The Role of Agency and Equity-Based Compensation in the Valuation of Diversified and Focused Companies

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Agency problems are generally viewed in the literature as one of the reasons why the diversification discount exists. The adoption of equity-based forms of executive compensation is considered one way of mitigating agency problems and enhancing the firm valuation. This study investigates how the intensity of the equity-based compensation impacts the valuation of diversified firms in two dimensions of diversification: industrial and geographic. Building on the prior literature, we take a multi-dimensional approach by considering the combined effects of the EBC levels, degrees of product and geographic diversification on the valuation of the firm. Results of this study show a firm's valuation is negatively affected by geographic diversification, but it is positively related to industrial diversification. Firms pursuing dual diversification strategies are valued at a discount. Use of the equity-based compensation helps to mitigate agency problems and has a positive valuation effect.

INTRODUCTION

The existence of a diversification discount is a well-documented phenomenon in the literature. Decisions to diversify are a viewed as a value-reducing activity undertaken by the top managers, while adoption of equity-based compensation (EBC) is traditionally considered as an attempt to resolve agency problems and minimize unnecessary costs to shareholders. This study investigates the firm-valuation effects of equity-based compensation to top managers in the context of diversification decisions made by managers. Specifically, we examine valuation effects of EBC across a sample of diversified (multi-segment) and focused (single-segment) companies on the geographic and industrial dimensions of diversification.

According to the diversification literature review study by Martin (2003), agency problems are viewed as the key explanatory factor in the diversification discount. The complexity of managing a corporation with multiple geographic and/or industrial divisions enhances informational asymmetry between the managers and the shareholders, leading to limited monitoring, higher costs to shareholders, and subsequent reduced valuation of the firm. Economies of scope and scale, which are usually viewed as benefits of diversification, are often outweighed by the negative effects of the increased agency costs.

Most of the outstanding diversification literature is two-dimensional in nature: studies explain relationships between the level of diversification and the magnitude of the value discount. However, a number of studies focus on examining diversification-related agency cost dynamics and corporate aspects other than firm-valuation. For example, Duru, Reeb (2002) examine the relationship between the level of diversification and the level and structure of executive compensation. They support findings from the prior literature that diversification is likely associated with a greater potential for high agency costs and

that diversified firms are more likely to adopt compensation practices that better align managers' decision-making with the shareholders' interests. Ataullah et al. (2012) studies the profitability of insider trading across diversified and focused firms. Their results also support the notion that the level of diversification is positively related to the level of agency costs.

Few diversification studies address jointly both aspects of diversification: geographic and industrial. For example, Sambharya (1995) reports that while individually geographic diversification and product diversification do not have significant effects on firm valuation, while the combined effect of the two forms does result in a higher valuation. Fauver et al. (2004) suggest that recognizing both sides of diversification and considering the interaction between the two is necessary for an accurate and reliable examination of the combined diversification effect.

This study examines firm-valuation by linking diversification and compensation decisions made by the management. Specifically, we study the utilization of equity-based forms of compensation and its subsequent effect on the valuation of the firms in the context of their level of diversification.

LITERATURE REVIEW

Diversification is an extensively studied area in corporate finance literature, but no consensus as to whether diversification is a value-enhancing activity has yet been fully reached. According to Martin (2003), the study of corporate diversification can be classified into two main bodies of literature: cross-sectional studies of the relationship between diversification and firm valuation, and longitudinal studies of the corporate diversification dynamics over time.

Existing studies on the valuation effects of diversification generally agree on the existence of a discount that diversified firms are selling at. For instance, Lang, Stulz (1994), Berger, Ofek (1995), Lamont, Polk (2002) all provide supporting evidence that diversified firms are worth less than their comparable focused counterparts. However, some studies question the existence of the diversification discount and suggest that this discount may stem from the use of poor-quality data in prior studies, or even that the diversification discount may be a function of factors that are unrelated to diversification itself. A study by Villalonga (2004) using the Business Information Tracking Series (BITS) finds a diversification premium for a sample that yielded a discount based on the segment data in previous studies, which rely on COMPUSTAT segments data. A few studies show that conflicting results regarding the valuation effects of diversification do not pertain to the U.S. market alone. Khanna, Yafeh (2005) study the effects of industrial diversification across different countries and observe a high degree of value-enhancing risk-sharing across business groups in Japanese, Korean, and Thai markets. But there is little evidence for the same level of significance of product diversification in other countries covered by their study.

It should be further noticed that majority of diversification studies consider only one aspect of diversification – either geographic, or industrial – and relatively few studies explore the combined effect of both aspects jointly or attempt multidimensional approaches. Most of the prior research concentrates on dual relationships: diversification and firm-valuation, diversification and compensation of the top executives, etc.

There are a few studies that investigate diversification effects in multi-dimensional settings. For example, Nam et al. (2006) consider the relationship between diversification levels, reliance on equity-based compensation and subsequent firm valuation. Kim, Mathur (2008) investigate the link between industrial and geographic diversification and firm value. They report both industrial and geographic diversification forms are associated with reduced firm value. This supports the notion that the costs resulting from corporate diversification might be higher than the corresponding benefits. Moreover, they emphasize the importance of considering the interaction effect between industrial and geographic diversifications, as they report varying combined effects for the firms pursuing different dual expansion strategies. Apostu (2010) studies the effects of geographic and corporate diversification on capital-structure decisions in a sample of European companies; Ataullah et al. (2012) examine the links between geographic and industrial diversifications and the profitability of insider trading. In studying valuation

effects and researching how executive compensation structures factor into firm-valuation under various diversification decisions, this study examines two forms of diversification individually and jointly.

In general, there is strong support in the literature for the role of agency in diversification decisions made by managers. Misalignment of managerial and shareholders' interests and high monitoring costs result in sub-optimal value creation for shareholders. Individual effects of the geographic and industrial diversification, level and structure of the executive compensation structure have different implications from their combined effects for a firm's valuation. Recent diversification literature suggests that interaction matters, and that both geographic and industrial diversification should be studied jointly. Moreover, interaction between diversification decisions and compensation will have joint effect for the corporate value.

DATA

The sample utilizes three databases over the period 1993 to 2006. ExecuComp is used as a source of the data on CEO compensation. It is available in the ExecuComp database from 1992; however, it is a conventional approach in the compensation literature to exclude the first year as incomplete and to provide only partial coverage for the S&P 1500 firms. For this reason, 1993 is selected as a starting year for the sample period. Three components of the CEO compensation used in this study are: cash compensation, including salary and bonuses; equity-based compensation, consisting of restricted stock grants and the value of stock option grants; and other compensation, including all other compensation benefits reported by the firm. Total compensation is defined as the sum of these three components.

Firm and segment-level data come respectively from the Fundamentals Annual files and the Historical Segments files of the Compustat North America database. Firm-level characteristics are sized by sales across the entire sample: book value of total assets, level of total debt, capital expenditures and free cash flows. Selection of the sample in this study is largely conditional on the availability of CEO compensation data and segment data across all three databases over the sample period. This leaves a base sample of 14,055 firm-year observations over the period of 1993-2006.

Table 1 summarizes the characteristics of the CEO compensation and firms' financials. A sample median of the equity-based compensation level is used as the sorting criterion to classify firms as low-EBC, if their respective equity-based compensation is below the sample median and as high-EBC otherwise. Interestingly, means and medians for all three firm-value measurements are greater for the high-EBC firms. Differences in means are statistically significant for all three measures at the conventional significance levels. This suggests the pattern documented in prior literature exists in the test sample of this study.

TABLE 1
SUMMARY STATISTICS

Panel A: Compensation Structure of CEOs

	Mean	Median
Salary	639.87	584.08
Bonus	627.87	250.00
Total Cash Compensation	1267.74	875.00
Other Compensation	242.89	42.89
Shares Owned	2663.52	227.84
Annual cash compensation to total compensation ratio	0.5476	0.5275
Stock options and restricted stocks granted to total compensation ratio	0.3955	0.4092
Other compensation to total compensation ratio	0.0569	0.0190

Panel B: Firm Characteristics – All Firms and Firms with High/Low EBC Structures

	Entire Sample		Low EBC		High EBC	
	Mean	Median	Mean	Median	Mean	Median
Number of industrial segments	2.5014	2.0000	2.3210	2.0000	2.6810	2.0000
Number of geographic segments	2.3308	1.0000	2.3578	2.0000	2.3038	1.0000
Tobin's Q	2.1435	1.5872	1.9418	1.4689	2.3490	1.7295
PE ratio	36.3768	19.3664	31.6997	17.8808	41.0492	21.1538
Excess value	1.5125	0.7013	1.1673	0.5743	1.8573	0.8805
Total Assets to sales ratio	1.8401	1.0503	1.8054	0.9968	1.8747	1.0961
Debt to sales ratio	0.4857	0.1969	0.4703	0.1930	0.5011	0.2008
Capital expenditures to sales ratio	0.0811	0.0458	0.0788	0.0441	0.0834	0.0478
Free cash flow to sales ratio	0.0593	0.0484	0.0531	0.0443	0.0656	0.0534

A proxy variable for equity-based compensation is calculated as the total of the restricted stock and stock-option grants to CEOs. The number of the geographic and business segments is a count number of reported segments under Historical Segments files per each firm annually. A firm is classified as geographically or industrially diversified if it reports more than one geographic or industry segment in a given year, respectively; it is classified as pursuing a dual diversification strategy if it reports more than one geographic and more than one industrial segment in a given year.

Tobin's Q is used as the main variable measuring the firm's value. It is calculated as (Book Total Assets - Book Common Equity - Deferred Taxes + Market Common Equity) / Book Total Assets, or using Compustat identifiers:

$$\text{Tobin's Q} = [\text{item 6} - \text{item 60} - \text{item 74} + (\text{item 25} \times \text{item 24})] \ / \ \text{item 6} \quad (1)$$

Alternative firm valuation variables are used in the models for robustness tests. The alternative variables are: the price-to-earning (PE) ratio and excess value (EV), which was originally used in Thomadakis (1977). The PE ratio is calculated as the closing price of the common stock for a given calendar year divided by the earnings per share for the fiscal year ending on or before the end of that particular calendar year. Excess value (EV) is defined as the difference between the market and book values of equity sized by the firm's sales – or, using Compustat identifiers:

$$\text{EV} = (\text{item 25} \times \text{item 24} - \text{item 60}) \ / \ \text{item 12} \quad (2)$$

Variable definitions used in this study are summarized in Table 2. These variables are used directly in the models or are used as inputs for calculated variables, as explained further in the Methodology section.

TABLE 2
LIST OF VARIABLES

This table reports a list of variables used in the study. Annotations of the databases used: Compustat HS – Compustat Historical Segments database; Compustat FA – Compustat, North America, Fundamentals Annually database.

Variable Name	Variable Description	Database Identifier	Database
CASHCOMP	Salary + bonus	SALARY + BONUS	ExecuComp
EBC	Restricted stock grants + stock option grants	RSTKGRNT + OPTION_AWARDS_BLK_ Value	ExecuComp
OTHERCOMP	Other benefits	OTHCOMP	ExecuComp
TOTCOMP	Total compensation = CASHCOMP + EBC + OTHERCOMP	Calculated variable	
INTEBC	Intensity of the equity-based compensation = EBC/TOTCOMP	Calculated variable	
INDNUM	Count number of industry segments	Calculated variable	Compustat – HS
GEONUM	Count number of geographic segments	Calculated variable	Compustat – HS
IND	Indicator variable for industrial diversification		Compustat – HS
GEO	Indicator variable for geographic diversification		Compustat – HS
SALES	Total sales	Item 12	Compustat – FA
TA	Total assets	Item 6	Compustat – FA
FCF	Free cash flow	Item 308 – Item 128	Compustat – FA
CAPX	Capital expenditures	Item 128	Compustat – FA
DEBT	Total debt	Item 9 + Item 34	Compustat – FA
EQUITY	Market value of equity	Item 25 × Item 24	Compustat – FA
PE	Price-to-earnings ratio	calculated variable	Compustat – FA
MB	Market-to-book ratio	calculated variable	Compustat – FA

METHODOLOGY

Agency Costs and Valuation of Single-Segment and Multi-Segment Firms

This study investigates the valuation effects of geographic and industrial diversifications and the role of equity-based forms of executive compensation in reducing agency costs.

Firstly, we test a base model, which is a modification of the model in Nam et al. (2006). Two variations of this model are examined: the first uses indicator variables for the levels of geographic and industrial diversification (Equation 3), and the second is based on continuous variables, which are the count numbers of reported industrial and geographic segments (Equation 4.) Both models utilize Tobin's Q as a primary valuation measure of the firm; both models measure the level of diversification in geographic and industrial dimensions; and both models include dummy variables to identify firms pursuing dual diversification strategies.

Model 1a: Dummy variables

$$TobQ = \beta_0 + \beta_1 D_{1ij} + \beta_2 D_{2ij} + \beta_3 D_{3ij} + \beta_4 EBC_{ij} + \sum_{k=1}^{n} \beta_k C_{ijk} + \varepsilon \quad (3)$$

- D1: indicator variable for geographic diversification equals 1 if the firm reports more than one geographic segment in a given year, and zero otherwise, for firm *i* in year *j*;
- D2: indicator variable for industrial diversification equals 1 if the firm reports more than one industry segment in a given year, and zero otherwise, for firm *i* in year *j*;
- D3: indicator variable for the firms diversified both geographically and industrially equals 1 if the firm reports more than one geographic and more than one industrial segment in a given year, and zero otherwise, for firm *i* in year *j*;
- EBC_{ij}: total value of the stock options and restricted stock option grants to the CEO of firm *i* in year *j*, sized by the sales.

Model 1b: Continuous variables

$$TobQ = \beta_0 + \beta_1 GEONUM_{ij} + \beta_2 INDNUM_{ij} + \beta_3 EBC_{ij} + \beta_4 D_{ij} + \sum_{k=1}^{n} \beta_k C_{ijk} + \varepsilon \quad (4)$$

- $GEONUM_{ij}$: a number of geographic segments reported by firm *i* in year *j*;
- $INDNUM_{ij}$: a number of industrial segments reported by firm *i* in year *j*;
- EBC_{ij}: total value of the stock options and restricted stock option grants to the CEO of firm *i* in year *j*, sized by the sales*;*
- D_{ij}: indicator variable for the firm diversified both geographically and industrially equals 1 if the firm reports more than one geographic and more than one industrial segment in a given year, and zero otherwise, for firm *i* in year *j*.

Both models use the following control variables, C_{ijk} (*k*-variable for firm *i* in year *j*), which are sized by the sales variable:

- $SIZE_{ij}$ – book value of total assets;
- $DEBT_{ij}$ – book value of total debt;
- $CAPX_{ij}$ – capital expenditures;
- FCF_{ij} – free cash flow.

The primary objectives of the multivariate models outlined above are: a) to account for the two dimensions of firm diversification simultaneously, b) to use a firm-valuation metric that is relatively more common in the current literature and c) to test for the possible interaction effect resulting from the firms' decisions to pursue dual diversification strategies. For this purpose, interaction term D_{ij} is introduced to the model in Equation 4 (D_{3ij} in Equation 3). For both models it is included as the indicator variable: it equals 1 if the firm reports more than one geographic and more than one industrial segment for the same year, and it equals zero otherwise. Addition of this term into the model is one way of finding valuation differentials across various geographic-industrial diversification combinations. A parameter estimate for the interaction term makes it possible to test the null hypothesis that the valuation differential from the geographic diversity of the firm does not depend on the industrial diversification status. Equivalently, valuation differential resulting from the level of industrial diversification does not depend on the level of geographic diversification.

Model Evaluation and Robustness Tests

Validation of the results from the base models in Equations 3 and 4 is performed with multivariate tests on the following aspects:

- whether results are sensitive to the choice of the firm valuation metric;
- whether results are sensitive to the sample selection.

Tobin's Q metric is used for the firm-valuation in the base models. Alternatively, excess value and price-to-earnings ratios are used as the alternative valuation variables in Equations 3 and 4.

To validate results on whether EBC is used to mitigate agency problems an additional robustness test is performed. Following the methodology of Nam et al. (2006), the base sample is divided into sub-samples of firms ranked by characteristics proxying for the severity of the potential agency costs existing at these firms. The level of free cash flow is used as a proxy measure of the firm's current financial performance and the availability of financial resources for future uses, while market-to-book ratio is used as a proxy measure for future growth opportunities. Firms are sorted around respective sample medians on these two dimensions and classified as high (or low) on free cash flow if their corresponding FCF is above (or below) the sample median, and high (or low) on growth opportunities as the MB ratio for that firm is above (or below) the MB sample median, respectively. Two sub-samples are of a particular interest: firms with the relatively low cash flows and high growth opportunities theoretically should have less pronounced agency problems and use of the equity-based forms of compensation may have lesser valuation effect. At the same time firms with a higher level of free cash flow and lower growth opportunities should have greater potential for high agency problems. If diversification is a value-reducing activity for these firms, it is expected that implementation of the equity-based components in the executive compensation structures will have a more significant valuation effect within the latter group.

Lastly, there is a potential problem that results are sensitive to the sample selection and are not the same over alternative time horizons. The original sample covers fourteen years of data and to test for the potential sample selection we re-examine base models in Equations 3 and 4 on the sub-samples of the 1-year, 3-year and 5-year increments.

EMPIRICAL RESULTS

Agency Costs and Valuation of the Single-Segment and Multi-Segment Firms

Tobin's Q valuation measure is used in two base models, Equations 3 and 4, to examine the effectiveness of equity-based forms of compensation in reducing agency costs. Base models account for the industrial, geographic and dual diversification strategies adopted by the companies in the test sample. The main results are reported in Table 3. The Model 1, 2 and 3 columns show results for the Equation 3 model, which uses dummy variables for the levels of industrial and geographic diversification; the Model 4, 5 and 6 columns report results for the tests based on the continuous variables. It should be noted that most of the tests in this study using dummy variables for the diversification levels are less robust in terms of the statistical significance of the coefficient estimates and overall goodness-of-fit for the models as measured by adjusted R^2, but their results are similar to the model runs on continuous variables. To conserve space, most of the results in the following sections are reported for the tests using continuous variables, while results for the tests using dummy variables are largely omitted. Results for Models 3 and 6 are from the base model tests with added time and industry fixed effects to account for the panel nature of the sample dataset. Two first digits of the SIC industry codes are used as the industry identifiers in modeling fixed effects, and year of observation is used to model time fixed effects. The results of the fixed effects models support the overall findings of this study and are discussed below.

Additional tests with the firm-level fixed effect are performed on the Equation 3 and 4 models. These tests do not provide any additional insights into valuation effects of the diversification levels and the use of equity-based forms of compensation, and the results are not reported in Table 3. Statistical insignificance of the variables of interest in the firm-level fixed effects models (variables for the industrial, product and dual diversification strategies and use of the EBC) may be an indication of the low variability in these variables over time within individual firms, and this leads to the low explanatory power of these variables of the firm-valuation dynamics.

TABLE 3
MULTIVARIATE TEST FOR FIRM VALUATION EFFECTS OF GEOGRAPHIC, INDUSTRIAL, DUAL DIVERSIFICATION AND EBC

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Equation 3 Models			Equation 4 Models		
Intercept	2.0711 (0.0763) ***	2.0486 (0.0557) ***	1.4408 (0.0912) ***	2.0479 (0.0457) ***	2.0850 (0.0462) ***	1.4257 (0.0927) ***
Ind	0.0366 -0.0741	0.0664 (0.0396) *	-0.0471 (0.0182) ***	-	-	-
Geo	-0.6162 (0.0706) ***	-0.5736 (0.0338) ***	-0.1068 (0.0204) ***	-	-	-
IndNum	-	-	-	0.0597 (0.0095) ***	0.0416 (0.0088) ***	0.0137 (0.0036) ***
GeoNum	-	-	-	-0.1305 (0.0087) ***	-0.1633 (0.0087) ***	-0.0174 (0.0041) ***
EBC	0.8550 (0.0736) ***	0.8558 (0.0734) ***	0.2327 (0.018) ***	0.8415 (0.0743) ***	0.8558 (0.0744) ***	0.2288 (0.018) ***
GII	0.0580 (-0.0803)	-	-0.0298 (0.0230)	-0.2101 (0.0304) ***	-	-0.1058 (0.0144) ***
Size	-0.0675 (0.0115) ***	-0.0680 (0.0115) ***	-0.0385 (0.0044) ***	-0.0626 (0.0114) ***	-0.0603 (0.0116) ***	-0.0378 (0.0044) ***
Debt	-0.1406 (0.0236) ***	-0.1399 (0.0236) ***	-0.0235 (0.0075) ***	-0.1494 (0.0234) ***	-0.1512 (0.0236) ***	-0.0250 (0.0076) ***
Capx	0.8733 (0.1816) ***	0.8759 (0.1817) ***	0.6847 (0.0561) ***	0.8654 (0.1804) ***	0.8855 (0.1805) ***	0.6989 (0.0561) ***
FCF	1.8200 (0.2317) ***	1.8232 (0.2318) ***	0.7857 (0.0385) ***	1.7903 (0.2286) ***	1.7956 (0.2298) ***	0.7886 (0.0386) ***
	Obs. = 14,055 Adj.R^2= 0.07	Obs. = 14,055 Adj. R^2 = 0.07	Obs. = 14,055 Adj. R^2 = 0.15	Obs. = 14,055 Adj. R^2 = 0.07	Obs. = 14,055 Adj. R^2 = 0.07	Obs.= 14,055 Adj. R^2 = 0.15

Models 1, 2, 3 (Equation 3): $TobQ = \beta_0 + \beta_1 D_{1ij} + \beta_2 D_{2ij} + \beta_3 D_{3ij} + \beta_4 EBC_{ij} + \sum_{k=1}^{n} \beta_k C_{ijk} + \varepsilon$

Models 4, 5, 6 (Equation 4): $TobQ = \beta_0 + \beta_1 GEONUM_{ij} + \beta_2 INDNUM_{ij} + \beta_3 EBC_{ij} + \beta_4 D_{ij} + \sum_{k=1}^{n} \beta_k C_{ijk} + \varepsilon$

OLS estimates of the regression of the Tobin's Q value measure on industrial, geographic, dual diversification and compensation structures of the CEOs with control variables. The top numbers are the OLS estimates of the parameters and the numbers in parentheses are the heteroscedasticity consistent standard errors. Statistical significance of the estimated parameters is denoted with *** for the 0.01 level, ** for the 0.05 level and * for the 0.10 level.

Models 1, 2, 3 use indicator variables IND and GEO for the levels of the industrial and geographic diversification respectively. Models 4, 5, 6 use count numbers of the reported industrial and geographic segments, IndNum and GeoNum for each firm-year.

Results in the Models 3 and 6 columns are based on the fixed effects model tests. Fixed effects for the 14 years length of the test sample and 65 unique first two-digits of the SIC codes are added into the base models. Parameter estimates and corresponding standard errors for the variables of interest are reported in Model 3 and Model 6 columns.

The level of geographic diversification appears to be a value-reducing activity. This finding is strongly supported across all base models: the coefficient estimate for geographic diversification variable is negative and significant in all four models. This result is consistent with findings in prior literature. For example, Harris et al. (1982) and later Denis et al. (2002) suggest that benefits created by geographic diversification in the form of internal capital markets and firm- and market-specific risk reduction are largely offset by inefficient allocation of resources and unnecessary expansion motivated by the self-interest of the top management.

The results on the valuation effect of industrial diversification appear to be less robust than the results on geographic diversification. Coefficient estimates for industrial diversification variables are positive and statistically significant only in the models with and without fixed effects, where continuous variables are used. In the models with dummy variables, coefficients for industrial diversification are statistically insignificant at the conventional levels, except for the time and industry fixed effects model, where industrial diversification is negatively related to firm valuation.

Use of equity-based forms of compensation has a positive valuation effect across all models. Coefficient estimates for the EBC variable are statistically significant and approximately of the same magnitude across all six base models. Overall, these results are also robust across all additional tests explained below. Results on the use of the EBC are consistent with prior compensation literature. Nam et al. (2006) report a positive relationship between firm-valuation and adoption of equity-based components in compensation structures of the top managers; Duru, Reeb (2002) suggest that the increased complexity of diversified firms affects the level and structure of managerial compensation, and that it is beneficial to implement performance-based compensation mechanisms because of the higher cost of monitoring the managers.

The finding that geographic diversification is a value-penalizing activity and that industrial diversification is positively related to firm-valuation raises an important question regarding the combined valuation effect of the dual diversification strategy. There might be a mutual offsetting between geographic and industrial expansion and it is important to understand the net effect of the two strategies on firm-valuation. For example, Bodnar et al. (2003) report evidence that a diversification premium exists for companies that are diversified geographically or industrially. Denis et al. (2002) use the same sample as in the above-mentioned study but report opposite results, finding that there is a diversification discount for either diversification strategy. This finding is confirmed by Kim, Mathur (2008), who also find a diversification discount for companies expanding either on the product or the geographic dimension.

We introduce the indicator variable GII to identify companies pursuing dual diversification strategies. Results for the GII variable appear to be less robust than for the individual diversification variables. The parameter estimate for GII is statistically insignificant across all models utilizing dummy variables. It is statistically significant only in the models using continuous variables measuring industrial and geographic diversification characteristics of the firms. Moreover, results are robust across sub-samples being used: GII is negative in the tests on the entire test sample and shorter sub-samples in the robustness section below. GII is also negatively related to the firm valuation using the EV measure instead of the Tobin's Q; however, it is statistically insignificant in the model with PE used for the valuation measurement.

Two observations can be made on the results of this study. Firstly, it is important to account for both dimensions of diversification in empirical models, something that has become a standard practice only in relatively recent diversification literature. Secondly, the possibility of interaction between two forms of diversification should be taken into consideration, as the joint effect of diversification for the firms pursuing dual diversification strategies is not known beforehand and the prevailing of one of the diversification forms can lead to different consequences in valuation of the firm.

Robustness Tests

Two robustness checks are performed to ensure that study results are not driven by the methodologies of this study or sample selection. Robustness tests are conducted on the sub-samples of firms sorted by the levels of agency problems: two-dimensional sorting is done on the levels of the market-to-book ratios and the levels of free cash flows.

In the first test we analyze a choice of the firm-valuation metric to ensure it does not affect results under the base model tests. In the base models, Equations 3 and 4, Tobin's Q valuation measure is used, which is relatively a more traditional valuation technique in the literature. Alternatively, we re-evaluate the base models' results with the excess value measure and price-to-earnings ratio. Two valuation metrics are used in the models with both continuous and indicator variables for geographic and industrial diversification. Since the results are qualitatively similar between models in Equations 3 and 4, we report results only for the models with continuous variables, both with and without the indicator variable for dual diversification, in Table 4. There is a high degree of consistency between models using alternative valuation measurements: for all models, there is a positive and statistically significant relationship between firm value and degree of industrial diversification, and a negative relationship between valuation and the level of geographic diversification. Reliance on equity-based compensation has a positive effect on firm-valuation, regardless of the valuation measurement used. There is significant positive relationship between EBC and firm-valuation across all models.

TABLE 4
ROBUSTNESS TESTS USING DIFFERENT VALUATION METRICS

OLS estimates of the regression of the EV and PE value measures on industrial, geographic, dual diversification and compensation structures of the CEOs with control variables. The top numbers are the OLS estimates of the parameters and the numbers in parentheses are the heteroscedasticity consistent standard errors. Statistical significance of the estimated parameters is denoted with *** for the 0.01 level, ** for the 0.05 level and * for the 0.10 level.

	EV	PE	EV	PE
Intercept	0.2693 (0.0990) ***	20.7981 (3.5373) ***	0.3150 (0.1005) ***	20.2193 (3.6290) ***
IndNum	0.1055 (0.0165) ***	1.1396 (0.6158) *	0.0829 (0.0154) ***	1.4247 (0.6586) **
GeoNum	-0.1669 (0.0183) ***	-2.2347 (1.0018) **	-0.2088 (0.0175) ***	-1.7051 (0.7979) **
EBC	1.4466 (0.1606) ***	23.3436 (4.9454) ***	1.4642 (0.1610) ***	23.1216 (4.8989) ***
GII	-0.2647 (0.0525) ***	3.3477 (2.9963)	- -	- -
Size	0.2826 (0.0562) ***	4.6607 (1.7631) ***	0.2862 (0.0564) ***	4.6151 (1.7583) ***
Debt	-0.3808 (0.0909) ***	-4.3179 (2.7761)	-0.3840 (0.0912) ***	-4.2769 (2.7781)
Capx	4.8833 (0.8326) ***	50.7182 (32.1479)	4.9123 (0.8309) ***	50.3508 (32.1036)
FCF	3.3820 (0.5244) ***	-34.8384 (13.4265) ***	3.3895 (0.5260) ***	-34.9332 (13.4528) ***
	Obs. = 14,055 Adj. R^2 = 0.06	Obs. = 14,055 Adj. R^2 = 0.01	Obs. = 14,055 Adj. R^2 = 0.06	Obs. = 14,055 Adj. R^2 = 0.01

The valuation implications of the interacting effect of two-dimensional diversification strategies are less clear. Geographic and industrial diversification interaction is not consistently significant across the continuous and dummy variables base models, leading to an inconclusive answer to the question of how firms pursuing a dual diversification strategy should be valued relative to their less diversified

counterparts. Using alternative valuation measures does not provide any additional insights into this matter. In the model using the PE ratio, the parameter estimate for the dual diversification indicator variable is positive but statistically insignificant at the conventional significance levels. Model results using EV are consistent with the base models utilizing Tobin's Q: interaction term is statistically significant and negative for both models, meaning that a dual diversification strategy is a more value-penalizing activity relative to single-dimensional diversification.

Another test is performed using sub-samples sorted by the levels of free cash flow and growth opportunities. Table 5 presents the results of the base models run separately on the sub-samples with high- and low-potential agency problems. The results are consistent with the idea that higher equity-based compensation has a more significant effect on the valuation of companies with higher agency problems. In both base models, the coefficient estimate for the EBC variable is positive and statistically significant at the 1% significance level for the sub-sample of firms with high free cash flow levels and low growth opportunities. On the other hand, for companies in the low agency sub-sample, EBC has a much less pronounced valuation effect: the coefficient estimate on the equity-based compensation variable is statistically insignificant at the conventional 5% significance level, although it is significant at the 10% level. The valuation effect of diversification strategies remains consistent across the firms with different levels of agency problems: geographic diversification is an equally value-reducing activity for both group, and dual diversification strategies result in a lower firm valuation across both sub-samples of firms. Similarly to the base model tests, industrial diversification is positively related to firm valuation for firms grouped by a high level of the agency problems; however, the coefficient estimates for the industrial diversification variable are statistically insignificant in the tests on the sub-sample of companies with low agency problems.

There are a few inconsistencies in the signs of the coefficient estimates for some of the control variables. There appears to be a size premium in the sub-sample of firms with low agency problems. The coefficient estimate for capital expenditures is negative for the high agency problems group. In an attempt to reconcile the sign changes we repeat the tests on the sub-sample of firm with high and low agency problems using robust regression to account for the possible effect of outliers in the data. However, there is no indication of results sensitivity to outliers, as the coefficient estimates for the variables in question retain the same signs. A possible explanation may be that firms with limited financial resources and good growth opportunities are valued more highly if they find opportunities to expand current operations, as measured by the size and capital expenditures variables. On the other hand, firms with relatively higher financial resources and low growth opportunities get a lower valuation with increasing size and capital expenditure levels. Finally, the coefficient estimate of the parameter for the free cash flow variable is unexpectedly negative for the low agency problems group. Robust regression results also confirm a negative relationship between the FCF levels and firm valuation. A possible explanation of this phenomenon may be in the FCF data characteristics for this group of firms. Firms sorted into the high agency problems sub-sample have the highest level of cash flows in the entire test sample, while low agency problems firms have positive and negative levels of FCF observations for positive firm valuations. This suggests non-linear relationship between firm valuations and FCF levels for companies in the low agency problems sub-sample. This is confirmed with an additional test where we drop twenty percent of the largest negative observations on the FCF variable from this sub-sample and find a positive relationship between the level of the FCFs and firm valuation, while parameter estimates for the other variables in the model retain their signs and statistical significance.

TABLE 5
VALUATION EFFECTS OF GEOGRAPHIC, INDUSTRIAL, DUAL DIVERSIFICATION AND EBC ACROSS FIRMS WITH VARYING LEVELS OF AGENCY PROBLEMS

OLS estimates of the regression of the Tobin's Q value measure on industrial, geographic, dual diversification and compensation structures of the CEOs with control variables. The top numbers are the OLS estimates of the parameters and the numbers in parentheses are the heteroscedasticity consistent probability levels of rejecting the null hypotheses of parameter equal to zero. Statistical significance is indicated with *** for the 0.01 level, ** for the 0.05 level and * for the 0.10 level.

	High FCF – Low MB	High FCF – Low MB	Low FCF – High MB	Low FCF – High MB
Intercept	1.3465 (0.0161)***	1.3548 (0.0161) ***	2.8912 (0.0887) ***	2.9791 (0.0921) ***
IndNum	0.0338 (0.0041) ***	0.0273 (0.0037) ***	-0.0119 (0.0201)	-0.0425 (0.0200) **
GeoNum	-0.0187 (0.0032) ***	-0.0263 (0.0029) ***	-0.1079 (0.0210) ***	-0.1761 (0.0221) ***
EBC	0.1194 (0.0197) ***	0.1249 (0.0197) ***	0.2829 (0.1283) **	0.2947 (0.1287) **
GII	-0.0531 (0.0126) ***	- -	-0.4076 (0.0669) ***	- -
Size	-0.0304 (0.0034) ***	-0.0298 (0.0034) ***	0.1984 (0.0920) **	0.1998 (0.0937) **
Debt	-0.0196 (0.0065) ***	-0.0203 (0.0066) ***	-0.5764 (0.1483) ***	-0.5744 (0.1506) ***
Capx	-0.4040 (0.0653) ***	-0.4016 (0.0658) ***	-0.6978 (0.2568) ***	-0.6588 (0.2593) ***
FCF	0.2279 (0.0543) ***	0.2373 (0.0560) ***	-1.4601 (0.5200) ***	-1.4120 (0.5245) ***
	Obs. = 2,844 Adj. R^2 = 0.17	Obs. = 2,844 Adj. R^2 = 0.17	Obs. = 2,831 Adj. R^2 = 0.03	Obs. = 2,831 Adj. R^2 = 0.03

In the final robustness test, we seek to determine if the results of the base models are sensitive to the sample selection. The size of the base sample provides the flexibility to validate model results over various time sub-periods. We divide the test sample into smaller sub-samples of varying time increments: one, three and five year periods. The results for the three five-year periods are reported in Table 6. The results have a high degree of consistency with the findings based on all of the sample tests: industrial diversification leads to a positive valuation effect over all sub-periods, except for the marginally insignificant relationship in one out of six models, where the dummy variable for dual diversification is not included; geographic diversification proves to be a consistently value-decreasing activity across all three sub-periods. Equity-based compensation also consistently shows a strong positive effect on the firm valuation. It is still less clear how firm valuation is affected by the decisions to pursue dual diversification strategies. The indicator variable for dual diversification, GII, is less robust over time: the parameter estimator for GII is statistically significant and negative only in the early sub-period, from 1993 to 1996. It is statistically insignificant over the subsequent two periods reported in Table 6. Results over shorter sub-samples of one- and three-year intervals are qualitatively similar to the 5-year sorts and base sample: parameter estimates for EBC, industrial and geographic diversification individually are robust and

confirm the findings outlined above that industrial diversification and utilization of EBC result in a relatively higher firm valuation, while geographic diversification is a value-penalizing activity.

TABLE 6
ROBUSTNESS TESTS OVER DIFFERENT SUB-PERIODS

OLS estimates of the regression of the Tobin's Q value measure on industrial, geographic, dual diversification and compensation structures of the CEOs with control variables. The top numbers are the OLS estimates of the parameters and the numbers in parentheses are the heteroscedasticity consistent standard errors. Statistical significance of the estimated parameters is denoted with *** for the 0.01 level, ** for the 0.05 level and * for the 0.10 level.

	Period 1993-96		Period 1997-01		Period 2002-06	
Intercept	1.7733 (0.0712) ***	1.8816 (0.0735) ***	2.1880 (0.1035) ***	2.2348 (0.1040) ***	2.0812 (0.0540) ***	2.0688 (0.0537) ***
IndNum	0.1620 (0.0238) ***	0.1362 (0.0238) ***	0.0750 (0.0210) ***	0.0514 (0.0193) ***	0.0352 (0.0096) ***	0.0396 (0.0080) ***
GeoNum	-0.0479 (0.0112) ***	-0.1723 (0.0102) ***	-0.1952 (0.0209) ***	-0.2278 (0.0208) ***	-0.1143 (0.0092) ***	-0.1070 (0.0083) ***
EBC	0.3671 (0.0816) ***	0.3968 (0.0820) ***	1.1970 (0.1563) ***	1.2080 (0.1569) ***	0.4188 (0.0701) ***	0.4219 (0.0702) ***
GII	-0.4519 (0.0425) ***	- -	-0.2343 (0.0687) ***	- -	0.0540 (0.0483)	- -
Size	-0.1156 (0.0176) ***	-0.1107 (0.0171) ***	-0.0186 (0.0214)	-0.0150 (0.0218)	-0.1052 (0.0156) ***	-0.1057 (0.0156) ***
Debt	-0.0459 (0.0352)	-0.0539 (0.0351)	-0.2757 (0.0485) ***	-0.2791 (0.0488) ***	-0.0417 (0.0237) *	-0.0415 (0.0237) *
Capx	0.6455 (0.1692) ***	0.6375 (0.1708) ***	1.6556 (0.3677) ***	1.6712 (0.3673) ***	0.2240 (0.2224)	0.2039 (0.2200)
FCF	1.3711 (0.2528) ***	1.3225 (0.2533) ***	2.7621 (0.4197) ***	2.7503 (0.4234) ***	1.4714 (0.3227) ***	1.4686 (0.3218) ***
	Obs. = 4,110 Adj. R^2 = 0.11	Obs. = 4,110 Adj. R^2 = 0.10	Obs. = 5,309 Adj. R^2 = 0.07	Obs. = 5,309 Adj. R^2 = 0.07	Obs. = 4,636 Adj. R^2 = 0.12	Obs. = 4,636 Adj. R^2 = 0.12

CONCLUSION

This study takes a multi-dimensional approach to the examination of the individual and joint effects of geographic and industrial diversification on firm value and examines how equity-based compensation for CEOs helps mitigate agency problems and subsequently affects firm valuation. The main results indicate that industrial diversification has a positive valuation effect, while geographic diversification is a value-penalizing activity. Dual diversification strategies have a negative valuation effect, and firms pursuing dual diversification strategies are valued at a discount relative to their more focused counterparts. Implementation of EBC for CEOs helps mitigate agency problems and has a positive valuation effect across all the firms used in this study.

Using alternative valuation measures of excess value and price-to-earnings ratio generally leads to the same results as in the base model tests on the Tobin's Q valuation metric. Repeating tests on the sub-samples over various time periods of one, three and five years also supports the study's results: EBC and industrial diversification both have a positive valuation effect, while geographic and dual diversification strategies are value-reducing activities.

Finally, to examine the effects of equity-based compensation on firm value, we partition the sample into firm groups ranked by their level of potential agency problems. Two sub-samples of firms are tested: firms with large available financial resources and limited growth opportunities are classified as having a high potential for agency problems, while firms with relatively lower levels of cash flow but better growth opportunities are considered as having the lowest level of agency problems. We find a strongly significant positive relationship of equity-based compensation to the firm valuation in the sub-sample of the companies with high potential for agency problems, while the EBC value effect is statistically insignificant for firms with a lower level of agency problems. These findings support our hypothesis that higher equity-based compensation has a positive effect on firm valuation and that the use of EBC can at least partially mitigate the agency costs of geographic and dual diversification decisions.

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