 1 if the CEO has finance and technical experience, 0 otherwise. CEOs who have worked in a finance and technical firm has acquired more technical, financial, and generic skills to handle risk management activities compared to CEOs who do not have that experience.

We extract common components from all these five measures using Principal Component Analysis (PCA) and join them together into one index of General Managerial Ability Index (GA Index). Using this single index rather than using five measures separately, we avoid the problem of multi-collinearity and spurious regression.

Variable Description

Dependent variable

The main dependent variable in our paper is log of total notional value of derivatives scaled by assets (Total derivatives- scaled by Assets) which is used as our hedging variable. Total derivatives consist of interest rate derivatives (IR/Assets), foreign exchange derivatives (FX/Assets) and commodity derivatives (COMM/Assets). Data for this variable is hand collected from firm's 10K's and Mergent Online Database.

Independent variables

Proxies for Managerial Ability

We use two proxies for measuring the managerial ability (MA) of CEOs, our main independent variable.

First, is the Managerial Ability (MA) Score index from Demerjian et al. (2012). The authors used a two-step procedure where in the first step, they used DEA to generate a firm-level efficiency measure. In the second step, firm specific characteristics are removed giving us the CEO managerial ability (MAscores) as an error term. For a detailed explanation of the procedure, see Appendix C.

The second measure is the General ability CEO index variable (GA index). The GA index is constructed using Principal component analysis by combining five aspects of CEO past education and experience which might increase/decrease his general human capital. A higher value of both the scores (MA and GA Index) would show that the CEO has more managerial ability compared to their peers. We also divide both the index variables by their median (BinaryMAmedian) for robustness tests. Index scores greater than the median are termed as high ability CEOs while scores lower than the median are termed as low ability CEOs. We also divide the index by quartiles for regressions. Scores in the top 25% of the index (MA1stquartile) are termed high ability CEOs while scores below that are termed low ability CEOs.

Other Control Variables

Previous literature has documented CEO compensation variables are important predictors of hedging in firms. CEO's options Delta is defined as the sensitivity of a CEO's option portfolio with respect to the stock price of the underlying security, also known as the "hedge ratio". This measure has been used extensively in the previous literature as a proxy for risk aversion (Knopf et al. 2002, Rogers, 2002, Coles et al. 2006 among others). In the context of this study, the total Delta of a CEO's compensation portfolio (Total CEO Delta) is defined as the sum of the Delta due to the option portfolio and the stock portfolio. We expect a positive relation between the CEO's total Delta and hedging since the payoff of the CEO option is directly related to the firm's stock price which is designed to encourage risk aversion. CEO's option Vega is defined as the sensitivity of a CEO's option portfolio with respect to the volatility of the stock price. This variable is used in the previous literature as a proxy for CEO high risk tolerance (Knopf et al. 2002, Beber and Fabbri, 2012). The CEO's stock Vega is not significant as volatility of stock is close to zero (Guay, 1999). Thus, the total Vega of the CEO option portfolio (Total CEO Vega) is only due to the volatility of the option portfolio. Hence, we expect a negative relation between Vega and derivative holdings (hedging) due to the convex payoff of the option-like contracts. For detailed calculation of the total CEO delta and total vega, see the Appendix A and B. CEO stock compensation variable captures the total CEO stock holdings (CEO Share Equity) in the firm. CEOs with high stockholdings in the firm they run, are more likely to exhibit low risk tolerance, since a large fraction of their personal wealth would be invested in the firm (Stulz, 1984), and as a result engage in more hedging. Sundaram and Yermack (2007) and Edmans and Liu (2010) suggest that CEOs with higher inside debt (CEO Inside debt) are more likely to exhibit low risk tolerance since a large fraction of their wealth is tied to company stock

performance and job security. Consequently, if inside debt (CEO pension and deferred compensation) deters CEO risk taking, we expect to observe a positive relation between hedging and CEO inside debt. As is the influence of CEO inside debt on hedging, CEO cash compensation (Total Cash) is expected to have a positive effect on hedging (i.e., incentivize CEOs to hedge more) because of the linear nature of cash compensation. All CEO compensation variables are obtained from ExecuComp database. We also control for the reduction of expected taxes (using NOL carryforwards/Assets), reduction in financial distress (using Debt/assets ratio and interest coverage ratio) and the under-investment problem (using R&D/Assets and Capex/Assets), the three shareholder maximization theories of Smith and Stulz (1985). We expect a positive relation between all these variables and hedging (Graham & Smith, 1999; Graham and Rogers, 2002; Nance et al. 1993; Geczy et al. 1997; Froot et al. 1993; Knopf et al. 2002). To control for firm/idiosyncratic risk, we use the standard deviation of excess returns, using daily excess returns data from Crisp/Compustat database (Shen & Zhang, 2013; Rogers, 2002). We expect a negative relation between idiosyncratic risk variable and hedging activities. To control for alternatives to hedging we use the dividend yield variable obtained from the Compustat database. We expect a positive association between dividend yield (Dividend yield) and hedging (Nance et. al. 1993). For controlling multinationalism in firms, we use foreign sales to total sales (Foreign/Total sales). Hedging activities is expected to be positive since more foreign sales correspond to more foreign exchange risk (Fok et al. 1997 and Allayannis and Ofek, 2001). To control for firm size, we use the log of total assets as our control variable (Total Assets). The relationship between firm size and hedging could be positive or negative (Nance et. al., 1993; Warner, 1977; O'Brien & Bhushan, 1990). To control for the agency problem in firms mentioned in Jensen (1986), we use the insider ownership variable (Insider own). Firms that have higher information asymmetry between managers and shareholders tend to hedge more (Breeden and Vishwanathan (1998); DeMarzo & Duffie, 1991). Thus, firms with higher insider ownership (Insider own) should hedge more due to lower information asymmetry and as a result we expect a negative link between insider ownership (Insider own) and derivative hedging. To control for firm profitability, we use the lagged free cash flow scaled by assets (Lag FCF/Assets). Firms with high free cash flow should be more profitable in the long run and realize a greater firm value (Jensen, 1986). Quick ratio (Quick ratio) is a proxy for the liquidity of the firm. We expect a negative relation between quick ratio and hedging since firms which are more liquid have low hedging incentives and thus, they are expected to make lower use of derivatives (Opler, 1999, Nance et. al., 1993). All firm specific variables are obtained from the Crisp/Compustat database and Thomson Reuters database.

Results

Table 1 describes the summary statistics of the variables. The MA Score index variable (Demerjian et al. 2012) has a mean score close to 0 (0.034) which is expected as the residuals follow a normal distribution with mean 0. The total derivative to assets is 0.10 suggesting that firms in our sample hedge only 10% of their total assets. The mean Tobin's q for our sample is 1.97 implying that an average firm in our sample is overvalued. The CEO total delta of their compensation portfolio is $10.39 million and CEO total vega is $4.768 million due to the large size of the firms in our sample. The Debt to assets ratio is 0.468 suggesting that firms in our sample has approximately 50%

of debt in their books. The IR (Interest Rate) and FX (Foreign Exchange) derivatives constitute 5% and 4% of the total assets respectively while the COMM (Commodity) derivatives is only 0.8% of the total assets. Looking at R&D expenditures scaled by total assets and capital expenses scaled by assets values, we find both to be lower (1.44% and 7.25%, respectively), suggesting that firms in our sample invest only a minuscule amount in R&D and capital expenses.

Table 1- Summary Statistics

Variable	Mean	Std Dev	Min	Max
CEO Inside Debt (millions)	8.878	0.1994	0	232.6
Idiosyncratic Risk	0.02	0.0122	0	0.114
Total Cash (millions)	1.494	0.022	0	0.31
Total Option comp value (Current, exercisable & un-exercisable options-in millions)	2.33	11.39	0	218
Total CEO Delta (millions)	10.39	180.9	0	5275
Total CEO Vega (millions)	4.768	123.3	0	4195
CEO Share Equity (millions)	543.99	0.7444	0	1179
Debt/Assets ratio	0.468	1.15	0	25.38
Total sales (billions)	2.01	3.089	0	26.50
Total assets (billions)	2.691	5.860	0	79.78
R&D/Assets	0.0144	0.0361	0	0.399
Capex/Assets	0.0725	0.245	0	4.588
Total Derivatives- scaled by Assets	0.100	0.18	0	0.7
IR/Assets	0.05	0.001	0	0.636
FX/Assets	0.04	0.08	0	0.67
COMM/Assets	0.008	0.05	0	0.56
Managerial Ability (MA) Scores	0.034	0.17	-0.29	0.63
Dividend Yield	0.0124	0.0182	0	0.146
Quick Ratio	0.946	0.819	0	7.568
Insider Own	0.0101	0.0627	0	1
NOL Carryforwards/Assets	0.013	0.0548	0	1.412
Interest Coverage ratio	26.91	168.3	0	4762
Foreign/Total Sales	0.287	0.284	0	1
Tobin's q	1.97	17.43	-4.43	32.66

Table 2. General Managerial ability index: Principal component analysis					
	MBA from top 10 Business school	**Undergrad from top 10 B-school**	**Chairman/ CEO**	**CEO Tenure**	**Finance/ Technical career**
Loadings	0.624796	0.619801	0.281904	0.245017	0.293212
Scores	0.2681	0.2490	0.1928	0.1556	0.1345
Proportion Explained	0.2681				
Eigen Value	1.34				

Table 2 shows the results of the principal component analysis for the measures of the general managerial ability index (GA Index). Using this methodology, we obtain only one component with an eigenvalue higher than one (eigenvalue of 1.34). As expected, all the five variables have loadings which are positive, which means they are positively correlated with the GA index. This confirms our proxy to be robust and accurate as higher value of the general ability skills is manifested in a higher value of the index. The index gives close to equal weights to the CEO MBA education from Ivy League school, CEO undergraduate education from Ivy League School, and if the CEO is also the chairman of the board, and lower weights to CEO tenure and if CEO has technical and/or financial experience. The General Ability Index (GA Index) of CEO i in year t is calculated by applying the scores in Table 2 to the standardized general ability components:

GA I, t (General Ability Index) = 0.2681 X1i, t + 0.2490 X2i, t + 0.1928 X3i, t + 0.1556 X4i, t + 0:1345 X5i, t

Looking at Table 3, we analyze the effect of managerial ability on firm risk taking, proxied by the MA Score Index variable (Demerjian et al. 2012) using fixed effect regression and controlling for firm and managerial risk preference variables. Using hedging as the risk variable, in Model 1, we show that the MA Score variable (MAscores) is not significant in predicting total derivative hedging behavior of CEOs. We also check if individual derivatives usage by firms i.e., foreign exchange (FX), Interest Rate derivatives (IR) and Commodity derivatives (COMM) is affected by CEO's managerial ability. Looking at the results in Model 2, 3 and 4, we find that managerial ability has no effect on FX, IR or COMM derivatives usage by firms respectively. Thus, the results in Table 3 suggests that risk management by CEOs using derivatives is not influenced by managerial ability.

Table 3:
Regression with MA Scores (continuous variable) and hedging (For a detailed description of the variables, see Appendices D and E.)

VARIABLES	(1) Deriv/Assets	(2) FX/Assets	(3) IR/Assets	(4) COMM/Assets
MAscores	**0.329**	**0.278**	**-0.471**	**-0.235**
	(0.349)	**(0.386)**	**(0.404)**	**(0.396)**
lncash	0.0249	0.0192	0.0384	0.0732**
	(0.0320)	(0.0354)	(0.0371)	(0.0363)
Lndelta	-0.0193	-0.0793	-0.0497	-0.0725
	(0.0469)	(0.0519)	(0.0544)	(0.0533)
lnvega	-0.00403	0.00101	-0.00828	-0.00993
	(0.00898)	(0.00993)	(0.0104)	(0.0102)
Insidedebt	-3.15e-09	-3.40e-09	1.15e-09	-2.25e-09
	(7.40e-09)	(8.18e-09)	(8.58e-09)	(8.40e-09)
lnshares	0.00977	0.0713*	0.0400	0.0448
	(0.0339)	(0.0375)	(0.0393)	(0.0385)
carryassets	-0.516	-0.455	-0.296	0.0190
	(0.834)	(0.923)	(0.967)	(0.947)
lnda	-0.0369	-0.0102	-0.0367	-0.0713*
	(0.0365)	(0.0404)	(0.0424)	(0.0415)
MBratio	0.00107	0.00229**	0.00187	0.000690
	(0.00103)	(0.00114)	(0.00120)	(0.00117)
intsaltotsales	0.688*	-0.143	0.905*	1.274***
	(0.414)	(0.457)	(0.480)	(0.469)
lnassets	-0.653***	-0.274	-0.791***	-0.0635
	(0.191)	(0.211)	(0.221)	(0.216)
RDassets	-0.774	-0.996	-0.318	5.483
	(4.265)	(4.716)	(4.944)	(4.840)
Capexassets	-0.131	-0.110	-0.314	-0.0134
	(0.316)	(0.350)	(0.366)	(0.359)
Idiosrisk	5.518	-1.315	2.532	-3.711
	(4.810)	(5.319)	(5.576)	(5.458)
Quickratio	0.178	-0.134	0.0488	-0.0259
	(0.117)	(0.130)	(0.136)	(0.133)
Insiderown	-0.364	0.0255	-0.660	-0.484
	(0.637)	(0.704)	(0.738)	(0.723)
Divyield	-0.0718	-2.892	-5.954	-8.901**
	(3.795)	(4.197)	(4.400)	(4.307)
intcov	-6.50e-05	0.000239	5.87e-05	0.000272
	(0.000223)	(0.000246)	(0.000258)	(0.000253)
Constant	12.49***	4.860	16.24***	0.000448
	(4.454)	(4.925)	(5.163)	(5.054)
Observations	1,246	1,246	1,246	1,246
R-squared	0.034	0.024	0.030	0.042
Number of Company1	262	262	262	262

In Table 4, we use a dummy variable (BinaryMAmedian) which equals 1 if the variable is greater than the median (high ability CEOs) and 0 otherwise (low ability CEOs). Analyzing the effect of this dummy variable on total and individual derivatives usage, we did not find any relation between hedging and managerial ability.

Table 4. Regression with MA Scores Median- Demerjian et al., (2012)- (For a detailed description of the variables, see Appendices D and E.)				
VARIABLES	**(1) Deriv/Assets**	**(2) FX/Assets**	**(3) IR/Assets**	**(4) COMM/Assets**
BinaryMAmedian	**-0.0113**	**-0.0100**	**-0.0669**	**-0.00639**
	(0.0128)	**(0.00737)**	**(0.470)**	**(0.00623)**
Lndelta	0.00354	-0.000181	0.104	0.000932
	(0.00599)	(0.00344)	(0.220)	(0.00291)
lnvega	-0.000201	0.00113*	-0.0178	-0.000630
	(0.00114)	(0.000658)	(0.0419)	(0.000556)
lncash	-0.000491	-0.000442	0.0392	0.000230
	(0.00414)	(0.00238)	(0.152)	(0.00201)
lninsidedebt	-0.00164	-0.000271	0.00142	0.000568
	(0.00242)	(0.00139)	(0.0886)	(0.00118)
lnshares	-0.000381	-0.000935	-0.0896	0.000295
	(0.00433)	(0.00249)	(0.159)	(0.00210)
carryassets	-0.0745	-0.0350	-2.369	0.00658
	(0.107)	(0.0614)	(3.910)	(0.0519)
RDassets	0.169	0.138	8.646	0.144
	(0.544)	(0.313)	(19.94)	(0.265)
Debtassets	-0.0240**	0.00119	-3.850***	-0.0151***
	(0.00974)	(0.00560)	(0.357)	(0.00473)
Capexassets	0.0214	-0.00196	-1.195	0.0157
	(0.0423)	(0.0243)	(1.551)	(0.0206)
MBratio	3.85e-05	2.28e-05	0.00204	1.27e-05
	(0.000132)	(7.57e-05)	(0.00483)	(6.40e-05)
Idiosrisk	0.0119	0.646*	8.890	0.0775
	(0.615)	(0.354)	(22.53)	(0.299)
intsaltotsales	-0.0342	-0.0382	0.131	-0.0147
	(0.0526)	(0.0302)	(1.927)	(0.0256)
lnassets	-0.0344	-0.000632	-2.239**	0.00601
	(0.0246)	(0.0141)	(0.902)	(0.0120)
Quickratio	0.0295**	0.00880	0.230	0.00353
	(0.0150)	(0.00861)	(0.549)	(0.00728)
Insiderown	0.0380	0.00188	1.811	0.0107
	(0.0812)	(0.0467)	(2.976)	(0.0395)
Divyield	0.237	0.0925	-27.34	-0.262
	(0.484)	(0.278)	(17.72)	(0.235)
intcov	-1.46e-06	1.25e-05	-8.17e-07	-1.43e-06
	(2.84e-05)	(1.63e-05)	(0.00104)	(1.38e-05)
Constant	0.884	0.0576	53.65**	-0.145
	(0.576)	(0.331)	(21.10)	(0.280)

Observations	1,246	1,246	1,246	1,246
R-squared	0.020	0.027	0.132	0.024
Number of Company1	262	262	262	262

In table 5, we repeated the fixed effect regression but using a MA Score dummy variable (MA1stquartile) which is 1 if the index score is in the top 25%, and 0 otherwise. The results in Table 4 are like Table 2 and 3 and we did not find the managerial ability variable to be statistically significant in predicting hedging in firms.

Table 5. Top 25% MA Scores- Dependent variable- Hedging (For a detailed description of the variables, see Appendices D and E.)

VARIABLES	(1) Deriv/Assets	(2) FX/Assets	(3) IR/Assets	(4) COMM/Assets
MA1stquartile	**-0.0122**	**0.00695**	**-0.116**	**-0.00913**
	(0.0146)	**(0.00817)**	**(0.547)**	**(0.00713)**
lncash	-0.00175	-0.000531	-0.0402	4.77e-05
	(0.00377)	(0.00212)	(0.142)	(0.00185)
Lndelta	0.00252	-0.000216	-0.0120	0.000513
	(0.00460)	(0.00258)	(0.173)	(0.00225)
lnvega	-0.00267***	0.000115	-0.00177	-0.000832***
	(0.000363)	(0.000204)	(0.0136)	(0.000178)
Insidedebt	6.83e-10	4.87e-10	2.45e-09	3.44e-10
	(8.26e-10)	(4.63e-10)	(3.10e-08)	(4.04e-10)
lnshares	0.000711	-0.000445	-0.0268	0.000458
	(0.00341)	(0.00191)	(0.128)	(0.00167)
carryassets	-0.0298	-0.0263	0.768	0.0202
	(0.101)	(0.0565)	(3.783)	(0.0493)
lnda	-0.00201	0.000395	0.0270	-0.00104
	(0.00421)	(0.00236)	(0.158)	(0.00206)
MBratio	1.20e-05	-7.12e-07	1.91e-05	-1.78e-06
	(1.74e-05)	(9.77e-06)	(0.000655)	(8.52e-06)
intsaltotsales	-0.0155	-0.0329	0.00796	-0.00511
	(0.0477)	(0.0267)	(1.792)	(0.0233)
lnassets	-0.0168	-0.000295	-0.0634	0.0124
	(0.0219)	(0.0123)	(0.822)	(0.0107)
RDassets	0.0595	0.101	-2.406	0.109
	(0.517)	(0.290)	(19.44)	(0.253)
Capexassets	-0.00718	0.000332	-6.360***	-0.00542
	(0.0381)	(0.0214)	(1.432)	(0.0186)
Idiosrisk	-0.490	0.525*	-1.081	0.0237
	(0.541)	(0.303)	(20.33)	(0.265)
Quickratio	0.0220	0.00710	-0.0291	0.00210
	(0.0137)	(0.00769)	(0.515)	(0.00670)
Insiderown	0.0343	0.000965	0.386	0.00518
	(0.0766)	(0.0430)	(2.881)	(0.0375)
Divyield	0.0751	0.103	-25.49	-0.296
	(0.420)	(0.236)	(15.81)	(0.206)

intcov	-7.22e-06	1.14e-05	0.000123	-1.78e-06
	(2.63e-05)	(1.47e-05)	(0.000988)	(1.29e-05)
Constant	0.494	0.0412	4.155	-0.290
	(0.513)	(0.288)	(19.30)	(0.251)
Observations	1,450	1,450	1,450	1,450
R-squared	0.069	0.021	0.026	0.041
Number of Company1	302	302	302	302

For checking the robustness of our results, we used the previously constructed General Ability Index variable (log (GA index)) as proxy for managerial ability and replicated the previous regressions as shown in Table 6. Using the new managerial ability measure, our results remain the same as earlier i.e., we did not find managerial ability to influence firm hedging decisions. In unreported results, we also obtained similar findings when we replicate the regressions using CEOs with index above median and top 25% like Table 4 and 5.

Table 6. Regression of General managerial ability index (GA Index) with hedging variables (For a detailed description of the variables, see Appendices D and E.)

VARIABLES	(1) **Deriv/Assets**	(2) **FX/Assets**	(3) **IR/Assets**	(4) **COMM/Assets**
Log (GA index)	**0.0459**	**-0.00967**	**0.233**	**-0.123**
	(0.0681)	**(0.0779)**	**(0.295)**	**(0.0768)**
lncash	0.0331	0.0203	0.0319	0.0717**
	(0.0314)	(0.0359)	(0.136)	(0.0354)
Lndelta	-0.0290	-0.0182	0.0371	-0.0380
	(0.0382)	(0.0437)	(0.166)	(0.0431)
lnvega	-0.00606**	-0.00108	-0.00416	-0.00704**
	(0.00298)	(0.00341)	(0.0129)	(0.00336)
lninsidedebt	-0.0229	0.00620	-0.00450	0.0123
	(0.0183)	(0.0210)	(0.0795)	(0.0207)
lnshares	0.0167	0.0301	-0.0517	0.0215
	(0.0281)	(0.0321)	(0.122)	(0.0317)
carryassets	-0.641	-0.506	-2.027	0.0315
	(0.828)	(0.947)	(3.592)	(0.934)
Debtassets	-0.0858	0.0130	-3.629***	-0.0396
	(0.0740)	(0.0846)	(0.321)	(0.0834)
MBratio	0.000215	6.43e-05	0.000149	0.000205
	(0.000143)	(0.000164)	(0.000621)	(0.000161)
intsaltotsales	0.838**	-0.146	0.00228	1.208***
	(0.390)	(0.446)	(1.693)	(0.440)
lnassets	-0.722***	-0.285	-1.971**	0.00155
	(0.182)	(0.208)	(0.788)	(0.205)
RDassets	-0.323	-1.279	9.403	4.975
	(4.259)	(4.872)	(18.47)	(4.801)
Capexassets	-0.0913	-0.118	-1.441	0.0406
	(0.329)	(0.376)	(1.426)	(0.371)
Idiosrisk	2.486	2.951	6.086	-1.739
	(4.440)	(5.079)	(19.26)	(5.005)

Quickratio	0.198*	-0.115	0.150	-0.0540
	(0.113)	(0.129)	(0.489)	(0.127)
Insiderown	-0.303	-0.237	1.696	-0.492
	(0.630)	(0.721)	(2.732)	(0.710)
Divyield	0.533	-1.622	-24.76*	-10.64***
	(3.455)	(3.952)	(14.98)	(3.895)
intcov	-5.93e-05	0.000255	7.68e-05	0.000206
	(0.000216)	(0.000247)	(0.000937)	(0.000244)
Constant	14.39***	4.829	47.74**	-1.593
	(4.276)	(4.890)	(18.54)	(4.820)
Observations	1,450	1,450	1,450	1,450
R-squared	0.039	0.013	0.126	0.045
Number of Company1	302	302	302	302

Collectively, we can infer from the above results that managerial ability does not affect risk behavior using hedging. Our results contradict the earlier findings who found managerial ability affects risk-taking behavior of CEOs either positively or negatively (Chemmanur et al. 2009; Gormley and Matsa, 2016) and we did not find support for hypotheses 1 and 2.

Table 7. Hedging intensity of low and high Managerial Ability CEOs measured by MA Score Index and HC_OC Index.

	High CEO Ability (high MA Score)	High CEO Ability (high GA Index score)	**Average of High CEO Ability**	Low CEO Ability (Low MA Score)	Low CEO Ability (Low HC_OC Score)	**Average of Low CEO ability**	**Average for all CEOs**
Hedging Intensity	0.104	0.121	**0.1125**	0.121	0.105	**0.113**	**0.11**

Next, we look at the hedging intensities of low and high skilled CEOs as shown in Table 7. High skilled CEOs are defined as whose Managerial Ability Scores (proxied by MA Score Index) are greater than the median MA and HC_OC Scores, while low skilled CEOs are ones whose scores are less than the median. In Table 7, we find that the hedging intensities of low and high skilled CEOs are similar (0.11 and 0.115) suggesting that managerial ability of CEOs do not affect hedging or in other words, managerial ability of CEOs does not change the firm risk-taking behavior of the CEO measured through low or high hedging intensities. This result coupled with our earlier finding suggests that CEO's risk appetite is not affected by managerial ability i.e., ability of the CEO does not matter during hedging decisions on the firm.

Table 8. Dep variable- Tobin's q			
VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
MAScores			
BinaryMAmedian	**0.436*** **(0.124)**		
		0.0667 **(0.0420)**	
MA1stquartile			**0.109**** **(0.0465)**
RDassets	-0.800	-0.512	-0.222
	(0.666)	(0.666)	(0.621)
Capexassets	-0.0139	0.00382	-0.0416
	(0.0772)	(0.0774)	(0.0782)
Debtassets	0.117***	0.116***	0.133***
	(0.0200)	(0.0201)	(0.0198)
lnassets	-0.0769***	-0.0709***	-0.0814***
	(0.0200)	(0.0200)	(0.0181)
Divyield	4.485***	4.535***	4.974***
	(1.128)	(1.133)	(1.067)
intsaltotsales	0.361***	0.362***	0.375***
	(0.0761)	(0.0765)	(0.0727)
lagFCFasset	0.0892	0.110**	0.115**
	(0.0544)	(0.0544)	(0.0533)
Quickratio	0.0250	0.0273	0.0215
	(0.0257)	(0.0258)	(0.0248)
Insiderown	-0.257	-0.175	-0.227
	(0.265)	(0.265)	(0.265)
Constant	1.566***	1.365**	1.683***
	(0.606)	(0.606)	(0.540)
Observations	1,238	1,238	1,442
R-squared	0.422	0.417	0.389
Year effects	Y	Y	Y
Industry effects	Y	Y	Y

Note: We calculate Tobin's Q as the ratio of total assets minus the book value of shareholder equity plus the market value of equity to the book value of assets. Managerial ability proxied by MAScores, BinaryMAmedian and MA1stquartile. All MA score variables defined earlier. For a detailed description of the other variables, see Appendices D and E.)

In Table 8, we analyze the effect of managerial ability on firm value measured by Tobin's q. Consistent with Allayannis et al. (2012), we calculate Tobin's Q as the ratio of total assets minus the book value of shareholder equity plus the market value of equity to the book value of assets. In line with Allayannis and Weston (2001), we use the natural logarithm of Tobin's Q.

Looking at Model 1, we find higher managerial ability proxied by MA Score Index, corresponds to higher firm value. This result suggests that firms which are managed by high skilled CEOs have higher firm value compared to firms managed by low ability CEOs. In Models 2 and 3, we used binary and first quartile dummy MA score variable

regression respectively, as discussed above, and we find positive result for the first quartile dummy variable, i.e., firms managed by high ability CEOs have higher firm value measured by Tobin's q. To check for robustness of our result, we used the GA Index measure as discussed above, to determine if it affects firm value as shown below in Table 9.

Table 9. Dep variable- Tobin's q

VARIABLES	(1) Model 1
Log (GA index)	**0.0580***** **(0.0219)**
RDassets	-0.0617 (0.613)
Capexassets	-0.0263 (0.0779)
Debtassets	0.132*** (0.0198)
lnassets	-0.0788*** (0.0180)
Divyield	4.748*** (1.070)
intsaltotsales	0.397*** (0.0732)
lagFCFasset	0.124** (0.0530)
Quickratio	0.0184 (0.0248)
Insiderown	-0.216 (0.265)
Constant	1.616*** (0.539)
Observations	1,442
R-squared	0.390
Year	Y
Industry	Y

Note: Managerial ability proxied by GA index using Principal Component Analysis (For a detailed description of the variables, see Appendices D and E.)

As shown in Table 9, the GA index variable is significant at the 1% level supporting our previous result that high skilled CEOs increase firm's value. Our results support the findings by Demerjian et al. (2012, 2013) and while contradicts the results of Culver (2001) and Mishra (2014) and we got support only for our third hypothesis.

Conclusion

In this paper, we investigate the effect of managerial ability on firm's hedging decisions and firm value. For measuring the CEO ability, we used two proxies: first is the MA Score index (Demerjian et al. 2012) and second is GA Index. We constructed the GA Index using Principal Component Analysis utilizing CEO's past education and work experience. Using the two managerial ability proxies, we did not find either of them to affect corporate risk taking through firm hedging. Our results are robust to binary MA score and GA index variables and first quartile binary variables. On the other hand, we found that the hedging intensities of both high and low ability CEOs to be strikingly similar further stressing the point that hedging is an insurance policy rather than a firm strategic decision (Stulz, 2013). Also, consistent with Demerjian (2012, 2013), we find high ability managers run firms more efficiently resulting in higher firm value compared to their low ability counterparts. Our results hold for both our managerial ability proxies. This further proves the point of Kaplan et al. 2012; Graham et al. 2012 and Xuan, 2009 among others who have stressed the importance of CEO General capital and skills which makes their firm more competitive compared to their peers.

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Appendix A. Calculation of total Vega and total Delta of option and stock portfolios

The Delta and Vega of the stock option portfolios are calculated using the Core and Guay (2002) approach. Core and Guay (2002) separately calculated the option grants for the current year and the previously granted options. For the current year option grants, we collect data for CEOs' number of options from the ExecuComp database. Exercise price and time of maturity variables for current year option grants are obtained from ExecuComp. Other variables which are required to estimate the Delta and Vega like stock price, volatility, interest rate and dividend yield are collected from the firm proxy statements and 10k reports. Consistent with the previous literature, the Black-Scholes option valuation formula is used to calculate the option price for the current-year options (Knopf et al. 2002; Rogers, 2002).

For the previously granted options, ExecuComp lists separately the number of exercisable and un-exercisable options in their database, but it does not contain the exercise price and time of maturity variables for them. The Core and Guay (2002) approach is used to approximate the time of maturity and exercise price for both exercisable and un-exercisable options. We calculate the Delta and Vega of the exercisable and un-exercisable options separately. Time of maturity of the previously exercisable options, is approximated as the time of maturity of current options minus four, and for previously un-exercisable options, time of maturity minus one. We calculate the exercise prices by subtracting the total value of the option portfolio and the current year option portfolio value. Then, we divide this number by the number of options to get the difference of the stock and exercise price. Finally, we subtract this number with the stock price to get the exercise price. We calculate the exercise price separately for exercisable as well as un-exercisable options. Core and Guay (2002) have shown that this approximation is very close to actual values. Other variables which are required to estimate the Delta and Vega of previously granted options like stock price, volatility, interest rate and dividend yield are collected from the firm proxy statements and 10k reports. Appendix B provides the calculation of Delta and Vega using the Black-Scholes Options model.

We also calculate the Delta of the stock portfolio of the CEO. Thus, the total Delta of the option portfolio is the sum of the Delta of the current year option portfolio, plus Delta of previous year's exercisable and un-exercisable options and the sum of the Delta of the stock portfolio. Similar calculation procedure is employed to estimate the Vega of the current option grants, previous exercisable and un-exercisable options. Vega for the stock portfolio is assumed to be zero. Therefore, the total Vega is the sum of the Vega of the current year options, previous year's exercisable and previous year's un-exercisable options. Finally, we multiply the Vega and Delta with the total number of options to obtain the Vega (CEO Total Vega) and Delta (CEO Total Delta) of the entire CEO compensation portfolio. The above-mentioned procedure is used to calculate the Vega and Delta for each of the five years (2008-2012).

Appendix B. Calculating delta and Vega using the Black–Scholes option pricing model

In this appendix, we first present how CEO stock option values, deltas, and vegas are derived.

The Black–Scholes (1973) model for valuing European call options modified for dividend payments, as Merton (1973), is as follows:

$$Value = S \exp(-d*T)*N(d1) - X \exp(-r*T)*N(d2) \quad \text{(B1)}$$

where

$d1 = [\ln(S/X)+T(r-d+\sigma^2/2)]/\sigma\sqrt{T}$

$d2 = d1 - \sigma\sqrt{T}$

N (.) = cumulative probability function for the normal distribution

S = share price of stock at the fiscal year-end

d = dividend yield as of the fiscal year-end

X = exercise price of the option

r = risk-free rate of US T-bond yields corresponding to the option's time to maturity

d = annualized standard deviation of daily stock returns measured over the 120 days prior to the fiscal year-end

T = remaining years to maturity of the option

As Core and Guay (2002), the delta and vega measures are the option values' sensitivity with respect to a 1% change in stock price and a 0.01 change in the standard deviation, respectively, and are expressed as follows:

$$\partial value/\partial S*S/100 = \exp\{-dT\}\, N(d1)*S/100 \quad \text{(B2)}$$

$$\partial value/\partial S*0.01 = 0.01*[\exp\{-d*T\}\, N^{\prime}(d2)S\sqrt{T}] \quad \text{(B3)}$$

where N' (.) is the normal probability density function.

The exact values of the exercise price and time to maturity are obtained from proxy statements for current-year option grants. For options granted in prior years, the CoreGuay (2002) algorithm is used. We estimate average exercise prices by subtracting the ratio of the realizable value of options to the number of options (for both exercisable and unexercisable options) from the fiscal year-end stock prices. The time to maturity is set at one year less the time to maturity of the current year's grant (or nine years if no new grant is made) for unexercisable options. The time to maturity is set at three years less the time to maturity of exercisable options (or six years if no new grant is made). The delta and vega values for shares of stock held are assumed to be equal to one and zero, respectively.

Appendix C. Measuring Managerial ability

We follow the two-step methodology of Demerjian et al. (2012, 2013) in measuring managerial ability. The first step is to use data envelopment analysis (DEA) to create an initial measure of the relative efficiency of the firm within its industry (Charnes et al. 1978). DEA is a linear programming methodology that measures the relative efficiency of decision-making units (firms) by evaluating inputs (labor, capital, etc.) relative to outputs (revenue, income, etc.). Efficient firms are those that generate more revenues from a given set of inputs. The following optimization is applied to estimate firm efficiency:

$$Max\ V\theta = Sales / (v1CoGS + v2SG\&A + v3PPE + v4OpsLease + v5R\&D + v6Goodwill + v7OtherIntan)$$

where CoGS is cost of goods sold; SG&A is selling and administrative expenses; PPE is net PP&E; OpsLease is net operating leases; R&D is net research and development; Goodwill is purchased goodwill; and OtherIntan is other intangible assets. The firm efficiency measure, however, is affected by both firm-specific factors and management characteristics. The second step is to remove firm-specific characteristics from the DEA generated firm efficiency measure. This is done by removing the effects of firm size, market share, free cash flow, firm age, multi-segment and international operations challenges by performing the following regression:

$$Firm\ Efficiency_i = \alpha 0 + \alpha 1\ ln\ (Total\ Assets)_i + \alpha 2\ (Market\ Share)_i + \alpha 3\ (Free\ Cash\ Flow\ Indicator)_i + \alpha 4\ ln\ (Firm\ Age)_i + \alpha 5\ (Business\ Segment\ Concentration)_I + \alpha 6\ (Foreign\ Currency\ Indicator)_i + \alpha 7\ (Year\ Indicator)_i + \varepsilon i$$

According to Demerjian et al. (2012), the error term of the regression measures managerial ability.

Appendix D: Firm variables

This appendix presents the company variables.

- Debtassets: Total debt to total book value of assets
- Lnda: logarithm of debt to assets
- MBratio- market to book ratio

- Deriv/Assets: Total derivatives value (FX, IR, and COMM) divided by total assets
- IR/Assets: Total notional value of interest rate (IR) derivatives scaled by total assets
- FX/Assets: Total notional value of foreign exchange (FX) derivatives scaled by total assets
- COMM/Assets: Total notional value of commodity (COMM) derivatives scaled by total assets
- Excess_Deriv Residual derivatives after controlling for endogeneity (using the method of Shen and Zhang, 2013) divided by total assets
- intsaltotsales: International sales revenue divided by total sales revenue
- Capexassets: Logarithm of the total capital expenditure of the firm divided by the total book value of assets
- Quick ratio: (Current assets - inventories)/current liabilities
- RDassets: Total R&D expenses of the firm divided by assets
- Insiderown: CEO's insider stock ownership (%) of company shares
- Divyield: Total dividend yield of the company, calculated by dividing dividends by the current stock price
- LagFCFassets: Lagged free cash flow of the firm divided by assets
- lnassets: logarithm of the total book value of assets
- carryassets: Net operating loss carryforwards scaled by total assets
- intcov: Interest coverage ratio
- idiosrisk- standard deviation of excess returns, using daily excess returns data from Crisp/Compustat database

Appendix E: CEO risk preference variables

- lndelta: Logarithm of total delta of the CEO compensation portfolio (sum of the delta values of the CEO's current options, exercisable options, and un-exercisable options and the CEO's stock options)
- lnvega: Log of total vega of the CEO compensation portfolio (sum of the vega of the CEO's current options, exercisable options, and un-exercisable options)
- Ininsidedebt: Log of the inside debt is the sum of the CEO's deferred compensation and pension benefits
- lncash: Log of the sum of total salary and bonuses of the CEO's compensation portfolio
- lnshares: Log of CEO's total stock equity compensation