ESSAYS ON CORPORATE DIVERSIFICATION AND FIRM VALUE

DISSERTATION

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By

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ABSTRACT

This dissertation finds new evidence on the relationship between diversification and firm performance. In Chapter Two, theory and evidence are presented showing how empirical studies accounting for the endogeneity of the diversification decision must also account for a firm's alternative uses for its free cash flow. This chapter examines dividends and stock repurchases in tandem with the firm's diversification decision and finds that the factors that lead a firm to diversify also make it more likely to pay a dividend. Controlling for this relationship, the diversification premium found by recent research correcting for endogeneity turns back into a discount.

In Chapter Three, consideration is given to the possibility that different firms can have differing results from diversification. Using a random parameters model, a distribution of firm-specific diversification effects is estimated, finding that, while diversification destroys value on average, it creates value for a quarter of firms. This chapter also hypothesizes that firms may have an optimal portfolio of businesses, and firms that are not creating value from diversification could potentially do so through by diversifying further. Through a series of hypothetical related and unrelated diversification scenarios, this chapter finds that almost half of the diversified firms who are not creating value through their past diversification efforts would create value from

further related diversification; while very few of the firms that are currently creating value from diversification would create value from further diversification. After observing the heterogeneity across firms in the impact of diversification on firm performance, theory and evidence is presented on the source of this heterogeneity in Chapter Four. Using a Bayesian linear hierarchical model, firm-specific effects of diversification on firm performance are estimated as a function of firm attributes. The main finding is that the firm-specific resources that allow a firm to succeed in its original business, allow the firm to succeed through related diversification. Unsuccessful firms will not find success simply by finding a new market in which to compete.

Dedicated to the loves of my life—my sweetheart and colleague Alison, and my daughter Brooke. Your love and prayers are always with me.

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Truly, I can only express my feelings in song, to the tune of "Carmen, Ohio"

Oh come let's sing Jay Barney's praise
E'en louder than Jay's voice we'll raise
We've made it through in just four years,
We've parried reviewer #2's jeers
From staying up to work on slides
To winning the SMS big prize
Someday, we'll refine RBV
How firm thy friendship, Jay Barney!

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FIELDS OF STUDY

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CHAPTER 1

INTRODUCTION

Strategy scholars have been trying for years to reconcile resource-based theory on why diversification should create value for firms with evidence that it does not. Recent works have given new hope to the belief that diversification can create value (Maksimovic and Phillips, 2002; Campa and Kedia, 2002; Gomes and Livdan, 2004; Miller, 2004). The empirical works (Campa and Kedia, 2002; Miller, 2004) have presented evidence that after correcting for the endogeneity of a firm's decision to diversify, diversification creates value on average.

This dissertation examines the relationship between diversification and performance more closely. In Chapter Two, theory is presented on why research correcting for the endogeneity of a firm's diversification decision must also account for the endogeneity of a firm's decision to pay a dividend or repurchase stock, since the factors that lead a firm to diversify also may lead it to pay a dividend or repurchase stock. An empirical test of this theory shows that considering both of these decisions turns the recent diversification premium findings back into a discount.

In Chapter Three, theory and evidence are presented that diversification may have different effects for different firms. It may create value for some firms and destroy it for others. Using a random parameters model, a distribution of firm-specific diversification effects is estimated, finding that, while firms' past diversification moves have destroyed value on average, it has created value for between 22-27% of diversified firms, and that related diversifiers fare no better than unrelated diversifiers. This chapter also hypothesizes that firms may have an optimal portfolio of businesses, and firms that are not creating value from diversification could potentially do so through further diversification. Through a series of hypothetical related and unrelated diversification scenarios, this chapter finds that almost half of the diversified firms that are not creating value through their past diversification efforts would improve their value through further diversification.

In Chapter Four, the focus shifts from observing the heterogeneity across firms in the effect of diversification on firm performance to an examination of why diversification creates value for some firms and does not create value for others. Using a Bayesian linear hierarchical model, firm-specific effects of diversification on firm performance are estimated as a function of firm attributes. The central finding is that the firm-specific resources that allow the firm to succeed before diversifying allow it to succeed in its diversification efforts. Unsuccessful firms will not find success simply by finding a new market in which to compete.

CHAPTER 2

DIVERSIFICATION, PAYOUT POLICY, AND THE VALUE OF A FIRM

Research on the relationship between corporate diversification and firm value has evolved rapidly over the last several years. Initially, research by Lang and Stulz (1994), Comment and Jarrell (1995), Berger and Ofek (1995), and others showed that diversified firms trade at a significant discount relative to focused firms operating in the same industries. Speculation as to the source of this discount focused primarily on inefficient internal capital markets (Shin and Stulz, 1998) and other agency problems (Denis, Denis, and Sarin (1997), Rose and Shepard (1997), Scharfstein and Stein (2000).

More recently, the existence of this diversification discount has come into question. Empirically, Campa and Kedia (2002) and Villalonga (2004) showed that, controlling for a firm's propensity to diversify, a small diversification premium exists. Theoretically, Maksimovic and Phillips (2002) and Gomes and Livdan (2004) showed that, in some circumstances, diversification can be a valuing maximizing choice, even if, overall, diversified firms have a lower value than focused firms.

While this stream of research has substantially increased our understanding of the relationship between diversification and firm value, to this point, it has failed to examine the relationship between a firm's decision to diversify and other corporate actions a firm might take. In particular, this paper examines a firm's payout strategy as an alternative to diversification, and examines the simultaneous decision to diversify, or not, and to pay cash out to shareholders, or not, on the value of a firm.

Firms with free cash flow and limited growth options in their current business activities can use this cash to diversify or can return it to shareholders in the form of a dividend or through a stock buyback plan. The decision about whether or not to diversify cannot be made without understanding the value of the opportunity foregone of paying out this cash to shareholders. Failure to control for this payout option in investigating the relationship between diversification and firm value may lead to statistically biased results.

Our results suggest that after controlling for a firm's propensity to diversity and its propensity to payout cash to shareholders, firms that choose to diversify trade at a significant discount compared to firms that pay cash back to shareholders and also compared to focused firms.

The approach taken in this paper is to replicate, first, the Berger and Ofek (1995) diversification discount results. Then, the Campa and Kedia (2002) diversification premium finding is replicated, using the same modeling approach applied by these authors. These two replications ensure that our final results do not depend on some unusual attributes of our data or method. Next, the impact of a firm's diversification choices and its payout policy on its value are examined by endogenizing both the propensity to diversify and the propensity to payout with a bivariate probit selection model. Controlling for these propensities, the impact of diversification and payout on firm value are examined.

2.1. Replicating the Diversification Discount Finding

2.1.1. Data

The sample for this, and all subsequent analyses, includes all firms in the Compustat Industry Segment file from 1985 to 1997[1]. Sample selection criteria are similar to those used by Berger and Ofek (1995) and Campa and Kedia (2002): firm years that have any segments in financial industries, years where total firm sales are less than $20 million, firm years where the sum of segment sales differs from total firm sales by more than one percent, and years where the data does not provide four-digit SIC industry coding for all of its reported segments are removed from the sample. The final sample contains 30,096 observations and 5,606 firms.

Following Berger and Ofek (1995) and Campa and Kedia (2002), firm value is measured by the ratio of total firm capital to sales[2], where total capital is equal to the sum of the market value of equity, long-term and short-term debt, and preferred stock. To estimate the effect of diversification on firm value, the value of a diversified corporation is compared to the value that diversified corporation *would* have if it were broken into single-segment firms. This counterfactual value, called the "imputed value" in the literature (LeBaron and Speidell, 1987; Lang and Stulz, 1994; Berger and Ofek, 1995;

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[1] The years after 1997 are not used due to concerns about the changes in SIC classification of firms after that year; however, all the results presented in this paper are robust to using data through 2002.

[2] Campa and Kedia (2002) also calculated firm value as firm capital to assets. A significant diversification premium was not found using this measure. This paper only replicates the central results from Campa and

Campa and Kedia, 2002), is estimated for each segment by approximating its value as the median value of undiversified segments in the same industry.

To calculate the imputed value of a segment, the segment is valued by multiplying the segment's sales with the median value for single-segment firms in the segment's industry (a segment's industry is defined as the most restrictive SIC grouping—4-digit, 3-digit, or 2-digit—that includes at least five firms).[3] Using the imputed values of each segment, the imputed value of the corporation is calculated as the sum of each of its segments' imputed values.

Finally, the value of the diversified corporation is compared to its imputed value by dividing the actual value by the imputed value. If the actual value is greater than the imputed value, this ratio will be greater than one. The natural log of this ratio is called "excess value" and is used as the dependent variable in the antecedent literature (Berger and Ofek, 1995; Campa and Kedia, 2002) as well as in this study. A negative excess value indicates that that the firm has a lower value than its imputed value (discount) and a positive excess value indicates that the firm has a higher value than its imputed value (premium). Following Berger and Ofek (1995) and Campa and Kedia (2002), extreme excess values of more than 1.386 or less than –1.386 are eliminated from the sample.

Descriptive statistics are presented in Table 2.1. The median discount for diversified firm years is 8.6 percent, similar to the discounts reported by Berger and Ofek (1995) and Campa and Kedia (2002) of 10.6 and 10.9, respectively. Differences between this data set and the data used by Campa and Kedia (2002) are likely due to the time periods

Kedia using the firm capital to sales measure of firm value.

[3] Seventy nine percent were matched at the 4-digit SIC level, 13 percent at the 3-digit level, and 8 percent at the 2-digit level. This sample has more matches at the 4-digit level than Berger and Ofek (1995) or

studied in the different papers, as Campa and Kedia use data from the years 1978-1996. In Campa and Kedia's (2002) dataset, average excess value for all firms is lower in the years before 1985, so if the average excess value is lower for diversified firms as well, then this would explain the difference in the data. When Campa and Kedia (2002) restrict their data, to the years 1986-1991, the same years used by Berger and Ofek (1995), their median discount is 7.6 percent. In the data used in this paper, the median discount for diversified firms is 5.9 percent for the years 1986-1991. Other differences may be due to firms restating their financial statements, and also because when Compustat adds firms to the database, they will often add data on previous years for these firms. Even so, this smaller discount is likely to favor finding a diversification premium.

Table 2.1 also shows that firms that payout cash to shareholders are more likely to diversify (39%) than non-payout firms (18%) and that firms that payout cash to shareholders have a higher excess value than non-payout firms. Also, the simple cross tabulation reported in Table 2.1 shows that firms that diversify and do not return cash to investors have a negative excess valuation (-0.19), while firms that return cash to investors and do not diversify have a positive excess valuation (0.05). However, these descriptive results do not control for the endogeneity and sample selection problems identified in the diversification discount literature.

Diversified firms have more assets, higher profitability, lower median investment (but higher mean investment), higher leverage, and lower excess value than focused firms. Firms that pay a dividend or repurchase stock have more assets, higher profitability, higher investment, lower mean leverage (but higher median leverage), and higher excess

Campa and Kedia (45 percent and 50 percent, respectively).

	Obs.	Total Assets		EBIT/SALES		CAPX/SALES		DEBT/TA		CASH/AT		Excess Value	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Diversified Firms	8,683	2.23	0.41	0.09	0.09	0.08	0.05	0.23	0.21	0.08	0.04	-0.08	-0.09
Non-Diversified Firms	21,413	0.98[1]	0.14[1]	0.07[1]	0.07[1]	0.09[1]	0.04[1]	0.21[1]	0.17[1]	0.11[1]	0.05[1]	-0.05[1]	-0.01[1]
Payout Firms	14,406	2.38	0.42	0.11	0.10	0.09	0.05	0.20	0.19	0.09	0.04	0.02	0.00
Non-Payout Firms	15,690	0.39[2]	0.10[2]	0.05[2]	0.05[2]	0.08[2]	0.04[2]	0.23[2]	0.18[2]	0.12[2]	0.06[2]	-0.13[2]	-0.11[2]
Diversified, Payout Firms	5,743	3.04	0.91	0.11	0.10	0.08	0.05	0.21	0.20	0.08	0.04	-0.03	-0.03
Diversified, ~ Payout Firms	2,940	0.64	0.11	0.06	0.06	0.07	0.04	0.27	0.23	0.09	0.04	-0.19	-0.22
~ Diversified, Payout Firms	8,663	1.95	0.30	0.11	0.09	0.10	0.05	0.19	0.18	0.10	0.05	0.05	0.02
~ Diversified, ~ Payout Firms	12,750	0.33	0.09	0.04	0.05	0.08	0.04	0.21	0.16	0.12	0.06	-0.12	-0.09
Total	30,096	1.34	0.18	0.08	0.07	0.08	0.04	0.21	0.19	0.10	0.05	-0.06	-0.03

[1] The difference from diversified firms is significant at the one percent level.
[2] The difference from payout firms is significant at the one percent level.

Table 2.1: Descriptive Statistics. The significance of the difference in means is calculated with a two-sample t-test. The significance of the difference in medians is calculated with the nonparametric median test.

value than firms that do not repurchase or pay a dividend. The range of excess value over time is also reported in Table 2.2, with a low median of -.06 in 1985 and a peak median of 0 in 1989 and 1990.

Year	Mean	Median	SD	N
1985	-0.083	-0.062	0.517	1408
1986	-0.061	-0.056	0.520	2082
1987	-0.036	-0.010	0.540	2093
1988	-0.029	-0.007	0.521	2097
1989	-0.012	0.000	0.525	2155
1990	-0.025	0.000	0.558	2174
1991	-0.061	-0.027	0.560	2194
1992	-0.080	-0.046	0.561	2289
1993	-0.088	-0.060	0.554	2397
1994	-0.073	-0.047	0.553	2551
1995	-0.072	-0.039	0.568	2751
1996	-0.064	-0.034	0.577	2898
1997	-0.071	-0.028	0.579	3007

Table 2.2: The Distribution of Excess Value over Time

2.1.2. Models and Results

Berger and Ofek's (1995) model is replicated: excess value is expressed as a function of firm size (measured by the log of assets), profitability (measured as return on sales), investment (measured as capital expenditure divided by sales), two lags of firm size, profitability, and investment, leverage (measured as the debt to asset ratio), liquidity, (measured by a dummy indicating whether a firm belongs to the S&P industrial or transportation index, since firms belonging to the S&P index have higher liquidity), firm size squared, and a dummy that indicates whether the firm is diversified. Results of this

OLS model are presented in Column A of Table 2.3 and are generally consistent with Berger and Ofek (1995). In particular, the coefficient for diversification in this equation is negative, indicating a diversification discount.

2.2. Replicating the Diversification Premium Finding

Campa and Kedia (2002) argued that firms that have few growth options in their current businesses may maximize their market value by engaging in a diversification strategy. To control for the propensity of a firm to diversify on the impact of diversification strategy on firm value, they adopted a two-step estimation process.

2.2.1. Model

Campa and Kedia (2002) estimate excess firm value, V_{it}, using the following model:

$$V_{it} = \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + e_{it}, \quad (1)$$

where X_{it} represents exogenous firm characteristics, e_{it} is an error term, and D_{it} is a dummy variable equal to 1 for diversified firms and 0 otherwise. Their sample selection model hypothesizes that firms are not randomly assigned diversification strategies, but rather they choose them based on an unobserved latent variable that also affects firm value, D^*_{it}, which is determined by another set of firm characteristics such that

$$\begin{aligned} D^*_{it} &= \beta Z_{it} + \mu_{it} \\ D_{it} &= 1 \ if \ D^*_{it} > 0, 0 \ \ otherwise \end{aligned} \quad (2)$$

where Z_{it} is a set of firm characteristics that affect a firm's decision to diversify and μ_{it} is an error term. Estimation of (1) by OLS will lead to biased estimators. Campa and

Kedia (2002) use Heckman's (1979) two-step estimator to correct for the self-selection. The correction for self-selection, is found by estimating the self selection corrections

$$\lambda_1(\beta Z_{it}) = \frac{\phi(\beta Z_{it})}{\Phi(\beta Z_{it})} \qquad \lambda_2(\beta Z_{it}) = \frac{-\phi(\beta Z_{it})}{1-\Phi(\beta Z_{it})} \quad , \quad (3)$$

where $\varphi(.)$ and $\Phi(.)$ are the density and the cumulative distribution functions, respectively, of the standard normal distribution and using the correction in (1) and estimating

$$\begin{aligned} V_{it} &= \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + \delta_\lambda \left[\lambda_1(\hat{\beta} Z_{it}) D_{it} + \lambda_2(\hat{\beta} Z_{it})(1 - D_{it})\right] + \eta_{it} \\ V_{it} &= \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + \delta_\lambda \lambda + \eta_{it} \end{aligned} \quad (4)$$

The replication of Campa and Kedia's (2002) premium result uses maximum likelihood estimation (MLE) to account for self-selection. MLE is used rather than a Heckman (1979) two-step estimator because it is more efficient (Nawata (1994)), although results are robust to using a two-step estimator as well.

Following Campa and Kedia (2002), excess value is estimated as a function of the same independent variables as specified in the replication of the Berger and Ofek (1995) model, plus dummy variables for each year. The selection equation for the second model, a probit estimator of a firm's decision to diversify, includes firm size, profitability, investment, and their one and two-period lags, liquidity (described previously), and a dummy indicating if the firm is traded on a major exchange (NYSE, AMEX, or NASDAQ)—since firms traded in major exchanges are more likely to be diversified. Since foreign firms often list in the U.S. (and thus enter the sample) before diversifying, a dummy equal to one if the firm is incorporated outside the U.S. is also included. Macroeconomic trends are accounted for by the present and lagged values in the growth rate of real GDP. To control for time-invariant firm characteristics, the average values of size, profitability and investment are included. To account for time-varying industry heterogeneity at the two-digit level, the percent of industry sales that take place in diversified firms is included in the model. These variables are all included in Campa and Kedia's (2002) selection model. The selection model also includes industry dummy variables at the two-digit SIC level to account for time-invariant industry level heterogeneity. These industry level variables are especially important for ensuring that the selection model is identified, since the dependent variable, excess value, is divided by an industry median, so that the industry-level instruments are almost certain to be uncorrelated with the dependent variable.

2.2.2. Results

Results for the selection model are presented in Table 2.4. The self-selection parameter, λ, is equal to -.16 and is significant at the 1 percent level, meaning that in this specification of the model, self-selection bias is detected and the factors that lead firms to choose to diversify also decrease firm value.

The impact of diversification on firm value, controlling for a firm's propensity to diversify, is reported in Column B of Table 2.3. These results are consistent with Campa and Kedia's (2002) finding of a diversification premium.

Campa and Kedia also estimated two alternative models to the self-selection model—a fixed effects and a two stage least squares (2SLS) model. The fixed effects model is not replicated here since Campa and Kedia's estimation of fixed effects did not find a

	Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H	Column I	Column J
	Model 1: OLS	**Model 2: Self-Selection**	**Model 3: Self-Selection**	**Model 4: Self-Selection**	**Model 5: Self-Selection**	**Model 6: Self-Selection**	**Model 7: Self-Selection**	**Model 8: Self-Selection**	**Model 9: Fixed Effects Self-Selection**	**Model 10: Fixed Effects Self-Selection**
Constant	-0.896***	-.949***	-0.86***	-0.79***	-0.89***	-0.82***	-0.87***	-0.87***	-0.09	-0.09
Log of total assets	0.602***	0.620***	0.60***	0.59***	0.59***	0.58***	0.60***	0.60***	0.28***	0.29***
EBIT/SALES	0.407***	0.378***	0.39***	0.33***	0.43***	0.38***	0.44***	0.44***	0.40***	0.40***
CAPX / SALES	0.164***	0.193***	0.15***	0.16***	0.16***	0.16***	0.17***	0.17***	0.23***	0.23***
EBIT/SALES (1 lag)	0.264***	0.247***	0.23***	0.14***	0.23***	0.15***	0.26***	0.26***	0.21***	0.21***
CAPX/SALES (1 lag)	0.072***	0.083***	0.06**	0.07**	0.07***	0.07**	0.07***	0.07***	0.02	0.02***
Log of TA (1 lag)	-0.256***	-0.257***	-0.25***	-0.24***	-0.25***	-0.25***	-0.26***	-0.26***	-0.29***	-0.29***
EBIT/SALES (2 lags)	0.361***	0.371***	0.32***	0.28***	0.32***	0.28***	0.34***	0.34***	0.22***	0.22***
CAPX/SALES (2 lags)	0.052***	0.074***	0.04**	0.06***	0.04**	0.06**	0.05**	0.05**	0.03*	0.03*
Log of TA (2 lags)	-0.134***	-0.165***	-0.14***	-0.17***	-0.15***	-0.17***	-0.14***	-0.14***	-0.09***	-0.09***
S&P	0.213***	0.211***	0.20***	0.19***	0.19***	0.18***	0.20***	0.20***		
Leverage	0.062***	0.065***	0.06***	0.07***	0.11***	0.12***	0.11***	0.11***	0.29***	0.29***
(Log of TA)^2	-0.015***	-0.015***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	0.01***	0.01***
R&D/SALES					0.76***	0.92***	0.74***	0.75***	0.42***	0.43***
Diversified	-0.077***	0.174***	-0.30***	-0.09***	-0.26***	-0.03	-0.08***	-0.03***	-0.12***	-0.06***
Payout			0.10***		0.12***		0.04***		0.07***	
Diversified, ~ Payout				-0.31***		-0.30***		-0.04***		-0.08***
~ Diversified, Payout				0.28***		0.29***		0.05***		0.04***
Lambda$_D$		-0.164***	0.14***	0.18***	0.11***	0.15***	-0.01	-0.01	-0.01*	-0.01*
Lambda$_P$			-0.05***	-0.17***	-0.06***	-0.16***	-0.01	-0.02***	-0.01***	-0.02***
R^2	.19		.20	.20	.20	.21	.20	.20	.14	.14
F	545***		266***	262***	266***	263***	259***	251***	142***	136***
Wald		6814***								
No. Observations	30,096	30,096	30,058	30,058	30,058	30,058	29,998	29,998	29,998	29,998

***: p<.01, **: p<.05, *: p<.10

Table 2.3: The Effects of Diversification and Dividend Payouts on Firm Value.

premium for diversified firms. This paper focuses on replicating Campa and Kedia's central model—the self-selection model—rather than the 2SLS model because self-selection models are more appropriate for estimating binary choice variables since the 2SLS model uses a linear probability model for the first stage instead of a probit model.

	Coefficient	Z-statistic
Constant	-2.484***	-8.00
EBIT/SALES	0.277**	2.39
CAPX / SALES	-0.032	-0.34
Log of total assets	-0.005	-0.12
EBIT/SALES (1 lag)	0.052	0.43
CAPX/SALES (1 lag)	0.016	0.16
Log of TA (1 lag)	0.018	0.30
EBIT/SALES (2 lags)	-0.233**	-2.27
CAPX/SALES (2 lags)	-0.232***	-2.58
Log of TA (2 lags)	0.237***	6.32
Traded on a major exchange	0.036	1.60
S&P	-0.083***	-2.63
Foreign Incorporation	-0.125***	-3.48
Percent of industry sales in diversified firms	1.676***	17.79
Percent change in real GDP	-0.091	-0.13
Percent change in real GDP (1 lag)	6.625***	11.03
Avg. Log of total assets	-0.035	-1.39
Avg. EBIT/SALES	0.588***	2.98
Avg. CAPX / SALES	-1.014***	-5.51
Wald	6814***	

***: p<.01, **: p<.05, *: p<.10

Table 2.4: Selection Equation for Model 2. The dependent variable is equal to 1 for diversified firms and 0 for focused firms. The variable **EBIT/SALES** is the ratio of EBIT to sales, **CAPX/SALES** is the ration of capital expenditure to sales, and **S&P** is an indicator variable equal to 1 if the firm is listed on the S&P index.

2.3. The Joint Effect of Diversification and Payout Policy on Firm Value

2.3.1. Model

The next model accounts for *both* of the free cash flow allocation decisions that a firm faces—the decision to diversify, D_{it}, and the decision to payout cash through a dividend or stock repurchase, P_{it}, to shareholders.

$$V_{it} = \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + \delta_3 P_{it} + e_{it} \quad (5)$$

This model builds on Campa and Kedia's (2002) work by estimating a two-step selection model. However, in this case, the selection equation is a bivariate probit model where diversification is one dependent variable and the other dependent variable is the firm's payout policy decision (an indicator variable set equal to one if a firm paid dividends or repurchased stock with internal funds). Analogous to the seemingly unrelated regressions model, bivariate probit allows estimation of two selection variables with correlated residuals.

$$\begin{aligned} D_{it}^* &= \beta_D Z_{it} + \mu_{it} \\ D_{it} &= 1 \; if \;\; D_{it}^* > 0,\ 0 \;\; otherwise \\ P_{it}^* &= \beta_P Z_{it} + \nu_{it} \\ P_{it} &= 1 \; if \;\; P_{it}^* > 0,\ 0 \;\; otherwise \end{aligned} \quad (6)$$

This model generates two self-selection corrections, λ_D for the diversification decision and λ_P for the payout decision, to control for the two decisions a firm faces.

$$\begin{aligned} \lambda_{D1}(\beta_D Z_{it}) &= \frac{\phi(\beta_D Z_{it})}{\Phi(\beta_D Z_{it})} \qquad & \lambda_{D2}(\beta_D Z_{it}) &= \frac{-\phi(\beta_D Z_{it})}{1-\Phi(\beta_D Z_{it})} \\ \lambda_{P1}(\beta_P Z_{it}) &= \frac{\phi(\beta_P Z_{it})}{\Phi(\beta_P Z_{it})} \qquad & \lambda_{P2}(\beta_P Z_{it}) &= \frac{-\phi(\beta_P Z_{it})}{1-\Phi(\beta_P Z_{it})} \end{aligned} \quad (7)$$

Adding these correction terms to (5) allows for proper estimation of the joint effect of diversification and payout policy on firm value.

$$V_{it} = \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + \delta_3 P_{it} + \delta_D \lambda_D + \delta_P \lambda_P + \eta_{it} \,. \quad (8)$$

This model includes the same variables in the selection and regression equations as the Campa and Kedia (2002) model (replicated in Table 2.4 here) plus some additional controls in order to improve identification of the payout policy instrument. To account for time-varying industry heterogeneity at the two-digit level, the percent of industry participants that pay a dividend or buyback stock is included in the model. To account for the availability of free cash flow, the ratio of cash and short-term investments to assets is also included.

2.3.2. Results

The results of this selection model are presented in Table 2.5. The self-selection parameter for diversification, λ_D = .14, is positive and significant at the 1 percent level. The self-selection parameter for payout policy, λ_P = -.05, is negative and significant at the one percent level.

The regression results, incorporating the two self-selection parameters estimated in the first stage equation, are presented in Column C of Table 2.3. As suggested by previous literature (Allen and Michaely (2003)), the coefficient for payout policy is positive and significant. That is, controlling for a firm's propensity to pay out free cash flow, paying a dividend or buying back stock has a net positive impact on a firm's value.

Dividends can be seen as a signal that a firm has limited growth options in its current business (Grullon, Michaely, and Swaminathan, 2002). However, paying a dividend also

	Dependent Variable			
	Diversified		Payout	
	Coefficient	Z-statistic	Coefficient	Z-statistic
Constant	-2.25^{***}	-7.13	-2.80^{***}	-8.85
EBIT/SALES	0.35^{***}	3.09	0.74^{***}	5.87
CAPX / SALES	-0.04	-0.45	0.35^{***}	3.83
Log of total assets	0.07^{*}	1.65	-0.07^{*}	-1.75
EBIT/SALES (1 lag)	0.08	0.67	1.34^{***}	9.51
CAPX/SALES (1 lag)	-0.04	-0.38	0.15^{*}	1.73
Log of TA (1 lag)	0.00	-0.01	-0.14^{**}	-2.42
EBIT/SALES (2 lags)	-0.17^{*}	-1.69	0.47^{***}	4.14
CAPX/SALES (2 lags)	-0.25^{***}	-2.61	0.04	0.6
Log of TA (2 lags)	0.23^{***}	5.96	0.50^{***}	12.92
Traded on a major exchange	0.03	1.36	0.42^{***}	18.43
S&P	-0.05	-1.51	0.06^{*}	1.76
Foreign Incorporation	-0.12^{***}	-3.32	0.10^{**}	2.43
Percent of industry sales in diversified firms	1.70^{***}	18.05	1.35^{***}	14.68
Percent of industry participants that payout	-0.15^{***}	-2.71	0.25^{***}	4.23
Cash & Short-term investments/Assets	-0.93^{***}	-12.31	-0.37^{***}	-5.32
Percent change in real GDP	-0.47	-0.63	-2.04^{***}	-2.71
Percent change in real GDP (1 lag)	5.81^{***}	8.54	7.84^{***}	11.43
Avg. Log of total assets	-0.09^{***}	-3.75	0.03	1.15
Avg. EBIT/SALES	0.04	0.2	1.69^{***}	8.75
Avg. CAPX / SALES	-1.31^{***}	-7.28	-1.68^{***}	-10.27
rho	0.18^{***}	241[1]		
Wald	$11{,}617^{***}$			

***: p<.01, **: p<.05, * : p<.10

[1] Likelihood ratio (Chi-square) test statistic for correlation between the two residuals

Table 2.5: Bivariate Selection Equation for Models 3 & 4. The dependent variable, Diversified (Payout), is equal to 1 for firms that diversify (payout a dividend or buyback) and 0 for firms that focus (don't payout a dividend or buyback). The variable *rho* tests the correlation of the error terms between the two equations, and *Wald* is a test of model significance.

suggests that a firm is exploiting its current market opportunities successfully (Miller and Rock, 1985). Moreover, paying a dividend gives shareholders an opportunity to invest their capital according to their preferences (Shefrin and Statman, 1984), rather than according to the preferences of a firm's managers. Overall, paying dividends increases the value of a firm's stock (Allen and Michaely, 2003), although firms have become less inclined to pay dividends over the last 30 years (Fama and French, 2001).

Stock buyback plans increase the demand for a firm's stock, thereby increasing its price (Ikenberry, Lakonishok, and Vermaelen (1995)). Moreover, it can also signal management's belief that the firm's stock is currently undervalued and is thus a "good deal" (Miller and Rock (1985)). This can send a signal to the market that has the effect of further increasing demand for a firm's stock. For both of these reasons, a firm that repurchases its stock increases the wealth of its stockholders (Allen and Michaely (2003)).

However, unlike the Campa and Kedia (2002) findings, this model finds a significant diversification discount after controlling for both the decision to diversify and the payout policy decision.

2.4. Robustness and Extensions

In this section, the results presented in Column C of Table II are examined in more detail.

2.4.1. Interacting Diversification and Payout Policy

Having established the relationship among a firm's payout policy, its diversification decision, and its value, the next model examines the impact on firm value of the four possibilities created by the interaction of diversification and payout policy—diversification, no payout; diversification, payout; no diversification, no payout; no diversification, payout.

This model uses the same selection equation presented in Table 2.5. However, in the regression model, instead of including payout policy in the regression model, two interaction terms are used—a dummy equal to 1 if the firm is diversified but *does not* payout cash to shareholders (*Diversified, ~Payout*), and a dummy equal to 1 if the firm is *not* diversified but *does* payout cash to shareholders (*~Diversified, Payout*). The results of the regression model are included in the column D of Table 2.3.

This model finds the same sign on all the coefficients on the model reported in Column C of Table 2.3. The coefficient for diversification is still negative, indicating that diversification destroys value. Firms that payout and are not diversified create more value (+28%) than firms that neither payout nor diversify. Firms that payout and diversify create somewhat less value (-9%) than firms that engage in neither of these strategies. Finally, firms that do not payout but do diversify create much less value (-40%) than firms that engage in neither of these strategies.

2.4.2. R&D

In light of recent results by Miller (2004) that suggest that R&D decreases a firm's propensity to diversify, the ratio of R&D/sales is added to the selection and regression equations in Columns C and D of Table 2.3, presented in Column E and F, respectively, of Table 2.3. The new selection equation reflecting the addition of R&D/sales is reported in Table 2.6. Including R&D in the selection model generates results consistent with Miller (2004), i.e., increased R&D investment decreases the likelihood of diversification. However, including R&D in the equations does not change the core results presented in Column C of Table 2.3, i.e., a diversification discount still exists.

	Dependent Variable			
	Diversified		Payout	
	Coefficient	Z-statistic	Coefficient	Z-statistic
Constant	-1.90^{***}	-6.09	-2.43^{***}	-7.83
EBIT/SALES	0.17	1.46	0.51^{***}	3.97
CAPX / SALES	-0.03	-0.27	0.37^{***}	4.01
Log of total assets	0.08^{*}	1.85	-0.05	-1.33
EBIT/SALES (1 lag)	0.07	0.63	1.43^{***}	9.77
CAPX/SALES (1 lag)	-0.04	-0.35	0.16^{*}	1.88
Log of TA (1 lag)	0.01	0.16	-0.14^{**}	-2.34
EBIT/SALES (2 lags)	-0.08	-0.83	0.64^{***}	5.35
CAPX/SALES (2 lags)	-0.23^{**}	-2.40	0.06	0.86
Log of TA (2 lags)	0.22^{***}	5.64	0.49^{***}	12.68
Traded on a major exchange	0.04^{*}	1.84	0.45^{***}	19.25
S&P	-0.01	-0.29	0.15^{***}	4.03
Foreign Incorporation	-0.12^{***}	-3.31	0.10^{**}	2.44
Percent of industry sales in diversified firms	1.67^{***}	17.73	1.32^{***}	14.28
Percent of industry participants that payout	-0.16^{***}	-2.87	0.24^{***}	4.16
Cash & Short-term investments/Assets	-0.51^{***}	-6.43	0.24^{***}	3.18
Percent change in real GDP	-0.31	-0.42	-1.92^{**}	-2.52
Percent change in real GDP (1 lag)	5.57^{***}	8.13	7.54^{***}	10.86
Avg. Log of total assets	-0.09^{***}	-3.78	0.02	0.90
Avg. EBIT/SALES	-0.11	-0.58	1.57^{***}	7.84
Avg. CAPX / SALES	-1.22^{***}	-6.84	-1.60^{***}	-9.82
R&D/SALES	-4.74^{***}	-17.78	-7.68^{***}	-27.12
rho	$.14^{***}$	145		
Wald	$12,180^{***}$			

***: p<.01, **: p<.05, * : p<.10

Table 2.6: Bivariate Selection Equation for Models 5 & 6.

2.4.3. State Dependence in Selection Models

There may be significant transaction costs for firms that choose to change their payout or diversification status. The market reacts negatively to dividend omissions (Michaely, Thaler, and Womack (1995)). Whether diversifying or focusing, firms will incur costs of reorganization. Therefore, firms will not change their payout or diversification status very frequently. In the sample studied in this paper, firms that payout will continue to payout in the next year 95% of the time ((Pr($P_{it} = 1 | P_{it-1} = 1$) = .95); firms that do not payout will continue to not payout 96% of the time ((Pr($P_{it} = 0 | P_{it-1} = 0$) = .96). Firms that diversify will continue to diversify 95% of the time ((Pr($D_{it} = 1 | D_{it-1} = 1$) = .95); firms that are focused will continue to be focused 98% of the time ((Pr($D_{it} = 1 | D_{it-1} = 1$) = .98). For this reason, lagged values of a firm's diversification and payout status are added to the selection equations to account for the state-dependence of a firm's diversification/payout status.

The results of the selection model are presented in Table 2.7 and the results of the new regression model are contained in Columns G and H of Table 2.3. In the new selection model, the parameter rho is not significant as it is in the previous selection models, indicating that the bivariate probit results are similar to probit results estimating the two equations separately--i.e. the error terms in the two equations are no longer correlated.

Adding lagged values of a firm's diversification and payout status to the selection equation does not change the signs of any of the coefficients in the regression models; however, it does reduce the magnitude of the coefficients of interest, bringing the diversification discount down to -.08 from -.26, and the payout premium down to .04 from .12 (in Column G of Table 2.3). When specifying this model without the interaction terms, the sample selection corrections, λ_D and λ_P, are not significant. When adding the interaction terms (Column H of Table 2.3), the model retains the same general ordering of the four groups: firms that payout their free cash flow and do not diversify (*~Diversified, Payout*) create more value (+5%) than firms that neither payout nor diversify (*~Diversified, ~Payout*). Firms that payout and diversify (*Diversified, Payout*) create less value (-3%) than firms that neither payout nor diversify (*~Diversified, ~Payout*). Finally, firms that do not payout but do diversify (*Diversified, ~Payout*) create much less value (-7%) than firms that engage in neither (*~Diversified, ~Payout*) of these strategies.

2.4.4. Panel Data Models

Panel data models are a way to account for additional unobserved heterogeneity at the firm level that is constant over time. Fixed effects are added to the models reported in Columns G and H of Table 2.3. Fixed effects are not added to the selection model, because including fixed effects into a model with lagged dependent variables will introduce bias into the model (Judson and Owen, 1999), so the selection model remains the same as in the models presented in Columns G and H in Table 2.3. The results of the fixed effects models are reported in Columns I and J of Table 2.3.

Adding fixed effects does not result in any significant sign changes in any of the coefficients except the squared log of total assets. Fixed effects increase the magnitude of the diversification discount and the payout premium to -.12 and .07, respectively.

	Dependent Variable			
	Diversified		Payout	
	Coefficient	**Z-statistic**	**Coefficient**	**Z-statistic**
Constant	-2.95***	-5.43	-2.83***	-5.28
EBIT/SALES	0.05	0.26	1.25***	6.42
CAPX / SALES	-0.13	-0.78	0.29**	2.17
Log of total assets	0.97***	14.90	0.22***	3.39
EBIT/SALES (1 lag)	-0.13	-0.66	1.91***	9.25
CAPX/SALES (1 lag)	0.05	0.35	-0.03	-0.23
Log of TA (1 lag)	-0.95***	-9.50	-0.35***	-3.76
EBIT/SALES (2 lags)	0.10	0.49	-0.25*	-1.68
CAPX/SALES (2 lags)	-0.12	-0.71	-0.04	-0.34
Log of TA (2 lags)	0.12	1.74	0.08	1.35
Traded on a major exchange	0.02	0.54	0.25***	6.75
S&P	-0.01	-0.09	0.13**	2.10
Foreign Incorporation	0.10	1.37	0.08	1.18
Percent of industry sales in diversified firms	1.17***	6.44	0.43**	2.86
Percent of industry participants that payout	-0.08	-0.73	-0.05	-0.55
Cash & Short-term investments/Assets	-0.36**	-2.42	0.54***	4.49
Percent change in real GDP	-1.32	-0.90	0.27	0.22
Percent change in real GDP (1 lag)	-0.31	-0.23	1.02	0.90
Avg. Log of total assets	-0.09**	-2.02	0.16***	4.39
Avg. EBIT/SALES	0.21	0.63	-0.41	-1.40
Avg. CAPX / SALES	-0.46	-1.48	-0.49**	-2.05
R&D/SALES	-0.44	-1.07	-3.71***	-8.78
Diversified (1 lag)	3.78***	108.31	0.09***	2.65
Payout (1 lag)	0.16***	4.03	3.25***	109.87
rho	-.002	.003		
Wald	27,999***			

***: p<.01, **: p<.05, *: p<.10

Table 2.7: Bivariate Selection Equation for Models 7, 8, 9, & 10.

Firms that payout and are not diversified (*~Diversified, Payout*) still create more value (+4%) than firms that neither payout or diversify(*~Diversified, ~Payout*). Firms that payout and diversify (*Diversified, Payout*) still create less value (-6%) than firms that do neither, and firms that diversify and do not payout (*Diversified, ~Payout*) still have the lowest value (-14%) relative to firms that neither diversify nor payout cash to shareholders.

2.4.5. Switching Regression

We perform another robustness check by allowing the independent variables to have different effects on performance for diversified and undiversified firms. This version of the sample selection model is known as the switching regression model. In this model, the selection model is identical to the bivariate probit selection model in Model 3 (shown in Table 2.5), and the independent variables are the same as in Model 3, but separate regressions are estimated for diversified firms and undiversified firms. The effect of diversification on firm value is then interpreted as the difference in the predicted performances for diversified and undiversified firms. The switching model is estimated for two subsamples: firms that pay a dividend or buyback, and firms that do not pay a dividend or buyback. The results of the model are presented in Table 2.8. For the subset of firms that payout, the average predicted excess value is -0.143 for diversified firms and -0.079 for undiversified firms. For the subset of firms that do not payout, the average predicted excess value is -0.123 for diversified firms and -0.044 for undiversified firms. So the diversification discount remains, and consistent with the previous models, the diversification discount is a bit larger for firms that do not payout.

Diversified	Payout Firms Yes	No	Non-Payout Firms Yes	No
Constant	-0.931^{***}	-0.706^{***}	-1.359^{***}	-0.741^{***}
Log of total assets	0.601^{***}	0.729^{***}	0.578^{***}	0.675^{***}
EBIT/SALES	0.570^{***}	0.721^{***}	0.075	0.158^{***}
CAPX / SALES	0.099	0.027	0.179^{**}	0.213^{***}
EBIT/SALES (1 lag)	0.602^{**}	0.281	0.094	0.028
CAPX/SALES (1 lag)	0.004	0.093	0.083	0.064
Log of TA (1 lag)	-0.264^{***}	-0.240^{***}	-0.145^{**}	-0.279^{***}
EBIT/SALES (2 lags)	0.948^{***}	0.386^{***}	0.008	0.089^{**}
CAPX/SALES (2 lags)	0.132	0.037	0.044	0.049
Log of TA (2 lags)	-0.190^{***}	-0.235^{***}	-0.183^{***}	-0.196^{***}
S&P	0.112^{***}	0.158^{***}	0.307^{***}	0.219^{***}
Leverage	-0.260^{***}	-0.365^{***}	0.295^{***}	0.185^{***}
(Log of TA)^2	-0.009^{***}	-0.017^{***}	-0.019^{***}	-0.018^{***}
Lambda$_D$	-0.021	0.328^{***}	0.084^{**}	0.355^{***}
Lambda$_P$	0.025	-0.128^{***}	-0.175^{***}	-0.323^{***}

***: p<.01, **: p<.05, * : p<.10

Table 2.8: Switching Regression Model.

2.4.6. Propensity Score Matching

As an additional check on the robustness of the Heckman (1979) treatment effects methodology, we also use the propensity score matching methods used by Villalonga (2004) to test the effects of diversification and payout policy on firm value. Villalonga's work found a diversification discount that was not statistically significant.

Propensity score matching methods differ from Heckman's model in their fundamental assumptions. While Heckman's model assumes that sample selection bias occurs due to selection on unobservables, propensity score matching assumes the bias is a function of selection on observable variables. Rosenbaum and Rubin (1983) showed that this means conditional on the observables, the endogenous treatment can be considered random.

Execution of the propensity score matching requires two steps. First, we estimate propensity scores using the bivariate probit model in Table 2.5. To be consistent with Villalonga, propensity scores are generated using the full sample of 30,058 observations used in the preceding analysis. Next, following Villalonga (2004), we use the "nearest neighbor" matching methodology of Abadie and Imbens (2002). This estimator calls for each diversifying firm to be matched to a small number of single-segment firms. We match each diversifying firm with four single-segment firms, in keeping with both Villalonga's (2004) analysis and Abadie and Imbens' (2002) recommendations for minimizing mean squared error. Also following Villalonga, he matching is done with replacement to reduce asymptotic bias (Abadie and Imbens (2002)), and includes a correction for the non-orthogonal error term created by matching with replacement. The other methodology used by Villalonga (2004), Dehejia and Wahba's (2001) estimator, is not used because it cannot be adapted to multiple treatments (such as diversification and payout policy).

Since Villalonga used the change in excess value (instead of excess value) as her dependent variable, we will use it as the dependent variable in the following analysis. Also, while Villalonga (2004) generated propensity scores from a full sample of diversified and single-segment firms, her matching sample only consisted of single-segment firms and *diversifying* firms (firms one year after their first diversification event), we also restrict my sample accordingly in the analysis that follows. This reduces

	Coefficient	Z-statistic
Constant	-2.12***	-45.29
EBIT/SALES	0.02	0.18
CAPX/SALES	-0.11	-1.18
Log of total assets	0.20***	9.6
Traded on a major exchange	0.02	0.71
S&P	-0.03	-1.07
Foreign Incorporation	-0.06*	-1.65
Percent of industry sales in diversified firms	1.17***	33.93
Cash & short-term investments/Assets	-0.56***	-7.4
Percent change in real GDP	-0.52	-0.73
Percent change in real GDP (1 lag)	5.52***	9.38
Avg. Log of total assets	-0.03	-1.54
Avg. EBIT/SALES	-0.23	-1.54
Avg. CAPX/SALES	-0.98***	-8.24
R&D/SALES	-3.50***	-15.32
Payout	0.26***	13.55
Likelihood Ratio	4265***	

***: $p<.01$, **: $p<.05$, *: $p<.10$

Table 2.9: Probit Estimation of the Propensity to Diversify

the number of observations to 21,666 firm-years, 334 of which are in diversifying firms. Restricting the data in this way is consistent with assuming that all of the effects of diversification are realized immediately. Later on we relax this assumption.

We match on three variations of the propensity score. First, we match on the unconditional propensity to diversify, as Villalonga (2004) did, generating propensity scores using a first stage probit model similar to Villalonga's. This model includes payout policy as an exogenous variable, and does not include the lagged values of firm size, profitability, and investment. The results of this probit model are included in Table

2.9. This model finds a diversification discount of 4.4%, which is not statistically significant (t=-1.05). This compares very closely to the 2.7% discount (t = -.48) that

	Propensity Scores	
	Δ Excess Value "Diversifying" & Single-Segment Firms	Excess Value All Diversified & Single-Segment Firms
Villalonga	-0.044	-0.101***
(Table 2.8)	(-1.05)	(-21.45)
Campa & Kedia	-0.012	-0.086***
(Table 2.4)	(-0.4)	(-22.50)
Bivariate Probit	-0.030**	-0.056***
(Table 2.5)	(-2.49)	(-13.11)
# Diversified Firms	334	8,726
# Single-Segment Firms	21,332	21,332

***: p<.01, **: p<.05, *: p<.10

Table 2.10: The Effect of Diversification on Excess Value: Average Treatment Effect on the Treated.

Villalonga (2004) finds. The results of the propensity score matching are shown in the first column of Table 2.10.

Second, we generate propensity scores using the probit selection equation from our replication of Campa and Kedia's (2002) diversification premium model reported in Table 2.4. This model does not include payout policy but does include one and two period lags of firm size, profitability, and investment. This model finds a diversification discount of 1.2%, which is also not significant (t= -0.4).

The third way we generate propensity scores is from the bivariate probit model reported in Table 2.5. Using the unconditional propensity to diversify from this model, we find a diversification discount of 3.0%, which is statistically significant (t = -2.49).

After matching on these three propensity scores, we repeat the estimation, matching on the dependent variable from the first part of this paper, the undifferenced, logged, values of excess value. We also use the full sample used in the first part of the paper, including all observations on diversified firms, not just a firm's first diversified observation. We find diversification discounts of 10.1%, 8.6%, and 5.6% using the Villalonga (2004) propensity scores, the Campa and Kedia (2002) propensity scores, and the bivariate probit propensity scores, respectively. All three diversification discounts are significant at the 1 percent level. These results are reported in the second column of Table 2.10.

Next, we expand the analysis to both diversification and payout policy. The nature of propensity score matching allows us to only compare two outcomes at a time (Imbens, 2000; Lechner, 2000), so we estimate the joint effects of diversification and payout policy in two ways: we estimate the effects of diversification conditional on the payout policy decision, and we make pairwise comparisons of the four joint outcomes. Six propensity scores are all generated from the bivariate probit model in Table 2.5—the propensity to diversify conditional on paying a dividend or buyback, the propensity diversify conditional on not paying a dividend or buyback, and the four joint outcomes of

	Conditional on Payout = 1		
		Control Variable	
		Diversified	~Diversified
Treatment Variable	Diversified		-0.056***
	~Diversified	0.055***	

	Conditional on Payout = 0		
		Control Variable	
		Diversified	~Diversified
Treatment Variable	Diversified		-0.072***
	~Diversified	0.094***	

Table 2.11: The Effect of Diversification on Excess Value. Average Treatment Effect on the Treated Conditional on Payout Status.

		Control Variable			
		Diversified, Payout	Diversified, ~ Payout	~Diversified, Payout	~Diversified, ~ Payout
Treatment Variable	Diversified, Payout		0.076***	-0.094***	-0.029***
	Diversified, ~ Payout	-0.087***		-0.111***	-0.039***
	~Diversified, Payout	0.041***	0.08***		-0.02
	~Diversified, ~ Payout	0.04***	0.126***	-0.042***	

Table 2.12: Pairwise Comparison of Average Treatment Effect on the Treated.

the diversification and payout decisions. We find results consistent with the previous sample selection models—that diversification destroys value, and returning cash to shareholders through a dividend or buyback creates value. The results of propensity score matching conditional on payout policy estimation are shown in Table 2.11, and the pairwise comparisons of the four joint outcomes are shown in Table 2.12.

2.5. Discussion

So . . . is there a diversification discount? Certainly, this question has been of considerable interest—both for scholars and for practicing managers—since the mid-1990s. Initially, the answer was “yes”: Corporate diversification, on average, destroys firm value. Then, a careful analysis of the factors that lead firms to diversify in the first place suggested that the answer to this question was “no”: Corporate diversification can actually create firm value when a firm has few investment alternatives.

This paper suggests that this “diversification premium” literature failed to account for two investment options that are usually available to firms with free cash flow: Directly returning cash to shareholders in the form of a dividend or indirectly returning cash to shareholders in the form of a stock buyback. When these investment options are considered at the same time as diversifying investments, on average, diversification appears to be a less attractive option for creating firm value than returning cash to shareholders. That is, the answer to the question, “Is there a diversification discount?” is “Yes.”

Future research should revive the literature on why such a discount might exist. Internal capital market inefficiencies (Shin and Stulz, 1998) and a variety of other agency problems might exist that lead firms to diversify when, in fact, they should payout their free cash flow to stockholders (Denis, Denis, and Sarin; 1997; Rose and Shepard, 1997; Scharfstein and Stein, 2000).

However, evidence that on average, diversification does not create value does not mean that diversification will never create value. Future research will also have to examine the conditions under which it may be possible for diversification to create more value than paying cash to equity holders directly.

CHAPTER 3

THE HETEROGENEOUS FIRM EFFECTS OF RELATED DIVERSIFICATION ON FIRM VALUE

The relationship between corporate diversification and firm performance has been the subject of a great deal of research, both in the fields of strategy and finance. Initial work in strategy focused on the wealth creation advantages of related diversification versus unrelated diversification (Rumelt, 1982; Hill, Hitt, and Hoskisson, 1992).

However, in the mid-1990's, some of the emphasis in this literature shifted to comparing the performance of diversified firms with portfolios of focused firms (Lang and Stulz, 1994; Comment and Jarrell, 1995; Berger and Ofek, 1995). This research identified what became known as the "diversification discount": Diversified firms trade at a discount compared to portfolios of focused firms operating in similar businesses as the diversified firms.

Recently, the existence and meaning of this discount has been brought into question. Several scholars have identified important methodological problems with the original "diversification discount" works which, when corrected, change the discount into a small diversification premium (Campa and Kedia, 2002; Miller, 2004) or an insignificant diversification discount (Villalonga, 2004a). Other researchers have suggested that even if a discount exists, it still might represent the best value maximizing option available to a firm (Maksimovic and Phillips, 2002; Gomes and Livdan, 2004; Miller, 2004).

Debate continues about whether or not there is a diversification discount. However, new empirical work in this area suggests that other corporate decisions—including, for example, the decision about whether or not to pay a dividend or buyback stock—impact the relationship between diversification and firm value (Mackey and Barney, 2006). Failure to control for these relationships appears to bias the analysis of the relationship between a firm's diversification strategy and its market value, suggesting the existence of a discount where none exists or the existence of a premium where none exists. The conclusion of this work is that the diversification premium found by recent research correcting for the endogeneity of only the diversification decision (e.g. Campa and Kedia, 2002; Miller, 2004) turns back into a discount (Mackey and Barney, 2006) when controlling for both the decision to diversify and to payout.

This work also demonstrates that the optimal use of a firm's free cash flow is to return cash to shareholders in lieu of diversification (Mackey and Barney, 2006). There is some indication that this is true regardless of whether a firm is pursuing related or unrelated diversification (e.g. Mackey and Barney, 2006). However, none of this prior research has examined relatedness to a deep extent (e.g. Lang and Stulz, 1994; Gomes and Livdan, 2004; Campa and Kedia, 2002; Mackey and Barney, 2006).

There are, however, numerous studies of relatedness outside of this line of work (e.g. Rumelt, 1974; Berry, 1975; Jacquemin and Berry, 1979; Rumelt, 1982; Palepu, 1985; Markides and Williamson, 1994; Robins and Wiersema, 1995; Palich, Cardinal, and Miller, 2000). The merits of related diversification from these efforts are not conclusive. Since strategy scholars are particularly interested in heterogeneity among firms (Rumelt, Schendel, and Teece, 1994), one limitation of this entire stream of research is that the statistical methods used estimate only mean effects. In other words, whether or not related diversification creates or destroys value on average, it is creating value for at least some firms and the statistical approaches in this literature do not explain why related diversification would create value for some firms and destroy it for others.

Thus, the purpose of this paper is to examine how firms differ in the effects that related and unrelated diversification have on firm value. In particular, this paper examines how the initial portfolio of a firm influences the effect that related diversification will have on firm value as well as the alternative choices to related diversification such as maintaining the initial portfolio, pursuing unrelated diversification, or paying out cash to shareholders instead of pursuing related diversification. To estimate these effects, a nested two-level random parameters model is developed (Rabe-Hesketh and Skrondal, 2005). The advantage of this type of model is that it estimates firm-specific parameters for the effects of diversification on firm value. Sometimes these parameters will be positive, other times they will be negative. Not only does this approach control for unobserved firm-level heterogeneity identified in the previous literature, it also makes it possible to examine the optimal use of free cash flow—to use it for diversification or to return it to shareholders—for each firm.

3.1. Literature Review

Theoretically, the economic value of diversification depends upon the extent to which economies of scope are realized between the businesses a firm operates in and whether or not managing these economies of scope is most efficient through hierarchical forms of governance (Teece, 1980). Examples of economies of scope include operational economies (e.g. shared activities, core competencies), financial economies (e.g. internal capital allocation, risk reduction, tax advantages), and anticompetitive economies of scope (e.g. multi-market competition (Bernheim and Whinston, 1990; Gimeno and Woo, 1999)) and the exploitation of market power (Caves, 1981; Bolton and Scharfstein, 1990).

Empirically, much confusion exists about the financial benefits of diversification—both related and unrelated (Hoskission and Hitt, 1990; Markides and Williamson 1996; Palich, Cardinal, and Miller, 2000). Empirical work has yet to unambiguously demonstrate the value of diversification in generating competitive advantage (Hoskission et al, 1993). Part of the evolving understanding of the financial benefits of diversification is due to an evolving understanding of the endogenous relationship between diversification and firm value.

3.1.1. The diversification discount hypothesis

Lang and Stulz (1994), Comment and Jarrell (1995), and Berger and Ofek (1995) all document the existence of a diversification discount. The size of this discount ranges from 39% (in Lang and Stulz, 1994) to 10.6% (in Berger and Ofek, 1995). These discounts are calculated by comparing the market value of diversified firms to the market value of a portfolio of focused firms operating in similar industries as the diversified firms. Each of these papers also makes additional observations about the discount. For example, Lang and Stulz (1994) show that diversified firms have a lower value prior to diversifying than focused firms, suggesting that firms in low-growth industries are diversifying to create growth. Comment and Jarrell (1995) find that diversified firms do not take advantage of some of the hypothesized benefits of diversification, including access to cheaper debt (Lewellen, 1971) and lower transaction costs due to the use of internal capital markets (Williamson, 1986). Finally, Berger and Ofek (1995) find evidence that suggests that overinvestment in and cross-subsidization of unprofitable business units are sources of the value loss from diversification.

These empirical results are consistent with agency theory arguments concerning managerial interests to diversify (Jensen and Meckling, 1976). Agency theory suggests that diversification can benefit managers and hurt shareholders in at least two ways. First, since diversification generally increases the size of a firm, and since firm size is highly correlated with management compensation (Finklestein and Hambrick, 1996), managers can pursue diversification as a way to increase their compensation (Denis, Denis, and Sarin, 1997; Rose and Sheppard, 1997) even if diversification, per se, does not improve the wealth of a firm's shareholders. Second, since diversification reduces the riskiness of a firm's cash flows (Amihud and Lev, 1981), and since managers with substantial firm-specific human capital investments are likely to be risk averse with respect to those investments, managers may pursue diversification as a way to reduce their risk exposure.

Indeed, Denis et al (1997) explicitly attribute the diversification discount to agency problems on the part of managers. They find evidence that diversification is negatively correlated with equity ownership by management, external corporate control threats, and managerial turnover. Extending these ideas, Scharfstein and Stein (2000) develop a theoretical model in which agency problems on the part of division managers, not the CEO, are responsible for the diversification discount.

3.1.2. The diversification premium hypothesis.

In reaction to the empirical finding of a diversification discount, Campa and Kedia (2002) and Villalonga (2004a) made the observation that lower valuations of diversified firms does not necessarily mean that diversification destroys value. Rather, it may be that the variables that cause a firm to choose to diversify also lead a firm to have lower value. Their empirical findings show that when accounting for the endogeneity of a firm's decision to diversify, diversification actually creates value for the firms that choose to diversify, i.e., a diversification premium in the case of Campa and Kedia (2002) and Miller (2004), and a small, insignificant diversification discount in the case of Villalonga (2004a).

Maksimovic and Phillips (2002) and Gomes and Livdan (2004) advance a theoretical basis for this empirical result: While diversified firms may have a lower value than undiversified firms, diversification may still be the optimal choice for the firms that diversify. Models are presented in these papers in which diversifying firms operating in mature industries experience decreasing returns to scale in their current businesses, and might often increase firm value more by diversifying into new businesses than by reinvesting in current businesses.

3.1.3. The diversification discount returns.

Mackey and Barney (2006) observe that while diversification may be a preferred choice to further investment in mature businesses, it may not be the optimal choice relative to the firm's option to pay out cash to investors either as stock repurchases or dividends. The decision to diversify and the decision to return cash to shareholders both depend, to some extent, on the existence of free cash flow in a firm. The diversification discount and agency theory literatures suggest that free cash flow is a primary motivation for corporate diversification that destroys firm value (Jensen, 1986). The diversification premium literature argues that firms that pursue wealth-maximizing diversification strategies often do so after opportunities for positive present value investments in their current businesses are exhausted (Campa and Kedia, 2002; Gomes and Livdan, 2004; Maksimovic and Phillips, 2002), i.e., when they are generating free cash flow. The payout policy literature suggests that firms typically pay for dividends and stock repurchases out of free cash flow. For these reasons, it will often be the case that decisions about a firm's diversification strategy and its payout policy will be correlated, since they are both dependent on a firm's free cash flow. The conclusion of this work that controls for these relationships is that the diversification premium found by recent research correcting for endogeneity (e.g. Campa and Kedia, 2002; Miller, 2004) turns back into a discount (Mackey and Barney, 2006).

3.1.4. Related Diversification and Firm Value

Received strategic management theory suggests that when diversification exploits an economy of scope that outside equity holders cannot duplicate on their own (e.g. markets or contractual means), diversification can create value for a firm's shareholders (Teece, 1980; 1982; Barney, 1988). Such economies of scope are achieved through shared activities (Porter, 1985), learning curve efficiencies, or access to critical factors of production (Markides and Williamson, 1996). The existence of such economies of scope suggest that firms that are able to create shareholder value through their diversification efforts are typically implementing related, not unrelated, diversification (Markides and Williamson, 1994). Thus, even though diversification seems to destroy firm value on average as suggested by the diversification discount literature, this result may be different for related diversifiers. Empirical results for the benefits of related diversification are not conclusive, although many studies have shown that related diversification outperforms unrelated diversification (e.g. Rumelt, 1974; Berry, 1975; Jacquemin and Berry, 1979; Rumelt, 1982; Palepu, 1985; Markides and Williamson, 1994; Robins and Wiersema, 1995; Palich, Cardinal, and Miller, 2000).

Recent work on the relationship between a firm's payout policy and whether or not diversification creates value for the firm (Mackey and Barney, 2006) has implications for empirical work on related and unrelated diversification. This work suggests that the optimal use of a firm's free cash flow is to return cash to shareholders in lieu of diversification. There is some indication that this is true regardless of whether firms are engaging in related or unrelated diversification. The previous research on diversification (e.g. Lang and Stulz, 1994; Gomes and Livdan, 2004; Campa and Kedia, 2002; Mackey and Barney, 2006) has not examined in depth whether or not the extent to which a firm's business are related impacts performance.

Whether related diversification is likely to outperform unrelated diversification or focused strategies is likely to depend upon the firm's prior diversification decisions—i.e. the firm's current portfolio of businesses. In other words, the impact of further diversification given a firm's current portfolio of businesses is likely to be value decreasing for some firms but value increasing for others. It may also be that whether or not the current portfolio has created value for the firm will impact the value firms reap from further diversification choices. Additionally, since diversification is not a firm's only choice for use of free cash flow, the optimal use of the free cash flow may be something other than diversification—i.e. dividends or buying back stock (Mackey and Barney, 2006).

Testing this argument requires looking at the multiple portfolios firms could have and then several scenarios for diversification choices firms could make. For example, firms can be either focused or diversified as a baseline case. At a more refined level, they can either be undiversified (focused), related diversifiers, or unrelated diversifiers. Another categorization of the portfolio for firms would be based on whether the current diversification is creating value or not for the firms because whether or not the current portfolio has created value for the firm might impact the value firms can reap from further diversification choices. And a third categorization of portfolios could include the payout decisions that firms make.

From these initial portfolio we will consider the following three scenarios for diversification choices the firms could make: In the first scenario (referred to as *Scenario #1*), suppose a firm diversifies into a new segment that is 10% of total firm assets and that this new segment is related at the 2-digit SIC level to the firm's largest segment, but unrelated to all of the firm's other segments at the 4-digit SIC level. In the second scenario (referred to as *Scenario #2*), this same firm instead diversifies into a new, unrelated segment that is still 10% of the firm's total assets. Lastly, a third scenario is used (referred to as *Scenario #3)* in which this same firm maintains its current portfolio of businesses instead of opting for further diversification. These initial portfolio categorizations and the scenarios for diversification choices are summarized in Table 3.1.

Initial Portfolio	**Scenarios**
Focused Firm	Maintain current portfolio
Diversified Firm	Engage in related diversification
	Engage in unrelated diversification
Focused Firm	
Related Diversifier	
Unrelated Diversifier	
Successful Diversifier	
Unsuccessful Diversifier	
Payout Firm	
Non-Payout Firm	
Diversified, Payout Firm	
Diversified, Non-Payout Firm	
Focused, Payout Firm	
Focused, Non-Payout Firm	

Table 3.1: Firm Types and Scenarios for Corporate Strategy

Hence the value of related diversification in this paper is examined not only as how firms with initial portfolios of businesses that are related fare in further diversification decisions but also how firms with different initial portfolio such focused strategies, unrelated diversification, and paying out cash to shareholders fare with related diversification strategies. How all of these initial portfolios and diversification scenarios interact is the subject of the central hypotheses of this paper:

Hypothesis 1: The effect of diversification on firm value will be influenced by the *firm's current portfolio of businesses (e.g. focused, unrelated, or related).*

Hypothesis 2: The value of further diversification choices on firm value (i.e. maintaining current portfolio, unrelated diversification, or related diversification) will be influenced by the initial portfolio of businesses held by the firm.

3.1.5. Mean Effects vs. Firm-Specific Effects

Since every diversification choice is a unique situation, every diversification choice will have a unique effect on the firm's value. Some firms will create value through diversification, and others will destroy value through diversification. The implication for theory-development is that while it is informative to know the average effect of diversification on firm value, it would be more informative to estimate a distribution of the effect of diversification (related and unrelated) on firm value. This would provide additional information that mean effects cannot provide, such as the overall riskiness of diversification, the probability that diversification will create value, or the probability that a particular change in a firm's portfolio of segments will create value.

3.2. Methods

3.2.1. Data and Sample

The sample includes all firms in the COMPUSTAT Industry Segment file from 1985 to 1997[1]. Sample selection criteria are similar to those used by Berger and Ofek (1995) and Campa and Kedia (2002): firm years that have any segments in financial

[1] The years after 1997 are not used due to concerns about the changes in SIC classification of firms after

industries, years where total firm sales are less than $20 million, firm years where the sum of segment sales differs from total firm sales by more than one percent, and years where the data does not provide four-digit SIC industry coding for all of its reported segments are removed from the sample. This reduces the sample to 30,096 observations on 5,606 firms. Next, to improve identification of the firm-specific coefficients, we remove observations from firms from which there are less than 5 years of data. This gives us a final sample of 23,003 observations on 2553 firms.

3.2.2. Models

To estimate heterogeneous effects of diversification on firm value, this paper uses a random-parameters model.

Before estimating the effects of related diversification, a baseline-comparison is made for the effects of diversification and focus on firm value using the following nested two-level random parameters model (referred to as Model 1):

$$\begin{aligned}
&V_{it} = \delta_0 + \zeta_{0i} + \delta_1 X_{it} + (\delta_2 + \eta_{2j(i)} + \zeta_{2i})P_{it} + (\delta_3 + \eta_{3j(i)} + \zeta_{3i})D_{it} + \varepsilon_{it} \\
&V_{it} = \delta_0 + \zeta_{0i} + \delta_1 X_{it} + \beta_{2i}P_{it} + \beta_{3i}D_{it} + \varepsilon_{it} \qquad (1) \\
&\text{where } \beta_{2i} = \delta_2 + \eta_{2j(i)} + \zeta_{2i} \text{ and } \beta_{3i} = \delta_3 + \eta_{3j(i)} + \zeta_{3i}
\end{aligned}$$

where X_{it} is a set of independent variables, P_{it} is an indicator equal to one if the firm pays out a dividend or engages in a stock buyback in time t, and D_{it} is an indicator equal to one if the firm is diversified at time t. The δ parameters are fixed parameters that apply to all observations, the η parameters are random coefficients at the two-digit SIC level, and the ζ parameters are random parameters at the firm level. These random coefficients allow

that year.

diversification to have differing impacts on different industries and firms. By adding the δ, η, and ζ coefficients together, we can estimate the firm-specific effects, β.

The independent control variables used are *FIRM SIZE* (measured by the natural log of assets and its squared value), *PROFITABILITY* (measured as return on sales), *INVESTMENT* (measured as capital expenditure divided by sales), *LEVERAGE* (measured as the debt to asset ratio), *LIQUIDITY* (measured by a dummy indicating whether a firm belongs to the S&P industrial or transportation index, since firms belonging to the S&P index have greater liquidity) and the ratio of *R&D / SALES*. These controls are typically used in the antecedent literature (Campa and Kedia, 2002; Villalonga, 2004a).

To calculate the dependent variable in the model, V_{it}, several steps are taken. First, following Berger and Ofek (1995) and Campa and Kedia (2002), firm value is measured by the ratio of total firm capital to sales, where total capital is equal to the sum of the market value of equity, long-term and short-term debt, and preferred stock. To estimate the effect of diversification on firm value, the value of a diversified corporation is compared to the value the diversified corporation *would* have if it were broken into single-segment firms. This counterfactual value, called the "imputed value" in the literature (Berger and Ofek, 1995; Campa and Kedia, 2002; Lang and Stulz, 1994; LeBaron and Speidell, 1987; Mackey and Barney, 2006), is estimated for each segment by approximating its value as the median value of undiversified segments in the same industry.

Then, to calculate the imputed value of a segment, the segment is valued by multiplying the segment's sales with the median value for single-segment firms in the segment's industry (a segment's industry is defined as the most restrictive SIC grouping—4-digit, 3-digit, or 2-digit—that includes at least five firms).[1] Using the imputed values of each segment, the imputed value of the corporation is calculated as the sum of each of its segments' imputed values.

Finally, the value of the diversified corporation is compared to its imputed value by dividing the actual value by the imputed value. If the actual value is greater than the imputed value, this ratio will be greater than one. The natural log of this ratio is called *EXCESS VALUE* and is used as the dependent variable in the antecedent literature (Berger and Ofek, 1995; Campa and Kedia, 2002; Mackey and Barney; 2006) as well as in this study. A negative excess value indicates that that the firm has a lower value than its imputed value (discount) and a positive excess value indicates that the firm has a higher value than its imputed value (premium). Following Berger and Ofek (1995) and Campa and Kedia (2002), extreme excess values of more than 1.386 or less than –1.386 are eliminated from the sample.

To consider the additional effects of related diversification on firm value, adaptations are made to the previous nested two-level random parameters model as follows (referred to as Model 2):

$$\begin{aligned} V_{it} &= \delta_0 + \zeta_{0i} + \delta_1 X_{it} + (\delta_2 + \eta_{2j})A_{it} + (\delta_3 + \eta_{3j})A_{it}^2 + (\delta_4 + \eta_{4j} + \zeta_{4i})P_{it} \\ &+ (\delta_5 + \eta_{5j} + \zeta_{5i})D_{it} + (\delta_6 + \zeta_{6i})U_{it} + (\delta_7 + \zeta_{7i})R_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

The adaptations to the model are as follows: addition of industry-level coefficients on the natural log of assets and its square (represented by A_{it} and A_{it}^2) and the addition of two

[1] Seventy nine percent were matched at the 4-digit SIC level, 13 percent at the 3-digit level, and 8 percent at the 2-digit level. This sample has more matches at the 4-digit level than Berger and Ofek (1995) or Campa and Kedia (45 percent and 50 percent, respectively).

new variables—unrelated entropy (U_{it}) and related entropy (R_{it})—with corresponding fixed coefficients and firm-level random coefficients. Again, these random coefficients allow diversification to have differing impacts on different industries and firms.

3.2.3. The Entropy Index

Two measures of relatedness, the entropy index and the concentric index, are popular in the strategy literature (Robins and Wiersema, 2003) for use with a full cross-section of firms in all industries. For R&D intensive industries, Silverman's (1999) concordance linking the International Patent Classification (IPC) system to the U.S. SIC system is also a popular method of measuring related diversification, but is not useful for this study because it would limit the sample unnecessarily.

As noted in equation 2, the entropy index (Jacquemin and Berry, 1979; Palepu, 1985) is used to measure relatedness in this study. This index is one of the most common approaches for measuring the degree of relatedness within the literature. The advantage of using the entropy index in this paper rather than the concentric index is that the concentric index is only a measure of related diversification, while entropy can be broken into related and unrelated components, so that the effects of both can be estimated.

Recently the entropy index has received heavy criticism (Brush, 1996; Robins and Wiersema, 1995, 2003). Some criticisms are focused on the use of SIC classifications in calculating the measure (Brush, 1996; Robins and Wiersema, 1995; Bryce and Winter, 2005) while others are focused on methodological issues concerned with the validity of the construction of the related component of the index (Robins and Wiersema, 2003). For example, in the construction of the related component of the entropy index, an increase in the number of segments (regardless of how related these segments are) might increase the level of related entropy. Thus, the related component of the entropy measure might, in part, measure the effects of pure diversification on firm value instead of just the effects of relatedness on firm value (Robins and Wiersema, 2003).

As Robins and Wiersema note, “ambiguities in the meaning of the measures have significant implications for the interpretation of results” (2003: 57). Thus, instead of interpreting the coefficients on the entropy index as the true effect of relatedness on firm value, the approach of this paper is to directly compute the marginal effects of related diversification on firm value. This is done through the scenarios introduced earlier.

Recall that in Scenario #1, a firm diversifies into a new segment that is 10% of total firm assets and that this new segment is related at the 2-digit SIC level to the firm’s largest segment, but unrelated to all of the firm’s other segments at the 4-digit SIC level. In Scenario #2, this same firm instead diversifies into a new, unrelated segment that is still 10% of the firm’s total assets. For each scenario, the entropy index is recalculated to account for the new segment, but instead of just using the coefficient on the index measure to show the effect of diversification on firm value, the actual change in firm value from the hypothetical scenarios in which the change in level of diversification is imposed is used to show the effect of diversification on firm value. In other words, instead of using increases in entropy to examine the relationship between diversification and firm value, the approach of this paper is to use increases in diversification to examine the relationship between diversification and firm value. Doing so is important to avoid the limitations of the entropy index identified by Robins and Wiersema (2003).

3.3. Results

Descriptive statistics are presented in Table 3.2. The median discount for diversified firm years is 8.6 percent, similar to the discounts reported by Berger and Ofek (1995) and Campa and Kedia (2002) of 10.6 and 10.9, respectively. Smaller differences are likely due to the time periods studied in the different papers. Even so, this smaller discount is likely to favor finding a diversification premium.

	Obs.	Assets		CAPX/ SALES		DEBT/ ASSETS		Excess Value	
		Mean	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*
All Firms	23,003	1.47	0.21	0.08	0.04	0.21	0.19	-0.05	-0.02
Focused Firms	16,034	1.16	0.16	0.08	0.04	0.20	0.17	-0.04	0.00
Diversified Firms	6,969	2.17	0.46	0.07	0.05	0.23	0.21	-0.08	-0.08
Related Diversifiers	2,942	3.19	1.03	0.09	0.05	0.25	0.23	-0.05	-0.04
Unrelated Diversifiers	4,024	1.42	0.26	0.06	0.04	0.21	0.20	-0.10	-0.12

Table 3.2: Descriptive Statistics.

Diversified firms have more assets, lower median investment (but higher mean investment), higher leverage, and lower excess value than focused firms.

The results for Models 1 and 2 are presented in Tables 3.3 and 3.4, respectively. These tables report coefficient estimates for the fixed parameters in the model (e.g. firm size, diversification status, etc) as well as standard deviation estimates of the random parameters (e.g. industry level parameters on diversification, firm-level parameters on diversification, etc). Coefficient estimates on diversification and payout status are consistent with the prior literature (e.g. Mackey and Barney, 2006). The mean effect of diversification (-0.10 in Table 3.3, -0.04 in Table 3.4) is negative and significant and the mean effect of paying out (0.11 in Table 3.3, 0.10 in Table 3.4) is positive and significant. The mean effects of these variables in the nested two-level random parameters model include the result from the fixed effect portion plus all of the individual firm-specific effects on diversification/payout in the sample. These results for mean effects are consistent with the previous literature.

Firm-specific and industry-specific effects of diversification and payout (as well as variables such as related and unrelated entropy and firm size, Table 3.4) are not reported because of the sheer number of these effects (2553 firms and 50 2-digit industries). Rather, the standard deviations of all of the individual firm-specific and industry-specific effects are reported. For example, in Table 3.3, compare the estimated standard deviation of the effect of diversification at the industry level (0.015) with the effect at the firm level (0.296). Since the firm-level parameter has the higher standard deviation, this suggests that the variance of the impact of diversification on firm value is determined more at the firm level than at the industry level. The same can be said for the effect of payout policy on firm value—namely, that the variance of the impact is determined more at the firm level than at the industry level. Further interpretation of the results in Tables 3.3 and 3.4 are given in the following sections.

	Estimate	Std Error
Firm Size (log assets)	0.12^{***}	0.02
Profitability (ROS)	0.98^{***}	0.03
Investment (Capital Expend./Sales)	0.47^{***}	0.03
Liquidity (S&P dummy)	0.25^{***}	0.03
Leverage (Debt/Assets)	0.28^{***}	0.02
Firm Size (log assets squared)	-0.01^{***}	0.00
R&D to Sales Ratio	0.49^{***}	0.08
Diversification dummy	-0.10^{***}	0.01
Payout dummy	0.11^{***}	0.02
Constant	-0.65^{***}	0.05
Random-effects Parameters		
	Estimate [a]	**Std Error**
Industry-level (2-digit)		
Std. Dev. Diversification	0.015	0.014
Std. Dev. Payout	0.087	0.015
Firm-level		
Std. Dev. Diversification	0.296	0.016
Std. Dev. Payout	0.261	0.014
Std. Dev. Constant	0.377	0.008
sd(Residual)	0.328	0.002
Wald $chi^2(9) = 1957.34$		
Observations	23,003	

[a] Confidence levels are not calculated for random-effects parameters.
*** $p < 0.01$

Table 3.3: Estimation of Model 1 with a nested two-level random parameter maximum likelihood regression where excess value is the dependent variable.

	Estimate	Std. Error
Firm Size (log assets)	0.14***	0.02
Profitability (ROS)	0.99***	0.03
Investment (Capital Expend./Sales)	0.48***	0.03
Liquidity (S&P dummy)	0.25***	0.03
Leverage (Debt/Assets)	0.28***	0.02
Firm Size (log assets squared)	-0.01***	0.00
R&D to Sales Ratio	0.52***	0.08
Unrelated Entropy	-0.09***	0.03
Related Entropy	-0.09**	0.04
Diversification Dummy	-0.04**	0.02
Payout Dummy	0.10***	0.02
Constant	-0.70***	0.05

Random-effects Parameters

	Estimate [a]	Std. Error
Industry-level (2-digit)		
Std. Dev. Firm Size (log assets)	0.04	0.01
Std. Dev. Firm Size (log assets squared)	0.01	0.00
Std. Dev. Diversification	0.03	0.02
Std. Dev. Payout	0.05	0.02
Firm-level		
Std. Dev. Diversification	0.34	0.03
Std. Dev. Payout	0.26	0.01
Std. Dev. Unrelated Entropy	0.49	0.04
Std. Dev. Related Entropy	0.52	0.05
Std. Dev. Constant	0.37	0.01
Std. Dev. Residual	0.32	0.00
Wald $chi^2(11)$ = 1947.95		
Observations	23,003	

[a] Confidence levels are not calculated for random-effects parameters.
*** p< 0.01

Table 3.4: Estimation of Model 2 with a nested two-level random parameter maximum likelihood regression where excess value is the dependent variable.

3.3.1. Calculating Firm-Specific Effects

Although not reported (since there are over 2500 of them), the firm-specific effects of diversification are used for testing the hypotheses. Calculating each firm's specific effect of diversification, called the empirical Bayes prediction, (Efron and Morris, 1975) requires combining the three coefficients (fixed, industry-level, and firm-level) on diversification. The firm-specific effects of diversification (estimated from equation 1) on firm value are -0.095 on average, with a standard deviation of 0.14. A histogram of the distribution of these coefficients is shown in Figure 3.1. For Model 2, to obtain the total effect of diversification on a firm's value, we must also calculate the firm-specific coefficients on related and unrelated entropy in the same manner. Then the firm-specific coefficients are multiplied by their corresponding variables to get the firm-specific effect of a firm's diversification choices.

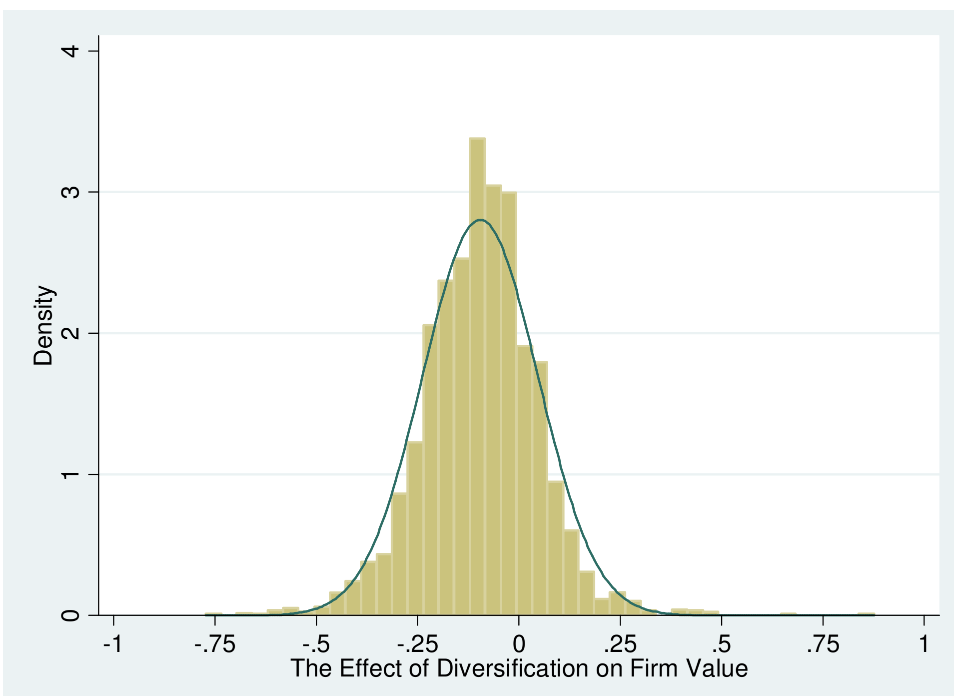

Figure 3.1: A histogram of the firm-specific effects of diversification on firm value.

3.3.2. Effect of a Firm's Prior Diversification Decisions

Hypothesis 1 argues that the effect of diversification on firm value will be impacted by the firm's prior diversification decisions (i.e. their current portfolio of business). Testing this argument, Table 3.5 shows the interpretation of the results from Model 2 for the varying effects of diversification on firm value for related diversifiers and unrelated diversifiers. Unrelated diversifiers have a higher probability of a positive effect from their prior diversification than related diversifiers (30.8% compared to 16.4%, Table 3.4). This does not mean that unrelated diversification is necessary a superior strategy to related diversification because the unrelated diversifiers are actually choosing a riskier strategy than the related diversifiers (compare standard deviations in Table 3.5). These results suggest minimal support for Hypothesis 1 since the mean and median estimates on the effect of diversification for both types of current portfolios are very similar.

	Mean	Median	Std. Deviation	Probability of Positive Effect	N
Related Diversifiers	-0.112	-0.097	0.156	16.4%	2942
Unrelated Diversifiers	-0.103	-0.102	0.225	30.8%	4024

Table 3.5: Effects of a Firm's Prior Diversification Decisions (Model 2)

3.3.3. Engaging in Related Diversification (Scenario #1)

Hypothesis 2 argues that the value of further diversification choices on firm value will be influenced by the initial portfolio of businesses held by the firm. Testing this hypothesis, we first examine how the choice to engage in related diversification impacts three different initial portfolios. Recall the specifics of Scenario #1: A firm diversifies into a new segment that is 10% of total firm assets and this new segment is related at the 2-digit SIC level to the firm's largest segment, but unrelated to all of the firm's other segments at the 4-digit SIC level. Coefficients from the estimation of Model 2 are used to derive the marginal effect on firm value of this scenario for the three types of firms. Table 3.6 reports the mean, median, standard deviation, and probability of a positive effect from this scenario for the three types of firms.

The group of firms most likely to have a positive outcome from the scenario to engage in related diversification is the *unrelated* diversifiers. However, the likelihood of a positive outcome is still not great since almost half of these firms are predicted as having a positive effect on diversification (49.7%, Table 3.6) and slightly more than half (50.3%) are predicted to have a negative effect from related diversification.

	Mean	Median	Std. Deviation	Probability of Positive Effect	N
All firms	-0.053	-0.06	0.085	18.3%	23003
Focused Firms	-0.068	-0.065	0.056	7.5%	16034
Related Diversifiers	-0.028	-0.034	0.103	34.5%	2942
Unrelated Diversifiers	-0.008	-0.001	0.133	49.7%	4024

Table 3.6: Marginal Effect on Financial Performance for Scenario #1: Engaging in Related Diversification

Focused firms are the least likely to see positive results from this scenario as only 7.5% are likely to see positive financial performance from engaging in related diversification. Focused firms are also the group with the lowest mean and median effect of diversification on firm value.

3.3.4. Engaging in Unrelated Diversification (Scenario #2)

Further examining Hypothesis 2, we next examine how the choice to engage in unrelated diversification impacts the same three types of firms (i.e. focused, related diversifiers, and unrelated diversifiers). Recall the specifics of Scenario #2: This same firm instead diversifies into a new, unrelated segment that is still 10% of the firm's total assets. Coefficients from the estimation of Model 2 are used to derive the marginal effect on firm value of this scenario for the three types of firms. Table 3.7 reports the mean, median, standard deviation, and probability of a positive effect from this scenario of engaging in unrelated diversification, for the three divisions of firms.

	Mean	Median	Std. Deviation	Probability of Positive Effect	N
All firms	-0.052	-0.041	0.109	30.6%	23003
Focused Firms	-0.066	-0.06	0.119	27.7%	16034
Related Diversifiers	-0.018	-0.018	0.066	37.8%	2942
Unrelated Diversifiers	-0.021	-0.018	0.075	36.7%	4024

Table 3.7: Marginal Effect on Financial Performance for Scenario #2: Engaging in Unrelated Diversification

Related diversifiers are the most likely to have a positive outcome from engaging in *unrelated* diversification as 37.8% of these firms should see positive effects from diversification. The related diversifiers also have the highest mean and median effect of diversification. Interestingly, it is again the focused firms that are the least likely to see positive results (27.7%, Table 3.7) and the group with the lowest mean and median effect of diversification. These results provide support for Hypothesis 2.

3.3.5. Comparing Related and Unrelated Diversification

One approach for comparing the effect of related versus unrelated diversification on firm value based on the initial portfolio of businesses held by the firm (Hypothesis 2) is to compare the probability of positive outcomes for engaging in these diversification strategies for the various initial portfolio types (comparing Tables 3.6 and 3.7).

For example, there is some evidence to suggest that focused firms are more likely to see positive financial returns to diversification when choosing to pursue unrelated diversification and not related diversification. This can be seen by looking at the difference in the probabilities of a positive effect for focused firms in Tables 3.6 and 3.7. Note that Table 3.6 shows that 7.5% of focused firms have a positive effect when pursuing related diversification whereas a large percentage more, 27.7% will likely see positive effects from pursuing unrelated diversification. Even still, choosing unrelated diversification is a higher risk strategy (standard deviation = 0.119, Table 3.7) than related diversification (standard deviation = 0.056). This may have implications for real options—the ventures with the highest option value may be unrelated diversification.

Related diversifiers also fare slightly better by pursuing unrelated diversification as compared to related diversification. When pursuing unrelated diversification, 37.8% (Table 3.7) of related diversifiers are likely to see value creation compared with only 34.5% (Table 3.6) of related diversifiers seeing value creation from pursuing further related diversification.

Unrelated diversifiers are the only group of firms that have a higher probability of a positive effect when choosing to engage in related diversification compared to further unrelated diversification (49.7% in Table 3.6 compared to 36.7% in Table 3.7).

A more direct way of comparing the impact of engaging in related versus unrelated diversification based on initial portfolio is to take the marginal effect of relatedness and subtract out the marginal effect of unrelated diversification (see Table 3.8). In other words, finding the probability—on a firm by firm basis—that related diversification will outperform unrelated diversification instead of comparing the number of firms that are likely to see a positive outcome from each strategy as was previously done.

	Mean	Median	Std. Deviation	Probability Related > Unrelated	N
All firms	0.001	-0.004	0.096	48.6%	23003
Focused Firms	-0.002	-0.005	0.077	47.9%	16034
Related Diversifiers	-0.011	-0.014	0.129	45.2%	2942
Unrelated Diversifiers	0.013	0.014	0.13	54.2%	4024

Table 3.8: Comparison of Related and Unrelated Diversification Scenarios: Financial Performance Effect of Scenario #1 less Financial Performance Effect of Scenario #2

The probabilities shown in Table 3.8 suggest related diversification outperforms unrelated diversification for 47.9% of focused firms, 45.2% of related firms, and 54.2% of unrelated diversifiers. These results suggest that the initial portfolio is not *significantly* indicative of whether or not related versus unrelated diversification is likely to create firm value. These results are consistent with the previous approach for comparing the benefits of related versus unrelated diversification based on initial portfolio. Namely, related diversification fares a bit better than unrelated diversification for firms with initial portfolios of unrelated businesses. And, unrelated diversification fares a bit better than related diversification for firms with initial portfolio of either related businesses or focus.

In sum, these results provide some support for hypothesis 2 as it appears that value creation from choosing to engage in further related versus unrelated diversification is somewhat impacted based on the initial portfolio of businesses held by the firm (Hypothesis 2).

3.3.6. Differing Effects of Diversification Based on Prior Diversification Success

Part of Hypothesis 2 is that the success of the initial portfolio of businesses held by the firm might impact how further diversification choices impact firm value. To test this portion of the hypothesis, firms are divided into those who have reaped positive returns from diversification ("successful" firms) and those who have not ("unsuccessful" firms).

For example, the analysis in this paper suggest that only 22.7% of diversified firms are creating value from diversification—a result consistent with the negative mean effect of diversification found in the diversification discount literature (see Table 3.9). For the 63.1% of diversified firms in which diversification is destroying firm value, almost half (46.6%) would see an increase in firm value from *additional* related diversification (Scenario #1). The effect is not as pronounced if unrelated diversification is pursued (Scenario #2) in lieu of related diversification—only 31.4% of these firms in this case would see an increase in performance.

Interestingly, for firms that are already creating value from pursuing diversification, very few of them (16.1%) would create additional firm value from additional related diversification and the far majority (64.4%) could actually create additional firm value from additional unrelated diversification (Scenario #1 and #2, respectively).

In sum, these results suggest that for some firms diversification appears to be destroying firm value because the firm has not yet reached its optimal level of diversification; and, for other firms, diversification appears to be creating value, but since these firms are either at or a bit past their optimal level of diversification, further diversification will not necessarily continue to create value for these firms.

	Mean	Median	Std. Deviation	Probability of Positive Outcome	N
All Firms	-0.095	-0.091	0.142	22.2%	23003
Focused Firms	-0.095	-0.09	0.136	22.0%	16034
Diversified Firms	-0.095	-0.095	0.156	22.7%	6969
Related Diversifiers	-0.093	-0.093	0.13	19.8%	2942
Unrelated Diversifiers	-0.095	-0.103	0.172	24.8%	4024
Non-payout Firms	-0.096	-0.091	0.141	21.2%	10668
Payout Firms	-0.095	-0.092	0.143	23.0%	12335

Table 3.9: Effects of a Firm's Prior Diversification Decision (Model 1)

3.3.7. Diversification vs. Maintaining Current Portfolio (Scenario #3)

The prior results have not compared the choice of related versus unrelated diversification with the choice to maintain the current portfolio of businesses. These results are presented in Table 3.10. Overall, looking at both focused and diversified firms in one sample, the percent of observations for which related diversification is preferred both to unrelated diversification and maintaining the current portfolio is 12.3%, unrelated diversification preferred to the related and maintaining options is 26.8%, and maintaining preferred to both related and unrelated diversification is 60.9%.

For focused firms, even though the marginal effect of engaging in related diversification (Scenario #1) is greater than the marginal effect of the unrelated diversification (Scenario #2) 47.9% of the time (see Table 3.8), the results in Table 3.9 illustrate that for 71.5% of the sample, it would be best to maintain the current portfolio and not engage in the further diversification.

However, for diversified firms, it appears that there is only a slight difference in the impact on firm value between engaging in related or unrelated diversification and maintaining the current portfolio of businesses. The optimal choice for 38.0% of diversified firms is related diversification, while it is unrelated diversification for 25.5% of diversified firms, and maintaining the current portfolio is best for 36.6% of diversified firms.

	Related Diversification	Unrelated Diversification	Maintain Current Portfolio
Overall	12.3%	26.8%	60.9%
Focused Firms	1.2%	27.3%	71.5%
Diversified firms	38.0%	25.5%	36.6%

Table 3.10: Percent of firms for which each option is the optimal use of free cash flow

3.3.8. Diversification and Payout Policy

As previously stated, since diversification is not a firm's only choice for use of free cash flow, the optimal use of the free cash flow may be something other than diversification—i.e. dividends or buying back stock (Mackey and Barney, 2006). Recall that only 22.7% of diversified firms are creating value from diversification. Contrast this with the results for payout policy: Over 68% of firms that pay out are creating value from these actions and almost 80% of firms not currently paying out to shareholders in the form of dividends or buying back stock could see positive financial performance from doing so (see Table 3.11). This certainly provides some evidence to suggest that the optimal use of the free cash flow for the firm may in fact be something other than diversification. Testing this, the marginal effects of payout policy are subtracted from the marginal effects of diversification on firm value on a firm by firm basis to estimate the probability for which diversification would outcome paying out. The results of this analysis are presented in Table 3.12.

For very few firms will diversification likely outperform paying out cash to shareholders. This is particularly true for firms not currently paying out. Only 12.4% are likely to see more positive results from diversification than from initiating payout. For firms that already pay a dividend or buyback, only 25.4% of these firms will find that their marginal effect of diversification outperforms the effect of the payout policy already enacted.

	Probability of a Positive Outcome
All Firms	73.3%
Payout Firms	68.1%
Non-Payout Firms	79.3%

Table 3.11: Effect of a firm's prior payout policy decisions on firm value.

	Mean	Median	Standard Deviation	Probability Diversification > Payout	N
All Firms	-0.18	-0.208	0.221	19.4%	23003
Focused Firms	-0.184	-0.208	0.216	18.2%	16034
Diversified Firms	-0.17	-0.192	0.231	22.2%	6969
Related Diversifiers	-0.144	-0.167	0.197	23.0%	2942
Unrelated Diversifiers	-0.189	-0.207	0.252	20.0%	4024
Non-Payout Firms	-0.195	-0.218	0.196	12.4%	10668
Payout Firms	-0.166	-0.181	0.239	25.4%	12335
Diversified, Paying Out	-0.16	-0.189	0.200	21.4%	4832
Diversified, Non-Payout Firm	-0.192	-0.227	0.287	24.1%	2137
Focused, Paying Out	-0.17	-0.174	0.261	28.1%	7503
Focused, Not Paying Out	-0.196	-0.218	0.166	9.5%	8531

Table 3.12: Probability that diversification will outperform payout policy.

3.4. Discussion

Efforts to estimate the mean effects of diversification on firm value only tell part of the story. Since strategy scholars study firm heterogeneity, their empirical methods would benefit from a study of firm heterogeneity also. By looking at the distribution of the effects of diversification on firm value, we notice that the outlook on diversification, while still negative on average, is not as bleak as it once seemed (Lang and Stulz, 1994; Mackey and Barney, 2006). A substantial percentage of diversifiers are creating value from diversification, and a smaller percentage of undiversified firms would create value by diversifying.

We learn that the risk of diversification increases as firms diversify into more unrelated territory. We have also seen evidence indicating that firms have an optimal level of diversification, that some firms who are destroying value through their past diversification efforts would still increase their value through further diversification. It also seems likely that firms who are creating value through diversification have reached their optimal level of diversification, as they are less likely to create value through further diversification than the firms who are not creating value through diversification. This notion of an optimal level of diversification might also indicate that value destruction through diversification is not the result of firms lacking quality opportunities for diversification; rather, it is that firms have quality diversification opportunities but they are lacking the proper portfolio mix.

CHAPTER 4

WHY DOES DIVERSIFICATION CREATE VALUE FOR SOME FIRMS AND NOT FOR OTHERS?

One of strategy's central questions is "Why do firms differ in performance?" (Rumelt, Schendel, and Teece, 1994). Empirical research in strategy tends to address this question by estimating the aggregate effect of different phenomena on performance. For instance, in the diversification literature, Mackey and Barney (2006) estimate that firms choosing to diversify destroy, on average, 8-30 % of firm value. While such a finding is useful to strategy scholars, it is somewhat incomplete, as it is only an average effect. It would be incorrect to conclude from Mackey and Barney's (2006) findings that no firms should diversify. Some firms may be creating value from diversification, while others might be destroying value from diversification.

Confusion as to the conditions under which diversification is likely to create value has prompted empirical inquiry of specific forms of diversification. For instance, numerous scholars have found that related diversification creates more value than unrelated diversification (e.g. Rumelt, 1982; Bettis and Mahajan, 1985; Markides and Williamson, 1994; Robins and Wiersema, 1995; Palich, Cardinal, and Miller, 2000). But while related diversification may, on average, create more value than unrelated diversification, some firms may actually be destroying value from *related* diversification, while other firms are creating value from *unrelated* diversification. Thus, even at this more refined level, the difficulty in generalizing from average effects still remains. In short, diversification, like many phenomena in the field of strategy, has a different effect on every firm, based on the firm's unique position, resources, and capabilities.

One potential methodological improvement for measuring firm-level heterogeneity is to estimate the amount of heterogeneity that exists between firms using statistical models that estimate a distribution of firm-specific coefficients instead of point/interval estimates from classical statistical techniques such as ordinary least squares or simple panel data models. For example, in the case of diversification, Chapter 3 estimates using a random parameters model that while 22.7% of diversified firms are creating value through diversification, 22% of undiversified firms would actually create value through a hypothetical diversification scenario. Notice that firm-specific coefficients can be estimated for both the firms choosing to diversify as well as the firms who have not chosen to diversify. For the undiversified firms, the firm-specific coefficient is interpreted as the *potential* effect of diversification if the firm had chosen to diversify.

While it is interesting to observe the existing heterogeneity between firms in creating value from diversification, it is even more interesting to observe the *source* of the heterogeneity. Identifying sources of firm-level heterogeneity allows for more accurate estimation of the effect of resources on competitive advantage (Hansen, Perry, and Reese, 2004). While the random parameters model in Chapter 3 can estimate a distribution of the effects of diversification on firm value, only a Bayesian model can model inter-firm heterogeneity as a function of observed variables.

Thus, the purpose of this paper is to explore several conditions under which diversification will create value (or at least destroy less value). A Bayesian linear hierarchical model is used to estimate the distribution of firm-specific heterogeneity in creating value from diversification as well as the sources of this firm-specific heterogeneity. Bayesian methods allow for each firm in the sample to have its own distribution and consequently its own parameter estimates (see Rossi, Allenby, and McCulloch, 2005 for an overview of Bayesian statistics). Hence, this methodology is ideal for answering why diversification would create value for some firms and destroy it for others compared with classical statistics, which can only provide point/interval estimates.

4.1. Creating Value From Diversification

4.1.1. Economies of Scope

Received strategic management theory suggests that when diversification exploits an economy of scope that outside equity holders cannot duplicate on their own (e.g. markets or contractual means), diversification can create value for a firm's shareholders (Teece, 1980; 1982; Barney, 1988). Such economies of scope can be achieved, for instance, through operational linkages between business segments in a diversified firm. For example, shared activities throughout the value chains of various businesses may allow for leveraging similar technologies throughout design, manufacturing (St. John and Harrison, 1999), distribution, and service activities of the various segments of the firm.

The existence of such economies of scope suggest that firms that are able to create shareholder value through their diversification efforts are typically implementing related, not unrelated, diversification (Markides and Williamson, 1994). Thus, even though diversification seems to destroy firm value on average as suggested by the diversification discount literature (e.g. Lang and Stulz, 1994; Berger and Ofek, 1995; Comment and Jarrell, 1995), this result may be different for related diversifiers able to exploit valuable economies of scope. Even still, empirical results for the benefits of related diversification have not been conclusive, although many studies have shown that related diversification outperforms unrelated diversification (e.g. Rumelt, 1974; Berry, 1975; Jacquemin and Berry, 1979; Rumelt, 1982; Palepu, 1985; Markides and Williamson, 1994; Robins and Wiersema, 1995; Palich, Cardinal, and Miller, 2000).

Hypothesis 1: Firms with more potential for sharing activities across business units will be more likely to create value if they choose to diversify into a related (but not unrelated) business than firms without this potential.

4.1.2. Resource Sharing

In addition to exploiting valuable economies of scope, resource-sharing across business units may create firm value. Markides and Williamson (1996) argue from a resource-based perspective that competitive advantage arises only when diversification provides access to valuable, rare, imperfectly tradable, and costly-to-imitate assets that single-business competitors cannot duplicate. Such resource sharing may create value for diversified firms through divisional cost reductions and/or price increases associated with increasingly differentiated products (Hill, Hitt, and Hoskisson, 1992).

"Diversification will enhance performance…if it allows a business to obtain preferential access to skills, resources, assets, or competences that cannot be purchased by nondiversifiers in a competitive market or replaced by some other asset that can be purchased competitively." (Markides and Williamson, 1996: 344). In short, diversification will create value when resources that are valuable in one business create value in another business. If a firm has no resources in the spirit of Barney (1986), Dierickx and Cool (1989), and Peteraf (1993), it will be difficult to use them to create advantage in another industry.

Hypothesis 2: Firms with more potential for resource sharing across business units will be more likely to create value if they choose to diversify into a related (but not unrelated) business than firms without this potential.

4.1.3. Growth Options for Firms in Declining Industries

The diversification premium literature (e.g. Campa and Kedia, 2002; Villalonga, 2004a) argues that diversification can be a wealth-maximizing strategy for firms when opportunities for positive present value investments in their current businesses have been exhausted, even if there are no shared activities or common resources between the two businesses (Campa and Kedia, 2002; Maksimovic and Phillips, 2002; Gomes and Livdan, 2004). The lower valuation of these firms does not necessarily mean that diversification destroys value; rather, it may be that the variables that cause a firm to choose to diversify (e.g. decreasing returns to scale) also lead a firm to have a lower value (Campa and Kedia, 2002; Villalonga, 2004a). Empirical work in this area has shown that when accounting for the endogeneity of a firm's decision to diversify, diversification actually creates value for the firms that choose to diversify, i.e., a diversification premium in the case of Campa and Kedia (2002) and Miller (2004), and a small, insignificant diversification discount in the case of Villalonga (2004a).

Hence, firms operating in mature industries experiencing decreasing returns to scale in their current businesses might often increase firm value more by diversifying into new businesses than by reinvesting in current businesses (Maksimovic and Phillips, 2002 and Gomes and Livdan, 2004) and firms operating in young, growing industries might not see the same value creation from diversifying into new businesses in lieu of reinvesting in their current business. Taken together, these arguments suggest the following hypothesis:

Hypothesis 3: Firms with growth options will be less likely to create value from unrelated diversification than firms without growth options.

4.2. Methodology

4.2.1. Data and Sample

The sample includes all firms in the COMPUSTAT Industry Segment file from 1985 to 1997[1]. Sample selection criteria are similar to those used by Berger and Ofek (1995) and Campa and Kedia (2002): firm years that have any segments in financial industries, years where total firm sales are less than $20 million, firm years where the sum of segment sales differs from total firm sales by more than one percent, and years

[1] The years after 1997 are not used due to concerns about the changes in SIC classification of firms after

where the data does not provide four-digit SIC industry coding for all of its reported segments are removed from the sample. This reduces the sample to 30,096 observations on 5,606 firms. Next, to improve identification of the firm-specific coefficients, we remove observations from firms from which there are less than 5 years of data. This gives us a final sample of 23,003 observations on 2553 firms. Descriptive statistics on these firms are presented in Table 4.1.

The median discount for diversified firm years is 8.2 percent, similar to the discounts reported by Berger and Ofek (1995) and Campa and Kedia (2002) of 10.6 and 10.9, respectively, using the same construction of the dependent variable.

Diversified firms have more assets, higher profitability, lower median investment (but higher mean investment), higher leverage, and lower excess value than focused firms.

	Obs.	ASSETS		CAPX/ SALES		DEBT/ ASSETS		EXCESS VALUE	
		Mean	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*
All Firms	23,003	1.47	0.21	0.08	0.04	0.21	0.19	-0.05	-0.02
Focused Firms	16,034	1.16	0.16	0.08	0.04	0.20	0.17	-0.04	0.00
Diversified Firms	6,969	2.17	0.46	0.07	0.05	0.23	0.21	-0.08	-0.08
Related Diversifiers	2,942	3.19	1.03	0.09	0.05	0.25	0.23	-0.05	-0.04
Unrelated Diversifiers	4,024	1.42	0.26	0.06	0.04	0.21	0.20	-0.10	-0.12

Table 4.1: Descriptive Statistics

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that year.

4.3. Measures

4.3.1. Economies of Scope/Activity Sharing

One common shared activity in diversified firms is research and development (Barney, 2002). Involvement in R&D activities might enable firms to create economies of scope through diversification since firms engaging in high levels of R&D are more likely to have opportunities for technological innovations. These firms could conceivably diversify in other businesses in which these new technologies could be leveraged throughout the value chain and thereby increase financial performance. Hence, as one measure of shared activities, the ratio of R&D expenditure to sales is included as a determinant of a firm's effect of diversification on performance.

4.3.2. Resource Sharing

One hypothesized source of value creation in related diversification is resource sharing. Resource-based theory suggests that related (but not unrelated) diversification will create value when resources that are valuable in one business create value in another business. Firms with superior resources will be able to create more value through related diversification than firms without these resources. If a firm has no valuable resources, it will be difficult to use them to create advantage in another industry. Profitability is typically evidence that a firm has superior resources. Therefore, the ratio of EBIT to sales is included as a measure of the potential for resource sharing to create value through related diversification.

4.3.3. Growth Options/Maturity

Theoretical models (Maksimovic and Phillips, 2002; Gomes and Livdan, 2004) as well as empirical work (Campa and Kedia, 2002; Villalonga, 2004a) have advanced the case that diversification can be a profit-maximizing choice for mature firms that have few growth options, since these firms may have experienced decreasing marginal returns to scale in their original businesses. Some indicators of firm maturity are a large firm size, a decrease in the firm's growth rate, and a low level of capital investment relative to sales. These are measured by the natural log of assets, the percent change in the natural log of assets, and the ratio of capital expenditure to sales, respectively.

4.3.4. Industry-level Heterogeneity

There may also be unobserved factors at the industry level that increase or decrease the effect of diversification on firm performance. For instance, if a firm is mature, it is likely that its competitors are also mature. Or if a firm has capabilities that create value in one business, it is possible that its competitors may also have capabilities that create value in the same business. While a firm following its competitors into a new business may not lead to competitive advantage, it may create competitive parity, and not following may lead to competitive disadvantage. Also, for some poorly performing industries, diversification into just about any business may create more value than a firm's current industry (Jandik and Makhija, 2005). For these reasons it seems likely that some industries get a higher return from diversification than others.

4.4. Model and Estimation

A novel feature of this paper is that it requires a Bayesian hierarchical linear model to examine both unique effects of diversification on firm value for each firm as well as the determinants of these unique effects. The Bayesian methodology differs from classical statistics (e.g. ordinary least squares) in that rather than viewing the data as random and investigating the probability of generating the data conditional on the estimated parameters, Bayesian models instead consider the probability distribution of the parameters conditional on the data.

Bayesians subscribe to the likelihood principle, which states that the likelihood function contains all the relevant information about model parameters. The other major difference of the Bayesian methodology is that it incorporates prior beliefs about the model parameters. This aspect of Bayes is often misunderstood. The use of prior information has often been criticized because of the potential subjectivity, but in most Bayesian analysis, and in this paper, the prior distribution is specified with sufficient uncertainty (high variance), that the information in the data dominates the information contained in the prior so that the prior has little influence over the outcome of the model, called the posterior distribution of the parameters. Bayes theorem expresses the posterior distribution of the parameters as being proportional to the likelihood multiplied by the prior distribution.

$$p(\theta \mid y) = \frac{p(y \mid \theta)\, p(\theta)}{p(y)} \propto p(y \mid \theta)\, p(\theta) \qquad (1)$$

One issue that plagues panel data models using classical techniques is that to use asymptotic assumptions, both the number of cross-sectional units (N) and the number of observations within each cross-section (T) must be large (Rossi, Allenby, and McCulloch, 2005). One of the virtues of the Bayesian linear hierarchical model is that it does not require asymptotic assumptions, meaning that it can make good predictions where there are many cross-sections but little information within each cross-section. In strategy, it may be common to have a large number of cross-sections but it is rare to have very much data within the panel. Since Bayesian models do not rely on asymptotic assumptions, this problem is avoided.

One powerful benefit of both the "empirical Bayes" methodology (Efron and Morris, 1975) used in Chapter 3 and the full Bayesian model in this chapter is that by estimating a distribution of the parameters of interest, one can learn much more than can be learned through point estimates, such as the probability that a coefficient is positive.

Another advantage of the Bayesian approach is that while classical statistics can incorporate firm-level heterogeneity in the parameters through the "empirical Bayes" approach used in Chapter 3, only the full Bayesian modeling can estimate the specific determinants of firm-specific parameters. So, while Chapter 3 can tell us how much heterogeneity exists in the effects of diversification on firm value, the Bayesian linear hierarchical model used in this chapter can tell us *why* some firms create value through diversification and others do not. The reason for this is that the Bayesian hierarchical model estimates separate regressions on the effect of diversification on firm value for each firm, where each firm has a maximum of 13 observations. Classical statistical methods do not allow the researcher to make reasonable inferences with such small amounts of data. The Bayesian approach allows for "borrowing of strength" between a large number of individuals to allow for accurate estimation (Rossi, Allenby, and McCulloch, 2005).

The Bayesian hierarchical linear model in this paper estimates firm excess value for firm *j* at time *t* as a function of firm-specific coefficients on diversification and payout policy (whether the firm pays a dividend or repurchases stock), and a firm-specific intercept. Each of these firm-specific coefficients and intercepts is in turn estimated as a function of the 2-digit SIC industry *i* the firm competes in, and time invariant firm attributes—the firm's average of the log of total assets over the years in which it is in the sample, the firm's average return on sales over the years in which it is in the sample, and the firm's average ratio of capital expenditures to sales over the years in which it is in the sample.

Two different specifications of the model are estimated. In the first model, no distinction is made between related and unrelated diversification (Model 4.1). This model, estimated with a Bayesian hierarchical linear model, is estimated without distinguishing between related and unrelated diversification as a baseline comparison with Model 3.1 which estimates the distribution of the firm-specific effects of diversification using a nested two-level random parameters model (also known as empirical Bayes). Model 4.1 is expressed in equation (1) below. Again, notice that firm-specific coefficients are estimated for both the firms choosing to diversify as well as the firms who have not chosen to diversify. For undiversified firms, the firm-specific coefficient is interpreted as the *potential* effect of diversification if the firm had chosen to diversify.

$$\text{Excess Value}_{jt} = \alpha_j + \beta_{1j}\text{Diversified}_{jt} + \beta_{2j}\text{Payout}_{jt} + \varepsilon_{it}, \qquad \varepsilon_{it} \sim \text{iid N}(0, \sigma^2_j I_{nj}) \quad (1)$$

The second model (Model 4.2) is used to test the hypotheses developed in this paper. In this model, the there are two indicator variables for diversification: one for related diversification (diversification in which at least two of the firm's segments operate in the same two-digit SIC industry) and another for unrelated diversification (diversification in which no two of the firm's segments operate in the same two-digit SIC industry). Model 4.2 is expressed in equation (2) below.

$$\text{Excess Value}_{jt} = \alpha_j + \beta_{1j}\,(\text{Related})\text{Diversified}_{jt} + \beta_{2j}(\text{Unrelated})\text{Diversified}_{jt} +$$
$$\beta_{3j}\text{Payout}_{jt} + \varepsilon_{it}, \qquad \varepsilon_{it} \sim \text{iid N}(0, \sigma^2_j I_{nj}) \quad (2)$$

Each of the coefficient vectors, α_j, β_{1j}, β_{2j}, and β_{3j} are assumed to have the following prior distributions that are common across all firms:

$$\alpha_j = \delta_1\text{Avg. ln(Assets}_j) + \delta_2\text{Avg. ROS}_j + \delta_3\,\text{Avg.CAPX/SALES}_j$$
$$+ \delta_4\,\text{Avg.R\&D/SALES} + \delta_5\,\text{Avg. }\Delta\text{Assets} + \delta_6\text{I(firm } j \text{ in industry } i) + \nu_{\alpha j}$$

$$\beta_{1j} = \theta_1\text{Avg. ln(Assets}_j) + \theta_2\text{Avg. ROS}_j + \theta_3\,\text{Avg.CAPX/SALES}_j$$
$$+ \theta_4\,\text{Avg.R\&D/SALES} + \theta_5\,\text{Avg. }\Delta\text{Assets} + \theta_6\text{I(firm } j \text{ in industry } i) + \nu_{\beta 1j}$$

$$\beta_{2j} = \varphi_1\text{Avg. ln(Assets}_j) + \varphi_2\text{Avg. ROS}_j + \varphi_3\,\text{Avg.CAPX/SALES}_j$$

$+ \varphi_4$ Avg.R&D/SALES + φ_5 Avg. ΔAssets + φ_6I(firm *j* in industry *i*) + $\nu_{\beta 2j}$

$\beta_{3j} = \psi_1$Avg. ln(Assets$_j$) + ψ_2Avg. ROS$_j$ + ψ_3 Avg.CAPX/SALES$_j$

$+ \psi_4$ Avg.R&D/SALES + ψ_5 Avg. ΔAssets + ψ_6I(firm *j* in industry *i*) + $\nu_{\beta 3j}$

$$\text{with prior distributions } \begin{pmatrix} \nu_{\alpha j} \\ \nu_{\beta 1 j} \\ \nu_{\beta 2 j} \\ \nu_{\beta 3 j} \end{pmatrix} \sim iid\ N(0, V_\beta)\ ,\ V_\beta \sim IW(7, 7I_4)$$

$$\text{and } \begin{pmatrix} \Delta \\ \Theta \\ \Phi \\ \Psi \end{pmatrix} \sim N(0, 100 I_{55})\ , \qquad \begin{aligned} \Delta &= (\delta_1 \ldots \delta_6) \\ \Theta &= (\theta_1 \ldots \theta_6) \\ \Phi &= (\phi_1 \ldots \phi_6) \\ \Psi &= (\psi_1 \ldots \psi_6) \end{aligned}$$

V_β is a standard diffuse prior for the error variance following an Inverse Wishart distribution. This allows the effect of the prior distributions on the posterior distributions to be small. Also, a normal prior of this sort creates "shrinkage" where the posterior estimates are shrunk toward the prior mean, with a much greater shrinkage effect for outliers. Model 4.2 is estimated using Markov Chain Monte Carlo methods using 6,000 draws from a Gibbs sampler, keeping every 3rd draw (see Rossi, Allenby, and McCulloch, 2005 for a discussion of this methodology).

The Gibbs sampler methodology works by drawing values of the β and σ^2_j variables given the prior distribution of V_β and the δ, θ, φ, and ψ variables, then drawing values of V_β and the δ, θ, φ, and ψ given the draws on β and σ^2_j , and then drawing values of the β and σ^2_j variables given the previous draws of V_β and the δ, θ, φ, and ψ variables, and so forth.

4.5. Results

The distribution of the firm-specific effects of diversification on firm value estimated in Model 4.1 is presented in Table 4.2. The main purpose of estimating this model is for a baseline comparison between the nested two-level random parameters model (also known as empirical Bayes) estimated in Chapter 3 and the Bayesian hierarchical linear model estimated in this chapter.

	Diversification			Payout			Intercept		
	Mean	Std Dev	Probability of Positive Outcome	Mean	Std Dev	Probability of Positive Outcome	Mean	Std Dev	Probability of Positive Outcome
All Firms	-0.09	0.31	38.1%	0.06	0.28	58.7%	-0.07	0.41	42.9%
Diversified	-0.07	0.29	39.8%	0.05	0.28	57.8%	-0.05	0.40	44.9%
Focused	-0.10	0.31	37.4%	0.06	0.28	59.1%	-0.07	0.41	42.0%
Related	-0.07	0.28	40.5%	0.04	0.27	56.0%	-0.02	0.38	48.4%
Unrelated	-0.08	0.30	39.3%	0.06	0.28	59.1%	-0.07	0.41	42.4%
Payout	-0.07	0.30	40.1%	0.07	0.28	59.6%	-0.02	0.40	48.7%
Non-payout	-0.11	0.31	35.8%	0.05	0.29	57.7%	-0.13	0.41	36.2%
Diversified, Payout	-0.07	0.29	40.0%	0.05	0.28	57.4%	-0.01	0.39	48.9%
Diversified, Non-Payout	-0.08	0.30	39.3%	0.05	0.27	58.7%	-0.14	0.40	35.9%
Focused, Payout	-0.08	0.31	40.1%	0.08	0.28	61.0%	-0.02	0.41	48.5%
Focused, Non-Payout	-0.12	0.31	34.9%	0.05	0.29	57.5%	-0.12	0.411	36.3%

Table 4.2: The distribution of firm-specific coefficients on diversification, payout, and the intercept in Model 4.1.

Thus, comparing Model 4.1 to the empirical Bayes approach used in Chapter 3, the mean of these effects are very similar, -.090 in Model 4.1 of this chapter versus -.095 in Model 3.1 of Chapter 3. This means that this model, like the models in Chapters 2 and 3, estimate a diversification discount on average.

However, the probability of a positive outcome (the probability of observing a positive firm-specific coefficient on diversification) is much greater in the full Bayes estimates (38.1%) than in the empirical Bayes estimates of Model 3.1 (22.2%). This is because the empirical Bayes method only estimates point estimates for each firm's firm-specific parameter rather than the full distribution for each firm specified by the full Bayes estimates. If we discarded the additional information provided by the firm-specific distributions and only considered the information given by the mean of the firm's specific parameter, we would find a probability of a positive outcome of 25.9% much more similar to the empirical Bayes estimates in Model 3.1. These results show that Bayesian linear hierarchical method in Model 4.1 is similar to the empirical Bayes estimates of Model 3.1 in its estimation of the distribution of firm-specific effects of diversification on firm value; however, since it does not consider the uncertainty of the firm-specific parameter estimates, empirical Bayes estimates used in Chapter 3 can overstate the value of the information contained in the parameters (Morris, 1983).

This model also finds some separation between diversified and undiversified firms in the effects of diversification on firm value. For example, these results suggest that diversified firms lose less value on average (7%) than undiversified firms would lose on average if they had diversified (10%).

For Model 4.1, the estimates of the firm attributes that affect the firm-specific coefficients on diversification and payout as well as the firm-specific model intercept are reported in Table 4.3. In this model, the firm-specific effect of diversification on firm value increases for larger firms and more profitable firms. The added specification of related versus unrelated diversification status in Model 2 clearly shows that these effects are very different for value created from related and unrelated diversification.

	Firm Attributes	Mean	Standard Deviation	Probability of Positive Outcome
Intercept	Ave LN (Assets)	0.05	0.01	100.0%
	Ave EBIT/Sales	1.84	0.15	100.0%
	Ave CAPX/Sales	0.71	0.11	100.0%
	Ave R&D	1.17	0.18	100.0%
	Ave Percent Change in Assets	0.82	0.08	100.0%
Diversification	Ave LN (Assets)	0.01	0.01	81.4%
	Ave EBIT/Sales	0.24	0.23	85.1%
	Ave CAPX/Sales	-0.04	0.16	39.3%
	Ave R&D	-0.50	0.51	16.2%
	Ave Percent Change in Assets	-0.07	0.13	29.0%
Payout	Ave LN (Assets)	-0.02	0.01	2.5%
	Ave EBIT/Sales	0.81	0.19	100.0%
	Ave CAPX/Sales	-0.10	0.17	26.8%
	Ave R&D	-0.95	0.41	0.5%
	Ave Percent Change in Assets	-0.14	0.11	11.7%

Table 4.3: The distribution of the effects of firm attributes influencing firm-specific coefficients. Firm size is measures as the average logarithm of assets, profitability is measured as return on sales (EBIT/Sales), capital investment is measured as capital expenditures over sales, shared activities are measured as the average level of R&D, and firm growth is measured as the average percent change in assets.

Turning to results from estimating Model 4.2, we now look at the differences in firm value based on related and unrelated diversification. Descriptive statistics of the distribution of the firm-specific coefficients for related and unrelated diversification are displayed in Table 4.4 and in Figures 4.1 and 4.2. As shown in Table 4.4, the average coefficient on related diversification across all firms is -0.070 (see Table 4.4). This means that related diversification destroys 7.0% of firm value on average across all firms. However, the probability of a positive outcome from engaging in related diversification across all firms is 39.0% (See Table 4.4). In other words, even though related diversification destroys value on average, approximately 40% of firms are likely to see positive returns from engaging in related diversification. These results are consistent across subsets of the data of just diversified firms, focused firms, related diversifiers, and unrelated diversifiers (see Table 4.4 for results based on firm-type stratifications).

	Related Diversification			Unrelated Diversification		
	Mean	Std Dev	Probability of Positive Coefficient	Mean	Std Dev	Probability of Positive Coefficient
All Firms	-0.070	0.579	39.0%	-0.078	0.334	40.0%
Diversified	-0.072	0.428	40.2%	-0.060	0.314	41.9%
Focused	-0.070	0.633	38.4%	-0.086	0.342	39.2%
Related	-0.075	0.301	40.5%	-0.042	0.311	40.5%
Unrelated	-0.070	0.501	40.1%	-0.072	0.315	40.2%
Payout Firm	-0.060	0.529	40.8%	-0.062	0.330	42.2%
Non-Payout Firm	-0.082	0.631	36.8%	-0.096	0.337	37.6%
Diversified, Paying Out	-0.081	0.369	40.1%	-0.053	0.312	42.9%
Diversified, Not Paying Out	-0.052	0.537	40.5%	-0.074	0.318	39.6%
Focused, Paying Out	-0.047	0.610	41.3%	-0.068	0.341	41.7%
Focused, Not Paying Out	-0.090	0.652	35.9%	-0.102	0.341	37.0%

Table 4.4: The distribution of firm-specific coefficients of engaging in related diversification for various types of firms.

Also shown in Table 4.4 is the average coefficient on *unrelated* diversification across all firms. This coefficient (-0.078) suggests that unrelated diversification destroys

7.8% of firm value on average across all firms. Similarly to the results concerning related diversification, despite the negative average effect of unrelated diversification on firm value, approximately 40.0% of firms would be likely to see positive returns from engaging in unrelated diversification. Interestingly, the average effect of engaging in unrelated diversification on firm value is somewhat different based on the firm-type stratification. For example, if related diversifiers were to engage in unrelated diversification, the average impact on firm value would be slightly less negative than for other types of firm (coefficient on unrelated diversification for related diversifiers is -0.042 compared to -0.086 for focused firms).

Payout policy is also included in Model 4.2 since decisions about a firm's diversification strategy and its payout policy, both dependent on a firm's free cash flow, will often be correlated (Mackey and Barney, 2006). The descriptive statistics of the distribution of the firm-specific coefficients for payout policy as well as the model intercept are presented in Table 4.5. Consistent with the results in Mackey and Barney (2006), firms that pay a dividend or buyback stock lose less value from related or unrelated diversification on average than firms that do not pay a dividend or buyback. Also consistent with Mackey and Barney (2006), paying a dividend or buyback increases firm value by 5.7%, with a 58.5% chance of positive returns from doing so.

The last columns of Table 4.5 report descriptive statistics for the distribution of firm-specific coefficients on the model intercept. These firm-specific coefficients are unobserved firm effect on firm value not associated with diversification or payout status. Including this intercept in the model allows us to control for unobserved heterogeneity across firms.

	Paying Out			Intercept	
	Mean	Std Dev	Probability of Positive Coefficient	Mean	Std Dev
All Firms	0.057	0.286	58.5%	-0.065	0.409
Diversified	0.050	0.280	57.6%	-0.046	0.398
Focused	0.060	0.289	58.9%	-0.073	0.414
Related	0.037	0.275	56.1%	-0.012	0.384
Unrelated	0.060	0.283	58.7%	-0.071	0.406
Payout Firm	0.064	0.281	59.3%	-0.012	0.402
Non-Payout Firm	0.050	0.291	57.7%	-0.125	0.409
Diversified, Paying Out	0.048	0.282	57.1%	-0.008	0.390
Diversified, Not Paying Out	0.055	0.276	58.8%	-0.132	0.401
Focused, Paying Out	0.074	0.280	60.7%	-0.015	0.409
Focused, Not Paying Out	0.048	0.295	57.4%	-0.124	0.411

Table 4.5: The distribution of firm-specific coefficients of paying out to shareholders for various types of firms as well as the distribution of firm-specific coefficients on the model intercept.

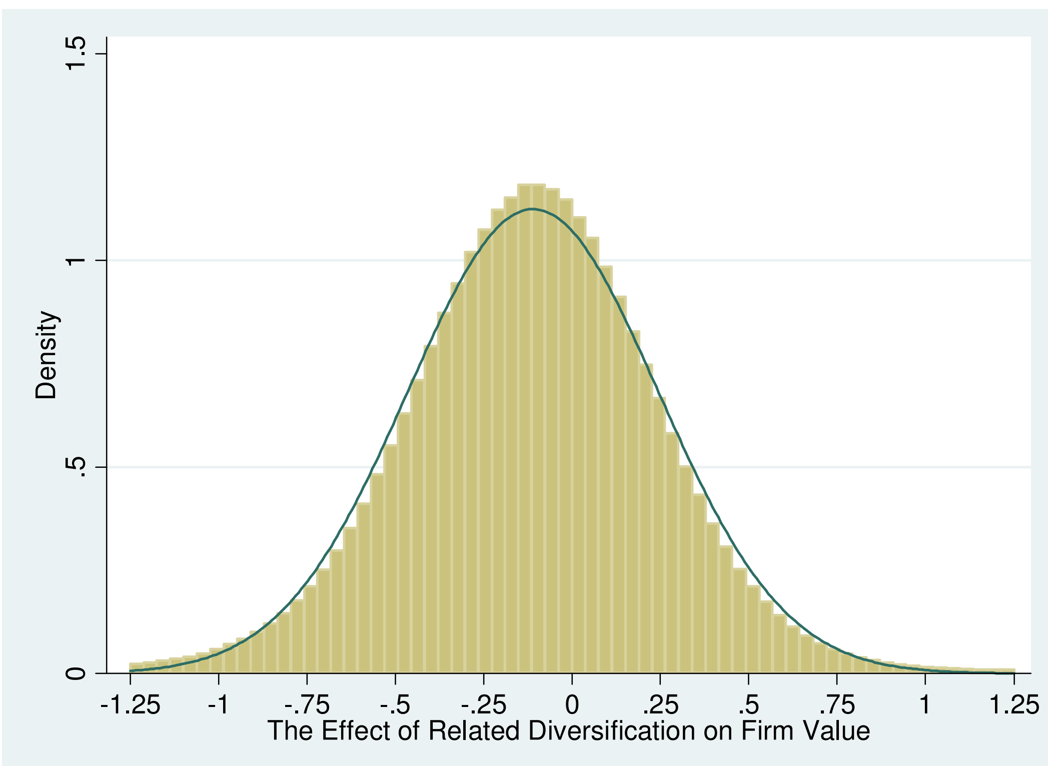

Figure 4.1: The distribution of the firm-specific effects of related diversification on firm value.

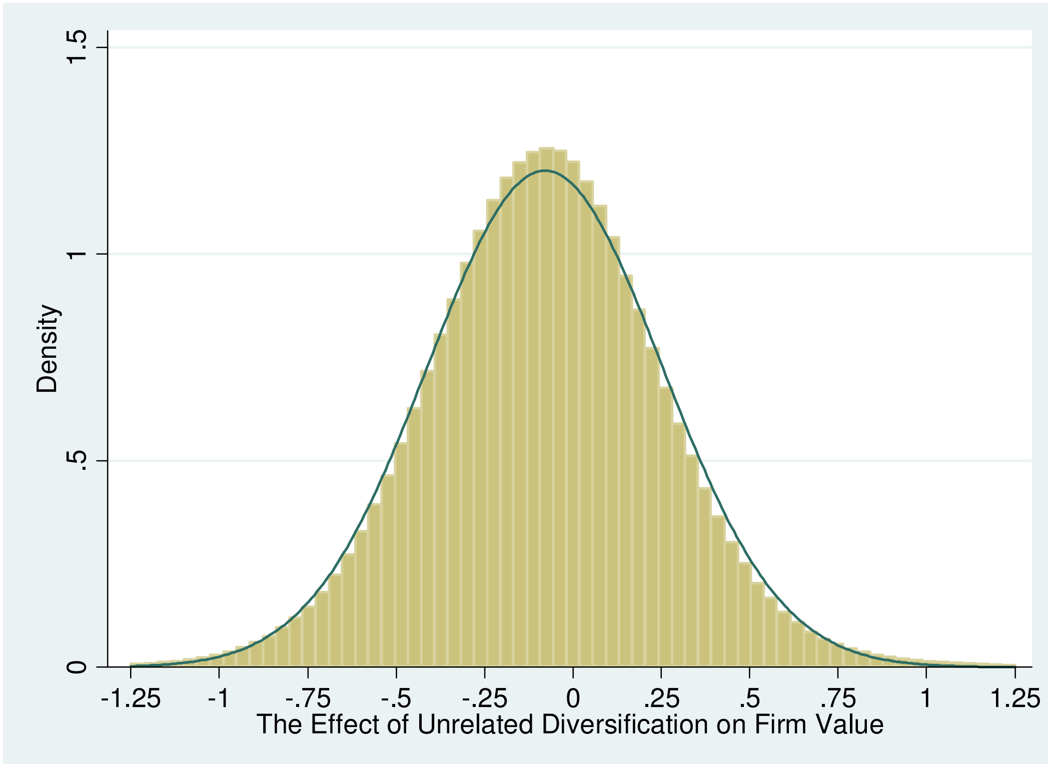

Figure 4.2: The distribution of the firm-specific effects of unrelated diversification on firm value.

Taken together, these results demonstrate why examining the sources of the heterogeneity in the effects is so important. We know that on average related and unrelated diversification are destroying firm value, but we now have seen that for many firms, positive returns could be generated by diversifying. This next section examines what we can learn about differences in firms that are able to create value from diversification from those that are unlikely to be able to create value from diversification.

4.5.1. Firm Attributes Influencing Firm-specific Intercept

Model 4.2 results for the firm attributes influencing the firm-specific intercept are reported in Table 4.6. We can interpret these coefficients as the direct effects of these variables on firm value.

Firm-Specific Coefficient	Firm Attributes	Mean	Standard Deviation	Probability of Positive Outcome
Intercept	Ave LN (Assets)	0.05	0.01	100.0%
	Ave EBIT/Sales	1.82	0.14	100.0%
	Ave CAPX/Sales	0.70	0.11	100.0%
	Ave R&D	1.16	0.18	100.0%
	Ave Percent Change in Assets	0.82	0.08	100.0%
Related Diversification	Ave LN (Assets)	0.00	0.01	42.1%
	Ave EBIT/Sales	0.58	0.36	94.5%
	Ave CAPX/Sales	-0.26	0.26	15.0%
	Ave R&D	-0.38	0.69	28.5%
	Ave Percent Change in Assets	0.05	0.20	61.3%
Unrelated Diversification	Ave LN (Assets)	0.02	0.01	97.1%
	Ave EBIT/Sales	-0.01	0.28	50.1%
	Ave CAPX/Sales	0.05	0.19	59.7%
	Ave R&D	-0.39	0.68	30.6%
	Ave Percent Change in Assets	-0.13	0.16	21.0%
Payout	Ave LN (Assets)	-0.02	0.01	2.3%
	Ave EBIT/Sales	0.81	0.20	100.0%
	Ave CAPX/Sales	-0.05	0.16	36.6%
	Ave R&D	-0.99	0.39	1.1%
	Ave Percent Change in Assets	-0.15	0.12	9.9%

Table 4.6: The distribution of the effects of firm attributes influencing firm-specific coefficients. Firm size is measures as the average logarithm of assets, profitability is measured as return on sales (EBIT/Sales), capital investment is measured as capital expenditures over sales, shared activities are measured as the average level of R&D, and firm growth is measured as the average percent change in assets.

The results are clear that all of the variables that influence the firm-specific intercept have a positive effect on firm value. One hundred percent of the draws on the posterior distribution for each of the variables—size, profitability, capital; investment, R&D intensity, and asset growth are greater than zero.

4.5.2. Firm Attributes Influencing Firm-specific Effects on Payout Policy

The evidence on firm attributes influencing the firm-specific effects on payout policy are consistent with the received literature on payout policy. Payout creates more value for profitable firms, with 100% of the draws predicting that higher EBIT/Sales impacts the effect of payout on firm value positively, with an average of 0.81. This is consistent with theory that payout is a signal of a firm's profitability (Miller and Rock, 1985). Consistent with Grullon, Michaely, and Swaminathan (2002), when payout is the result of a firm's maturity or lack of growth options (large assets, low capital investment, or asset growth), the effect of payout on firm value decreases. Firms with a high ratio of R&D to sales also have a lower effect of payout on firm value, meaning that most R&D intensive firms might get a better return from reinvesting the firm's free cash back in the firm.

4.5.3. Firm Attributes Influencing Firm-specific Effects on Related and Unrelated Diversification

Hypothesis 1 predicts that firms with potential for economies of scope through activity sharing will be able to create value through related diversification, but not unrelated diversification. The model does not provide support for Hypothesis 1. The results of the estimation, shown in Table 4.6, are that one potentially shared activity, R&D, does not have a very powerful effect on the ability of related or unrelated diversification to create value for firms. For both related and unrelated diversification, about 70% of the draws had a negative coefficient, with an average of -.38 for related diversification and -.39 for unrelated diversification.

Hypothesis 2 predicts that resources that create value in one business will be more likely to create value in a related business, but not in an unrelated business. The results support Hypothesis 2: 94.5% of the draws on the coefficient for EBIT/Sales are positive in the equation predicting the effect of related diversification on firm value, with an average of .58. This means that the firms that gain most from related diversification are those that have already found success in their original business. This evidence is consistent with resource-based arguments for how related diversification should create value (Barney, 1988).

While profitable firms are more likely to be able to create value through related diversification, profitable firms are no more likely than unprofitable firms to create value through unrelated diversification. 50.1% of the draws on the coefficient for Average EBIT/Sales are positive in the equation predicting the effect of unrelated diversification on firm value, with an average of -0.01. In other words, profitability has absolutely no impact on the effect of unrelated diversification on firm performance.

Hypothesis 3 tests the theory in Maksimovic and Phillips (2002) and Gomes and Livdan (2004) that unrelated diversification will create more value for mature firms with few growth options. The model finds that larger firms, and firms that are growing slowly, are much more likely to create value through unrelated diversification than smaller firms or firms that are growing quickly. For the impact of firm size on the effect of unrelated diversification on performance, 97.1% of the draws are positive, with an average of .02, and for the impact of firm growth (the firm's average percent change in assets) on the effect of unrelated diversification on firm performance, 79% of the draws are negative, with an average of -0.13. Looking at growth in terms of the ratio of capital expenditures to sales, a higher ratio leads to lower value for related diversification in 85.0% of the draws, with an average of -0.26, and it leads to a higher value for unrelated diversification in 59.7% of the draws, with an average of 0.05. This means that firms that grow through related diversification do not get as much benefit if it happens through building new assets rather than sharing existing resources.

4.5.4. Limitations

A general limitation of these results is that they do not estimate when related or unrelated diversification is a value creating strategy; only when they will create more or less value. For example, Hypothesis 3 asserts that mature firms will create more value from unrelated diversification than firms in a growth phase. While the model supports Hypothesis 3, it does not mean that mature firms are increasing (or would increase) their value through unrelated diversification; it might only mean that mature firms destroy less value through unrelated diversification than growing firms do. The mature firm may still be better off returning cash to shareholders, or acquiring a competitor (Anand and Singh, 1997).

4.6. Discussion

The results of Mackey and Barney (2006)—that diversification destroys value after accounting for a firm's payout policy choice—are supported : in both models, firms that pay a dividend or buyback destroy less value from diversification than firms that do not pay a dividend or buyback, while paying a dividend or buyback creates value for most firms. These results, while important, do not tell the entire story.

As noted at the outset, it is important to observe that, like many decisions that managers make (Hansen, Perry, and Reese, 2004) there is considerable heterogeneity between firms in the effects of diversification on payout policy (See Tables 4.2 and 4.4). This heterogeneity is sufficiently large that while most diversified firms are destroying value through diversification, some firms have found a way to create value through diversification. Still other firms remain undiversified when they could create value through diversification.

Using a Bayesian hierarchical model, the results presented in this paper support the idea that firms that have superior resources will be more likely to create value through resource sharing than firms without these resources. The implication is that a firm can't transfer resources that don't exist. Related diversification is not likely to be a successful escape for a firm that is having trouble competing in its present business.

In contrast, for unrelated diversification, results favor theory by Maksimovic and Phillips (2002) and Gomes and Livdan (2004) that mature firms will be the most likely to benefit from unrelated diversification. Hence, it is not as important for firms pursuing unrelated diversification to be successfully competing in current businesses to create value from diversification as it is for firms pursuing related diversification.

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