The effect of diversification on firm value: Publicly listed firms in the Netherlands and Germany post-financial crisis

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ABSTRACT,

This thesis investigates the influence diversification on firm value of publicly listed firms in Germany and the Netherlands. This influence is investigated by examining the relation between the number of industries a firm is active in and its Tobin's Q, EV and Adjusted Q. Diversification was found to have a statistically negative influence on EV and the adjusted Q valuation measures. For Tobin's Q a statistically insignificant diversification premium was found when using a diversification dummy and a statistically insignificant diversification discount was found when looking at the number of segments in which a firm is active.

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1. INTRODUCTION

This paper sets out to investigate the effect of diversification on the value of publicly listed firms within Germany and the Netherlands. Throughout the past two and a half decades much research has been done to assess the effect of diversification on firm value. The first empirical studies showed that diversified firms traded at a discount compared to a portfolio of similar single-segmented firms (Lang & Stulz, 1994; Berger & Ofek, 1995; Servaes, 1996; Denis, Denis, & Yost, 2002). Many studies followed leading to differing results and thus sparking the discussion if diversification leads to an increase or decrease in firm value. The results of these studies can be grouped into three different conclusions: 1) *'Corporate diversification destroys shareholder value'.* ((Shin & Stulz, 1998; Scharfstein, 1998; Rajan, Servaes, & Zingales, 2000; Bradely, Desai, & Kim, 1988; Loughran & Vijh, 1997) 2) *'Corporate diversification does not destroy shareholder value'*. (Graham, Lemmon, & Wolf, 1998; Lang & Stulz, 1994; Campa & Kedia, 1999; Lamont & Polk, 2001) 3) *'Corporate diversification creates shareholder value'*. (Corporate Takeovers and Productivity; Montgomery, 1994; Denis, Denis, & Sarin, 1997; Hyland, 1999; Villalonga B. , 2000a)

The lack of a clear consensus invites for more research to be undertaken into the effect of diversification. What further sets this paper apart from previous literature is the market in which it is done. A large portion of the previous literature was done with a dataset containing firms located in the US and UK markets. Both these countries have market-based financial systems while the two countries in this paper (the Netherlands and Germany) have bank-based financial systems. With the context mentioned above in mind, the following research question has been developed:

What is the effect of diversification on the value of publicly listed firms in Germany and the Netherlands between 2012 and 2017?

The second section of this paper will conduct a literature review on diversification and firm value, analyze previously conducted research into this topic and give an overview of what the conclusion from this previous research was. Finally, a discussion on different biases regarding the studies of the effect that diversification has on firm value will follow. In section three a hypothesis will be constructed based on the conclusion taken away from the literature review. Section four will talk about the methodology and data that is used in this study. The fifth section focuses on the output results through descriptive statistics, results of the regressions and robustness testing. Conclusions are given in the sixth section.

2. LITERATURE REVIEW

A literature review has been carried out to give insights into the previously presented research question. The literature review follows the structure as drawn out by Ridley (2008) and is based on both published and unpublished literature with the goal of collecting ideas, information and empirical evidence. Based on this research a holistic overview of the nature of this topic and the methods in which it can be effectively evaluated were developed. The material within the literature review has been collected from multiple online databases (Elsevier; Scopus; Google scholar; Wiley online library). Examples of the search terms that were used are: "diversification", "effect of diversification on firm value", "diversification". The available papers were scanned and ranked based on which sub-questions they could answer.

The literature review is split up into three different sub-sections to ensure a clear and well layout structure that is easily understandable. The first sub-section investigates diversification and gives a broad analysis on diversification and its effect on firm value. The second sub-section will analyze multiple theories which try to give explanations for the reasons that firms decide to diversify. The final sub-section will focus on the effect of diversification on firm value. Here an analysis is given on previous research, explanations for valuation effects are given and multiple possible valuation biases are given.

2.1 Diversification Background

The discussion regarding diversification and its effect on firm value goes back multiple decades and is still heavily debated. Before diving into the literature background on diversification, it might prove useful to understand what diversification is and why firms choose to diversify.

2.1.1 Types of Diversification

Diversification occurs when a firm decides to seek new opportunities which fall within a business sector or country in which the firm is not yet active (Martin & Sayrak, 2009). There are different ways in which a firm can decide to diversify its operations. The three most common types of diversification are related vs unrelated diversification, domestic diversification vs international diversification and horizontal vs vertical diversification. (Kotler & Keller, 2006)

2.1.1.1 Unrelated vs Related Diversification

Diversification can be either related or unrelated. (Dhandapani & Upadhyayula, 2015). Related diversification refers to the extent to which a firm uses similar resources and skills within its operations (Tanriverdri & Venkatraman, 2005). These resources and skills refer to the amount of experience firms and their employees have in certain business segments. Firms that undergo related diversification can more easily draw upon skills that are already present within the firm since the different segments contain similar characteristics at their core (Neffke & Henning, 2013). It can thus be stated that a diversification can be labeled as (un)related if there is a significant (mis)fit between the new business segment that a firm moves into and its core business.

2.1.1.2 Domestic vs International Diversification

Corporate diversification occurs when a firm combines business units that operate in different segments under the control of one common firm (Martin & Sayrak, 2009). This corporate diversification can be undertaken on domestic or on international level (Denis, Denis, & Yost, 2002). Firms that decide to diversify domestically further develop their operations in new business segments in the hopes to attract a new segment of customers while firms that diversify internationally focus on growing their customer base in new countries

2.1.1.3 Horizontal vs Vertical Diversification

Organizations can further choose to diversify their operations vertically or horizontally. Vertical diversification occurs a firm expands its operations into a stage in which products are produced successive to their current operations (merging with a supplier or customer). Horizontal diversification occurs when a firm adds parallel products to the existing product line. This can be done to either broaden the offered product range to a firm's current customers or with the goal to attract a completely different group of customers.

2.2 Theories

2.2.1 Agency Theory

The agency cost theory was developed by Jensen & Meckling (1976) and describes the costs that are made by the principle to monitor agents, the costs made by the agent when bonding with the principle and the residual loss incurred through these activities. In regards to diversification, the agency cost theory

states that managers will seek to diversify business operations regardless of the effect that it has on shareholder value. This drive to diversify comes from the incentives that it offers managers. These incentives are an increase in their power, compensation, and perquisites (Jensen, 1986; Jensen & Murphy, 1990; Stulz, 1990) and through the reduction in their individual employment risk that is closely related to firm risk (Amihud, 1981). Diversification leads to a reduction in employment risk since it allows managers to entrench themselves (Shleifer & Vishny, 1989), increasing the differential between themselves and potential replacement managers. Further research conducted by Agrawal & Samwick (2003) supported these earlier findings giving evidence that managers diversify to support their own private benefits and not to reduce the firm's exposure to risk.

2.2.2 Theory of Capital Markets

Firms that establish internal capital markets are able to use a segment's assets as collateral for obtaining funding for other segments and cash flows generated by one division to subsidize investment in other divisions of the firm. The creation of capital markets within a firm is one of the main reasons for diversification. By creating economic activity in different industries, firms can obtain capital for one business segment by putting up collateral from another business segment. This increase in available capital can be distributed over the different industries from less profitable projects to more profitable projects. Stein (1997) argues that, in contrast to outside investors (external capital), the CEO has insider information about the various segments' investment prospects and may thus be able to engage in winner-picking.

2.2.3 Debt Co-insurance Effect

The debt co-insurance effect theory states that firms have a purely financial rationale for diversification. This rationale is based on the consideration that a combination of different businesses, with imperfectly correlated cash flows, reduces overall firm risk and thereby decreases the probability of insufficient debt service. This so-called debt coinsurance leads to a higher (potential) debt capacity and, in turn, to gains in firm value, through an increased tax shield, due to the substitution of equity with debt capital (Rudolph & Schwetzler, 2014).

2.2.4 Resource-based View

The resource-based view argues that firm should try to achieve a competitive edge by accumulating valuable, rare, inimitable and non-substitutional (VRIN) resources. One strategy that could be used to collect these VRIN resources is through acquiring other business segments or firms. This makes VRIN resources an important driver for firm diversification (Wan, Hoskisson, & Short, 2011).

Firms that have already obtained VRIN resources might also feel the need to diversify so that they can better allocate these resources over different industries (Maksimovic & Phillips, 2008). This view was further built upon by Mastusaka (2001) who stated that in today's dynamic and fast-paced markets, it would prove useful to not only obtain VRIN resources but also to obtain the capabilities to move these resources across markets quickly.

2.3 Effect of Diversification on Firm Value

According to the Modigliani-Miller assumptions within perfect capital markets, diversification should be irrelevant to firm value since shareholders can diversify their portfolio more efficiently than the firm. Capital markets are never perfect though and thus diversification should affect firm value. What kind of effect diversification has on firm value is more difficult to explain, however. According to Santalo & Becerra (2008), the effects of diversification seem to be heterogeneous across industries, making a strong analysis of the effect of diversification on firm value even more difficult. During the introduction a group of 15 studies was highlighted which are used as a basis for this paper. These studies conducted in three distinct ways; cross-sectional studies, event studies and by studying a firm's internal markets.

2.3.1 Cross-sectional Studies

The cross-sectional studies that were undertaken to assess the effect of diversification tried to determine the value of diversified firms relative to their comparable single-segmented firms.

Lang & Stulz (1994) were the first to undertake a cross-sectional study to assess the effect of diversification on firm value. The results from this study showed that that diversified firms trade on average at a lower Tobin's q than their single-segment peers over the period of 1978 to 1990. Berger & Ofek (1995) confirmed the results that Lang & Stulz found as their results showed that diversified firms traded at an average discount of 13% to 15% in comparison to their single segmented counterparts.

Servaes (1996) and Klein (2001) studied the effect of diversification during the merger wave of the 1960's and found an average discount at which diversified firms traded. Lins & Servaes (1999) replicated this study for firms located in the U.K. and Japan and found the same results.

More recent cross-sectional studies were conducted by Kuppuswamy et al. (2012). Their investigation looked at a global sample of firms over a period of 15 years. They found that diversified firms in developed countries traded at a discount while diversified firms in emerging markets traded at a premium.

Multiple cross-sectional studies found no indication of diversification leading to a firm premium of discount. Most notable among these studies were two recently performed studies undertaken by Glaser & Miller (2010) and Zahavi & Lavie (2013).

2.3.2 Event Studies

The second method used to research the effect of diversification on firm value is through event studies. These event studies delivered empirical evidence that stock markets have the tendency to react positively to firm divestiture announcements (Comment & Jarrel, 1995; Berger & Ofek, 1995; Krishnaswami & Subramaniam, 1999; John & Ofek, 1995; Daley, Mehrotra, & Sivakumar, 1997). Other event studies provide evidence that firms receive abnormally negative returns once they undergo further diversification (Morck, Schleifer, & Vishney, 1990; Agrawal, Jaffe, & Mandelker, 1992).

During this time there were multiple event studies that showed that corporate diversification led to non-negative and positive results (Hubbard & Palia, 1999; Chevalier, 2004; Dos Santos, Errunza, & Miller, 2008; Akbulut & Matsusaka, 2010). Dos Santos et al. (2008) showed that there was only a post-merger drop in US firms after they diversified un-relatedly and cross-border. Akbulut & Matsusaka (2010) found in their studies that the returns that a firm received from diversifying acquisitions were not lower than acquisitions that were not of diversifying nature. Finally, Chevalier (2004) concluded from his research that the returns were higher for firms that underwent related diversification.

2.3.3 Explanation for Valuation Effect

Following the assessment on the effect of diversification on firm value in chapter 3.1, an overview is given on the explanations that literature has given for this presumed effect. The chapter is

split up into two main parts; Value reducing explanations and value enhancing explanations.

2.3.3.1 Value Reducing

Literature has identified multiple drivers which lead to the firm value reduction. These value reducing drivers are; Risk-reducing effects, agency conflicts, corporate governance and organizational costs. Each of these drivers is further elaborated on in the subparts below.

Risk-reducing effect

Multiple literature studies have pointed to risk-reducing effects as being the main contributor to the reduction of firm value. Berger & Ofek (1995) were the first to find evidence for this. They found that diversified firms had a stronger tendency to overinvest in comparison to their single-segmented counterparts. Both Berger & Ofek (1995) and Mansi & Reeb (2002) found evidence that the cross-subsidization between different segments of a firm actual led to value destruction. This value destruction comes forth from managers using cross-subsidization to invest extra capital in business segments with poor growth opportunities while simultaneously underinvesting in business segments with strong growth opportunities.

A final risk-reducing effect was identified by Amman et al. (2012). He stated that managers of diversified firms find themselves in a position that is aligned with that of bondholders leading to a risk-reducing strategy. Risk-reducing strategies lead to potential projects with high NPV's becoming unwanted. This will be in favor of the bondholders but will harm the shareholders as they receive less return on their invested capital.

Corporate Governance

Multiple studies relate the reduction in firm value to bad corporate governance within firms. As firms diversify it becomes more challenging to manage the firm and thus strong governance systems are needed. Hoeche et al. (2012) concluded that even though diversification always led to firm value reduction, that only a small portion of the total value reduction was explained by diversification. The rest of the value reduction came from other factors including poor corporate governance.

Hoechel et al. (2012) also found that the ownership structure of a firm had the effect on the firm value. Firms that diversified while being led by institutional owners could more easily create analytical and informational advantages compared to other firms making them better at winner picking projects and thus enhancing firm value.

Hautz et al. (2013) found that firms who had a CEO with a majority stake in the firm had a lower value discount or even a value premium. The explanation for this was that firms with a CEO who was also an owner would still take on risky projects as otherwise, the CEO would destroy his own value.

The final corporate governance aspect that impacted both firm diversification and the firm value was the compensation structure of a firm. Both Choe et al. (2014) and Agrawal & Samwick (2003) concluded that firms that pay their managers based on a long-term vision (and thus long-term incentives) ended up benefiting more from the diversification that the firm went through than firms that based their manager compensation structure on a short-term vision.

Organizational costs

The increase in organizational costs that a firm incurs during diversification is another reason brought up by the literature to explain the reduction in firm value. Anjos (2010) argued during his study that the firm's restructuring costs following a spin-off or acquisition were asymmetrical. Firms wanting to diversify paid a high restructuring cost than firms undergoing a refocusing strategy leading to the decrease in firm value when firms diversified

Zahavi & Lavie (2013) also looked into the costs that a firm incurred while diversifying and found that firms that had previously undergone diversification lost firm value due to negative transfer effects. They concluded however that as managerial experience with diversification increased that the negative effect of it on firm value also decreased and even disappeared.

Agency conflicts

Agency conflicts have been studied so strongly and widely that the driver has a complete theory built around itself (see chapter 2.2.1). Denis et al. (2002) was one researcher that tried to explain how diversification could lead to a reduction in firm value due to agency costs. They found that managerial compensation was positively correlated with firm size making it interesting for firm management to diversify even into unfavorable business segments. They further argued that managers could diversify the firm further to decrease the risk that they held in their own portfolio.

Leaven et al. (2007) further found that diversified firms trade at a discount due to the extra monitoring costs that a firm incurs due to the extra business segments and firm size that come with it.

2.3.3.2 Value Increasing

Contrary to the value decreasing findings were a multitude of studies which showed the value increasing effects of diversification. Two main explanations were developed to explain these value increasing results; institutional factors and internal capital markets.

Institutional factors

Multiple studies have looked for a value explanation into countries institutional factors to explain the differing results of the studies into diversification on firm value. Most notably Fauver et al (2004) and Kuppuswammy et al. (2012) looked into these institutional factors hoping to see if national frictions in a country's labor market, capital market, and product markets could play a role in the valuation of diversified firms. Their research showed that diversified firms trade at a premium compared to their single-segment counterparts in countries with less efficient capital markets. Fauver et al. (2004) built further on this notion by stating that if a countries economic or legal environment is not optimal that it might be beneficial for firms to merge and operate under one entity than to stay and act as single firms.

Internal capital market

As mentioned previously in chapter 2.2.2, a firm has the ability to create an internal capital market when it decides to diversify. During their study of organizational internal capital markets, Khanna & Tice (2001) found that firms that had undergone related diversification were able to efficiently move the capital between the separate business units. Peyer (2002) found that firms with efficient capital markets were able to attract more external capital than single-segmented firms. Ghosh & Jain (2000) came to the same conclusion interpreting the outcome as an increase in debt capacity. Finally, Glaser et al. (2013) found evidence that business segments with powerful and connected managers were able to achieve sizably higher returns in periods of financial slack.

2.3.4 Biases in Valuation Methodology

The disagreement within the literature has led to researchers questioning the causal relationship between diversification and firm discount. Researchers have identified multiple problems within the methodology used in the literature including;

endogeneity, biases related to COMPUSTAT and financial reporting.

Endogeneity

Most of the literature treats the diversification that a firm goes through as an exogenous variable. This is not the case since firms only diversify their operations after internally agreeing on it. The outputs from previous research focused on the average difference in outcomes between the control group (single-segmented firms) and the treatment group (diversified firms). However, by doing this, researchers act as if the assignment of firms in either the single-segmented or diversified group happen at random. Due to the assignment of diversification being non-random this will lead to biased ordinary least squares estimates.

Multiple researchers tried to solve this endogeneity problem during their research. Both Campa & Kedia (2002) and Villalonga (2004b) made use of different types of econometric approaches. Under these approaches were the fixed-effects estimator and simultaneous equation estimator, Heckman's two-stage method, and propensity scoring. The results of their study after checking for this possible endogeneity led to the firm value discount disappearing and in some cases even turning it into a premium.

Biases related to COMPUSTAT

A very large portion of the research done into the effect of diversification on firm value was done with the use of COMPUSTAT data. From very early on researchers have raised concerns revolving around this database. Back in 1991, Lichtenberg declared that the reported data by COMPUSTAT gave a lower representation of diversification within firms than was actually true. Denis et al. (1997) soon followed by stating that a large portion of the segment diversification which is reported within COMPUSTAT are not actually diversification events but merely changes in the reporting of business segments. Much later Maksimovic & Philips (2008) published a final concern when it came to using data from COMPUSTAT. They argued that COMPUSTAT calculated the firm's capital expenditures without accounting for any acquisitions done by the firm. By ignoring the acquisitions the database missed out on important data when looking at the investment behavior of diversified firms. These problems with COMPUSTAT could lead to diversified firms being reported as single-segmented firms, firms could be placed in wrong industries and organizational investment behavior could be wrongly assessed.

Financial Reporting

A final concern revolves around the accounting principles that get used while studying the effect of diversification. Custodio (2014) and Glaser & Muller (2010) state that these accounting principles lead to biases in the data outcome. The major accounting implication leading to valuation bias is the use of book values of debt instead of market values of debt. Domestic diversification lowers a firms risk (as discussed in chapters 2.2.3), and if the firm does not use this reduction in risk to attract new leverage this will lead to an increase in bondholder value. Shareholder value is partly based on a firm leverage level however and thus this will decrease if the company is not re-leveraged (Mansi & Reeb, 2002). After running tests on both non-all equity firms and all equity firms they concluded that using book debt in their research led to bias. When running tests with market debt they found that this reduced the level of bias.

3. HYPOTHESIS

During the assessment of the previously conducted literature, it became clear that there is still much disagreement within the literature with regards to the effect of diversification on firm value. Looking at the different subsections of the literature review it becomes clear that overall more research shows a negative relation between diversification and firm value. Sub-section 2.3.1 analyzed the results of previously conducted cross-sectional studies and concluded that five previously conducted types of research found a firm discount around diversified firms while three studies did not find such a discount. Sub-section 2.3.2 analyzed the outcomes of multiple event studies and found that five studies showed a value increase when diversifying vs three firms that found a value decrease. Finally, sub-section 2.3.3 found four different value reducing explanations and two value increasing explanation. Further, one of these value increasing explanations revolves around the creation of internal capital markets. Previous literature showed that firms operating in inefficient and/or illiquid capital markets receive more benefits from creating internal capital markets than firms operating in very efficient and liquid markets. Kristoufek & Vosvrda (2013) measured market efficiencies of over 50 countries worldwide and found that both the German and the Dutch capital markets belong to the most efficient and liquid markets globally. This means that Dutch and Germany's firms receive fewer benefits from creating internal capital markets. Based on these conclusions the following hypothesis can be developed:

(1) H0: Diversification has a negative effect on firm value

4. METHODOLOGY & DATA

The following section will present the model used to test the hypotheses developed in the previous section. First, an overview is given of the model paired with an explanation for the choice of the model used. This is followed by an introduction into the different variables used within the model and the references to previous literature which used the same model. Finally, an overview is given of the tests that were done on the model to reduce the chance of biases in the results.

4.1 Models

This paper makes use of cross-sectional time-series data, also known as panel data, to provide evidence regarding the influence of diversification on firm value. The choice for this method stems from the unbalanced short panel data used in this paper, which is built up over a large sample of firms covering multiple years. Two different regression models were developed to answer the hypothesis: which can be specified as:

1) $Firm\ Value\ (Tobin's\ Q, Adjusted\ Q, EV)_{it} = \alpha_0 + \beta_1 ID_{it} + \beta_2 Size_{it} + \beta_3 Growth\ Opp._{it} + \beta_4 Prof._{it} + \beta_5 Lev._{it} + \varepsilon_{it}$

2) Firm Value (Tobin's Q, Adjusted Q, EV)$_{it} = \alpha_0 + \beta_1 INum_{it} + \beta_2 Size_{it} + \beta_3 Growth\ Opp._{it} + \beta_4 Prof._{it} + \beta_5 Lev._{it} + \varepsilon_{it}$

Where α_0 is the intercept and both models is control for size, growth opportunities, profitability and leverage. Model 1 uses an industry dummy variable (ID) as independent variable and Model 2 uses the number of industries (NumInd) as independent variable. The denotations i refers to the different firms and t refers to the different time periods.

4.2 Variables

The variables used in the regression model have been picked after an analysis of multiple key papers (Lang & Stulz, 1994; Berger & Ofek, 1995; Servaes, 1996; Denis, Denis, & Yost, 2002; Villalonga B. , 2004; Rudolph & Schwetzler, 2014; Lee, Hooy, & Hooy, 2012)which studied the effect of diversification on firm value.

4.2.1 Dependent Variables

Literature shows three main ways in which the effect of diversification on firm value can be computed; through Tobin's Q (Lang & Stulz, 1994; Servaes, 1996) and the adjusted Q (MV/Sales) (Custodio, 2014; Lee, Hooy, & Hooy, 2012; Rudolph & Schwetzler, 2014) and through computing firm excess value (EV) (Denis, Denis, & Yost, 2002; Villalonga B. , 2004; Lee, Hooy, & Hooy, 2012). Both Tobin's Q and the adjusted Q are market variables which show how the stock market values a firm. The EV makes use of accounting variables to compute a firms value in comparison to the market.

4.2.1.1 Excess Value

The EV method was widely used in previous literature (Denis, Denis, & Yost, 2002; Villalonga B. , 2004; Lee, Hooy, & Hooy, 2012; Berger & Ofek, 1995) and relies on calculating the value of a diversified firm's different business segments and dividing the outcome with the firm's actual value as shown below:

$$EV = FV / FV_{imputed}$$

Imputed values of business segments

Accounting variables are used to measure the value of the different business segments of a firm. By multiplying accounting variables with an industry average multiplier to calculate the value of the individual business segments. This is shown in the formula below:

$$FV_{inputed} = \sum_{i}^{n} AV_i * IM_i$$

Where AV is the accounting variable and IM is the industry multiplier. Literature has used multiple accounting variables to compute firm EV. The most commonly used accounting variables are; Sales-based EV and EV based on assets and earnings. There is thus some freedom within the literature when it comes to choosing which accounting variables to use to obtain the imputed value of a firm's segment. From his research Custodio (2014) concluded that from the different accounting variables sales is the least vulnerable to manipulation due to accounting disclosure laws. Due to the time scope of this paper and previous literature stating that there is little difference between the different accounting variables (Custodio, 2014), the choice has been made to only use the sales-based EV of the diversified firms. This sales-based EV is obtained by taking the sales of firms different sub-segments and multiplying this with the industry multiplier.

Industry Multiplier

To be able to calculate the sales-based EV an accounting multiplier has been developed. Firms were placed into different industries based on their two-digit SIC code. The adjusted Q ratio was then calculated for the single-segmented firms to calculate an industry multiplier mean. In early literature, this industry multiplier was always based upon the group median. Rudolph & Shwetzler (2014) provided clear evidence that the geometric mean was a much more accurate representation of the actual industry and because of this the geometric mean will be used to calculate the industry multiplier within this paper.

4.2.1.2 Market Variables

Both other variables that will be used in this paper are market variables. These dependent variables were taken from previous literature (Lang & Stulz, 1994; Servaes, 1996; Lee, Hooy, & Hooy, 2012). Section 2.3.4 discussed biases in the previous literature due to financial reporting. To ensure that this bias does not occur in this paper the study will make use of two separate market variables; Tobin's Q ($\frac{\text{Market Value}_{equity}}{\text{Total Assets}}$) and the adjusted Q ($\frac{\text{Market Value}_{equity}}{\text{Total Sales}}$). Custodio (2014) addressed a major issue of biases occurring during research due to imputed values being based on book value assets. A second input value is introduced to ensure that this bias is controlled for in this paper. Lee et al. (2012) and Custodio (2014) both advised instead use sales ratios to calculate imputed values since these are less affected. An assessment will thus be made in this paper to see if Custodio's findings will find support or criticism from this paper.

Tobin's Q has been used extensively in previous research to measure firm value and thus it will also be used in this paper for the sake of continuity. Following the advice of Lee et al. (2012) and Custodio (2014), we will also compute firm value by dividing a market value by total sales. An assessment will thus be made in this paper to see if Custodio's findings will find support or criticism from this paper.

4.2.2 Independent Variables

The independent variables that will be used within this paper are based upon the previous empirical research that has been done into the effect of diversification on firm value. There are three different ways in which previously literature measured diversification within the firms:

1. Use of dummy variable for reporting more than one business unit
2. Take the number of reported business segmented
3. Use of a segment-sale-based Herfindahl index

The first two methods were used by Mansi & Reeb (2002) while the Herfindahl index was used by Doukas & Lang (2003). Due to the time scope of this paper diversification will only be measured through a dummy variable and a firm's number of business segments that have reported sales.

4.2.3 Control Variables

There are multiple variables that affect a firm's value. We are solely interested in how diversification interacts with firm value, and thus we must control for the other variables. The control variables used within the model in this paper are taken from previous literature (Lang & Stulz, 1994; Denis, Denis, & Yost, 2002; Villalonga B. , 2004; Lee, Hooy, & Hooy, 2012) and are:

Firm Size:

Firm size has a strong effect on firm value. As the size of firm growths, it acquires more property, plants, and equipment to facilitate in this growth. To control for this strong correlation between firm size and firm value the natural log of firm total assets will be taken.

$$\text{Firm Size (LTA)} = \log \text{Total Assets}$$

Growth opportunities:

Following previous literature, a control variable will be added to control firm's growth opportunities. This factor will be controlled for as taken Dennis & Yost (2002), Villalonga (2004), Hund et al. (2010) and Lee et al. (2012) in line with the literature.

$$\text{Growth opportunities(CPX)} = \frac{\text{CapEx}}{\text{Sales}}$$

Profitability:

A multitude of different literature has identified profitability as being a factor influencing firm value (Berger & Ofek, 1995; Lang & Stulz, 1994; Lins & Servaes, 1999; Fauver, Housten, & Naranjo, 2004). Since profitability is heterogeneous amongst firms, it will be controlled by the previous literature.

$$\text{Profitability(OIS)} = \frac{\text{Operation Income}}{\text{Sales}}$$

Leverage:

Leverage plays a crucial role in the financing of firm operations. By increasing its leverage, a firm can attract cheap capital to finance its operations. As the leverage level within the firm raises the firm's risk for insolvency rise as well increasing the firm's this leverage factor.

$$\text{Leverage (LEV)} = \frac{\text{Total debt}}{\text{Common share equity}}$$

4.3 Data

A sample of publicly listed firms within the Netherlands and Germany is gathered over a six-year period from 2012 to 2017. Financial and balance sheet data is collected from Orbis. Orbis is a database owned by Bureau van Dijk (BvD was acquired by Moodys in 2017). It contains information on companies across the world. It has information on around 250 million companies from all countries. Bureau van Dijk collects the information from over 150 different data providers. The Orbis Database will be used to collect the data needed to compute the different independent variables and control variables. A clear search strategy was developed to locate and extract the correct data from Orbis. Firms were only taken from Orbis if they were publicly listed and were publicly listed on the Euronext Amsterdam (Netherlands) or Boerse Frankfurt, Boerse Stuttgart, Boerse Berlin, Boerse Hamburg, Boerse Munchen and Boerse Dusseldorf (Germany). These boundaries brought the sample of firms back to 972 firms. Following previous literature, any firms with segments in the financial services sector (SIC 6000-6999) or firms active in an unclassified sector (SIC 999) were removed from the sample. Firms from the financial sector were removed as firms within these industries differ significantly from firms in other sectors and their capital structures are regulated by governments (Pandey, 2001). Next all firms with missing data needed to compute the necessary variables was removed. Finally, firms with faulty sales figures were removed as these play a vital role in the computing of EV. After having cleaned the data the sample had shrunk to 296 Dutch firm-year observations and 1687 German year observations.

4.4 Testing the Model & Robustness Check

Fixed effect model

Following the literature (Bartels, 2009), a fixed effect model will be used to run our regression. The choice to run a fixed effect model come from the assumption that firms do not diversify randomly but instead that something within firms drives them to diversify. This would mean that there will be a correlation between a firm's error term and predictor variables (Torres-Reyna, 2007; Greene, 1991). A Hausman specification test was run to further ensure that the fixed effect model would fit the data. Hausman's null hypothesis is that the preferred model is random effects while the alternative hypothesis states that the preferred model is fixed effects (Greene, 1991). The Hausman test rejected the null hypothesis (Appendix 7.1) for all models supporting the use of a fixed effect model.

Elimination of Outliers

Two different methods have been used to eliminate the outliers within the different models. Following Amman et al. (2012), all firms where the actual firm value is larger than four times or less than one fourth of the imputed value will be excluded resulting in the winsorizing of 19 firms. Following previous literature (Rudolph & Schwetzler, 2014; Berger & Ofek, 1995), the data within the models including adjusted Q and Tobin's Q as dependent variable have been winsorized at 2.5% and 97.5% level.

Autocorrelation

Autocorrelation occurs when the standard errors for the one-time period are correlated with the standard error for a subsequent time period. The Wooldridge's autocorrelation (Wooldridge, 2010) has been performed on the different models in order to control for autocorrelation.. Wooldridge's null hypothesis is that there is no autocorrelation within the model. The output (Appendix 7.2) show that the null hypothesis must be rejected in both models with EV and Tobin's Q. This means there is autocorrelation within these models while there is no autocorrelation in both models with adjusted Q as dependent variable.

Heteroscedasticity

Heteroscedasticity occurs when the variation of errors is unequal across the values of the variable that predicts it which causes standard errors to be biased. To ensure that my regression model is free of heteroscedasticity the modified Wald test has been run. This tests allows me to check for group wise heteroscedasticity (Torres-Reyna, 2007) in the residuals of the fixed effect model. The modified Wald test's null hypothesis is that there is homoscedasticity within the model while the alternative hypothesis is that there is heteroscedasticity. The outputs of the test (Appendix 7.3) show that heteroscedasticity is present in both models with EV and Tobin's Q as dependent variable. In both models with the adjusted Q homoscedasticity was present.

5. RESULTS

5.1 Descriptive Statistics

The complete descriptive statistics can be found in table 1. The mean EV of the diversified firms is 1.137 meaning that there is a value premium of 13.7%. The group's mean Tobin's Q is 1.006 which means that the average market value of all the diversified firms is 0.6% higher than the book value of their assets. Finally the group's mean adjusted Q is 0.866 which states that on average a firm's market value is 86.6% of the total sales it makes in a year.

The median EV of the diversified firms is 1.032, the median Tobin's Q is 0.786 and the median adjusted Q is 0.739. From these statistics, we can see that for every variable the mean is higher than the median and that thus the data is skewed to the right.

The summary of the single-segmented firms shows that these have a mean EV of 1.524 and that they thus trade at a value premium of 52.4%. The mean Tobin's Q is 1.152 and the mean adjusted Q is 1.267. When looking at the difference in between the median EV of single-segmented firms and diversified firms we see that single-segmented firms get traded at a premium of 6.2% compared to diversified firms. The same analysis of the median for the adjusted Q sees that firms single-segmented firms get traded at a 9.3% premium. Finally single-segmented firms also get traded at a premium (4.3%) when looking at the differences in Tobin's Q.

When looking at previously conducted research in this areas Amman et al. (2012) found that an average Tobin's Q of 1.39 for their European sample between 2003 and 2007. This is higher than the average Tobin's Q that was found during the research in this paper (1.152). The explanation for this could be that this research was conducted more than ten years ago and pre-financial crisis plus that it looked at more countries than only the Netherlands and Germany. A second study looking specifically at firms in Western Europe between 1996 and 1999 was conducted by Maury (2005) and found an average Tobin's Q of 1.25 which is a little higher than the Tobin's Q we found within

this paper.

Amman et al. (2012) found during their 2000-2005 based study of US a mean conglomerate of diversification discount that ranged between 0.009 and 0.139. This is further in line with Hoechle et al. (2012) who discovered a diversification discount between 0.06 and 0.053. The findings in this paper partially stroke with these earlier findings since the median diversification discount of diversified firms is 0.062 when comparing them to single-segmented firms.

The mean amount of industries in which the diversified firms are active is 2.507. Rudolph & Schwetzler (2014) looked into European firms for their research and found that diversified firms in continental Europe were on average active in 2.41 business segments while diversified British firms were active in 2.34 segments. The results from their research are thus very similar to that of this papers. For their sample in North America they found that diversified firms were active in 2.29 business segments which is a little lower than both the findings both our and their papers had in Europe. Berger & Ofek (1995) found that diversified firms in North America were active in 2.89 business segments showing that over the last two decades the number of business segments in which firms were active has shrunk.

When looking at firm size we see that single-segmented firms are on average smaller (5.45) than diversified firms (6.18). When comparing these results to previous literature we see that Rudolph & Schwetzler (2014) found a mean size of 12.10 for diversified firms, which is notably higher than the results we found.

Firm profitability is also higher for diversified firms (0.035) than for single-segmented firms (0.029). The results that we found are lower than the results found in previous literature where Rudolph & Schwetzler (2014) found that European firms had profitability ratios of 0.061 and British firms had profitability ratios of 0.067. Hoechle et al. (2012) further found that firms in North America were relatively profitable with results of 0.07 for their single-segmented firms and 0.079 for diversified firms.

Finally we found that diversified firms have a higher leverage ratio (1.27) than their single-segmented counterparts (1.008). The values that we found were much higher than that of previously conducted research however this could be due to many different methods being used to calculate the leverage levels of firms.

Table 1: Descriptive statistics

	Single						Diversified						Differences		
Variable	# Obs.	Mean	S.D.	Med.	Min	Max	# Obs.	Mean	S.D.	Med.	Min	Max	Sing - Div	t-statistic	Δ in Median
EV	941	1.524	0.990	1.094	0.247	3.992	149	1.137	0.667	1.032	0.245	3.913	0.387***	4.609	0.062***
Adjusted Q	1802	1.267	1.500	0.832	-4.954	9.834	205	0.866	0.561	0.739	0.064	2.828	0.401***	3.794	0.093**
Tobin`s Q	1802	1.152	1.121	0.829	0.112	9.872	205	1.006	0.801	0.786	0.129	3.799	0.145	1.801	0.043
NumInd	1802	1	1	1	1	1	205	2.507	2	2	6	0.820	-1.507***	-64.248	-1***
Size	1802	5.455	1.02	5.394	2.127	8.172	205	6.197	1.203	6.440	3.080	8.408	-0.741***	-9.655	-1.045***
Growth Opp.	1802	0.024	0.612	-0.004	-3.372	23.415	205	0.000	0.081	-0.007	-0.436	0.347	0.024	0.5538	0.002
Profitability	1802	0.029	0.267	0.029	-4.864	8.500	205	0.035	0.101	0.044	-0.535	0.486	-0.0059461	-0.3164	-0.016**
Leverage	1802	1.008	1.134	0.615	0.009	10.751	205	1.272	1.271	0.811	0.000	6.542	-0.264***	-3.1225	-0.196***

***, **, * represent significance at 1%, 5% and 10% levels, respectively. Differences are calculated as Private-Public. Inferences about the differences in means are taken out via t test and inferences about differences in medians via Two-sample Wilcoxon rank-sum test.

5.2 Bivariate Correlation

A Pearson's correlation was run in order to test the bivariate correlation between the different variables. The choice to run Pearson's correlation was made since its underlying assumption is that all variables are correlated in a linear way. Table 2 (Appendix 7.5) reports the results of the Pearson's correlation test. The correlation output shows that there is a high correlation between the different dependent variables. The correlation between Tobin's Q and EV is 0.505 while the correlation between Tobin's Q and the adjusted Q is 0.578. The correlation between the two independent variables, NumInd and ID, is also very high at 0.820. The high correlation between these different variables could lead to multicollinearity which would lead to insignificance within the model. The different variables with high levels of correlation will not be used within the same regression models however preventing multicollinearity from influencing the outcomes of the regression.

5.3 Multivariate Analysis

Within this section, the results of the different regressions will be discussed. All the results of the different regressions analyses can be found in table 3. Table 3 shows that all regression models have an F value of 0.000 ensuring that all of the developed models are significant.

5.3.1 Model 1

In the model in which the dependent variable is Tobin's Q the overall R-squared is 0.323 meaning that 32.3% of the variation in Tobin's Q can be explained through the model. ID has a coefficient of 0.046 with meaning that diversified models receive get a value premium of 4.6%. With a P-vale of 0.7 this influence is statistically insignificant however. Size statistically negatively (-0.496) influences Tobin's Q meaning that firms with a higher Tobin's Q are smaller. From this we can conclude that firms with firms carrying more assets does not necessarily lead to a more

favorable value rating from the market. Both growth opportunities (0.03) and profitability (0.189 are positively correlated with Tobin's Q meaning that the market values companies with good growth opportunities and profitability more. The influence of growth opportunities on Tobin's Q is insignificant however, while that of profitability is significant. Leverage has a significant negative (-0.419) influence on Tobin's Q. One could hypothesis from this that the market looks favorably on firms that hold less debt.

amount of growth opportunities that a firm has, has an insignificant positive (0.029) influence on Tobin's Q. The profitability of a firm has a significant positive (0.188) influence on the firm's Tobin Q, while leverage has a significant negative (-0.42) influence on the firm's Tobin's Q.

The second regression model looks for the influence of NumInd on the adjusted and has a R-squared value of 0.341. NumInd has a significant negative (0.115) influence on the adjusted Q. Size has a significant positive (1.242) influence on the adjusted Q.

Table 3 Regression Results

	Tobin's Q		Adjusted Q		EV	
ID	0.046		-0.181**		-0.117***	
	(0.703)		(0.04)		(0.000)	
NumInd		-0.049		-0.115***		-0.158***
		0.455		(0.003)		(0.000)
Size	-0.496***	-0.487***	1.235***	1.242***	0.011	0.013
	(0.000)	(0.000)	(0.000)	(0.000)	(0.690)	(0.626)
Growth Opp.	0.030	0.029	-0.729***	-0.729***	0.368**	0.369**
	(0.313)	(0.320)	(0.000)	(0.000)	(0.027)	(0.028)
Profitability	0.189*	0.188*	-0.115	-0.116	0.378	0.368
	(0.075)	(0.075)	(0.602)	(0.599)	(0.148)	(0.161)
Leverage	-0.419***	-0.42***	-0.446***	-0.449***	-0.399***	-0.403***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted r^2	0.323	0.216	0.341	0.342	0.265	0.206
F-value	0.000	0.000	0.000	0.000	0.000	0.000
N	1984	1984	1984	1984	1087	1087

Significance at the level 0.1 (*) 0.05 (**) 0.01 (***)

The model with the adjusted Q as the dependent variable has a R-squared of 0.341. ID has a significant negative influence on EV (-.181). Size has a significant positive influence on the adjusted Q (1.235). This means that large firms are seen as more favorable by the market. The difference between the outcomes in size between Tobin's Q and the adjusted Q ratio could be due to sales being less easily manipulated. Growth opportunities and profitability both have a negative significant influence (-0.729 and -0.116)) on the adjusted Q ratio. Finally leverage also has a significant negative influence (-0.449) on the adjusted Q ratio.

The final regression model that was run assessed the influence of ID on EV. The R-squared of this model was 0.265. The outcome of this regression model showed that ID has a significant negative (-0.117) influence on EV. This means that firms that diversify receive a value discount of 21.7%. Size has a positive (0.011) insignificant influence on EV. Growth opportunities has a positive (0.368) significant influence and profitability and positive (0.378) insignificant influence. Leverage a negative (-0.399) significant influence. Since the model depicts that ID has a significant negative influence on EV it supports the hypothesis.

5.3.2 Model 2

The model with Tobin's Q as dependent variable further has an R-squared value of 0.216. The independent variable, NumInd has an insignificant negative (-0.049) influence on Tobin's Q. Firms that diversify thus get a value discount of 4.9% from the market. Size has a statistically negatively (-0.487) influenced on Tobin's Q which means that smaller firms have a higher Tobin's Q. The negative influence (-.729) of growth opportunities on Tobin's Q is significant while the negative influence (-0.115) of profitability is insignificant. Leverage has a significant negative (-0.449) influence on Tobin's Q.

The final regression model that was run looked at the influence of NumInd on EV. The model has an R-squared value of 0.206. NumInd has a significant negative (-0.158) influence on EV. Further size has an insignificant positive (0.013) influence on EV. while leverage has a significant (0.000) negative influence on firm value. Growth opportunities has a positive (0.369) significant influence and profitability and positive (0.368) insignificant influence. Leverage a negative (-0.403) significant influence.

5.3.3 Previous Literature

When comparing the results of the regression analyses in this paper with previous research we see that the discount in this paper are higher than the discounts found in previous papers. We found that diversification led to Tobin's Q discount of 4.9%. This is much lower than the discounts found by Lang & Stulz and Servaes. Lang & Stulz (1994) found a diversification discount ranging from 26% to 70%, depending on the year of study. Servaes also studied US-based companies based on Tobin's Q and found a discount ranging between 9% and 40% depending on the year assessed. This large difference could partially come from the different time periods which were studies (30-40 year gap in time period analyzed).

Diversification also has a significant impact the adjusted Q ratio (-18.1% and 11.5%). The value discounts found in this paper are

higher than in previously analyzed papers where Rudolph & Schwetzler found a diversification discount of around 7% in their studies on US-based firms (adjusted Q). Custodio found an average diversification discount of between 7.5% and 10% based on the adjusted Q.

The last two regressions shows that diversification led to an EV discount of 11.7% and 15.8%. These results are higher than the results that Fauver (2004) found. He found a diversification discount of 7% for diversified firms in the Netherlands and a discount of 8% for English firms based on the EV. Lee et al. (2012) found a diversification premium of 15% based on his studies of firms in emerging markets. This large difference between their results and ours could be due to investors preferring diversified firms in less developed markets where investors prefer single-segmented firms in developed markets.

5.4 Discussion

Having analyzed the results from the different regression analysis it is time to relate these results back to the theories layout in section 2.2. Four different theories have been developed to better understand why firms diversify. These theories were; the agency theory, the theory of internal capital markets, the debt-coinsurance theory and the resource based theory.

The outcomes of the regression results showed that in five of the six models that diversified firms traded at a discount compared to their single-segmented counterparts. Even so the management of firms still choose to diversify their operations ignoring the value reducing effect it has for the shareholders. From this we can conclude that the management is not acting in the best interest of the shareholders and thus that there are agency conflicts arising supporting the agency theory.

We can further see in table 1 that diversified firms hold more debt that their single-segmented counterparts. This notion that diversified firms hold more debt is in line with the debt coinsurance effect. Holding this extra level of debt leads to a firm value discount in all the models however. From this we can conclude that the market does not look positively towards firms that take on more debt.

The theory of internal capital markets states that firms diversify in order to create internal capital markets and thus move money around more easily within the firm. Gosh & Jain (2000) and Peyer (2002) concluded that firms with efficient internal capital markets were able to attract more external capital by interpreting the outcome as an increase in debt capacity. We too found an increase in debt capacity for diversified firms. We also concluded that the market did not look favorably on this increased debt capacity however. Previous literature showed that firms operating in inefficient and/or illiquid capital markets receive more benefits from creating internal capital markets than firms operating in very efficient and liquid markets. Since both the Dutch and German markets are very efficient and liquid this could explain why the firms in this research did not receive the intended benefits from creating internal capital markets.

The resource based theory states that firms choose to diversify in order to attract VRIN resources and that firms that diversify into related segments receive more benefits than firms that diversify into unrelated segments. Within this paper no distinction was made between related and unrelated diversification and thus no definite answer can be given related to this theory.

5.5 Limitations and Future Research

The relatively small sample size of diversified firms within this research could have influence the outcomes. A bigger data sample (especially The Netherlands) and perhaps an improved categorization of the firms different business segments could possibly lead to more reliable and consistent results.

The time scope of this paper forced me to only analyze the overall effect of diversification on firm value ignoring the possible effects of more specific diversification (domestic diversification vs international diversification or related vs unrelated diversification). These different forms of diversification could have differing effects on the firm value making it an interesting topic to study.

6. CONCLUSION

The aim of this paper was to investigate the relationship between diversification and firm value employing the fixed effect regression model. The paper looked at a sample of firms that were publicly listed in the Netherlands and Germany. Three dependent variables were chosen based on previous literature to investigate the relationship between diversification and firm value. Earlier in this paper, multiple valuation biases were analyzed and controlled for to ensure that they would not affect the study.

The results within this paper differ per dependent variable. Both models with the Tobin's Q as dependent variable led to insignificant statistical results. The other four models with EV and the adjusted Q as dependent variables gave statistically significant results showing that both ID and NumInd have a negative influence on firm value. Based on these results we can confirm the hypothesis stating that there is a negative relation between diversification and firm value. When assessing previous literature we see a broad range valuation premium/discounts. The results of this paper are partly (due to a slightly higher found percentage) consistent with the findings of Rudolph & Schwetzler (2014) and Custodio (2014). The results within this paper were a lot less consistent with findings made by Lang & Stulz (1994), Servaes (1995) and Lee et al. (2012). These inconsistencies could be due to large time period differences or location differences.

6.1 Contribution

This research contributes to the body of research which researches the effect of diversification on firm value. Though much research into the subject was done most of this research focused on Anglo-Saxon firms. By studying the effect of diversification on Dutch and German firms new empirical evidence is gathered about countries within mainland Europe.

As for the practical contribution, within this paper, an analysis is given on the different reason of diversification and situation on when diversification might prove beneficial. This will help. managers of firms and advisors within M&A to better understand the effects and implications of diversification.

6.2 Acknowledgements

First of all, I would like to thank the entire finance department and especially dr. Huang for their great supervision while writing my bachelor thesis, their continuous support and valuable feedback. Though I was not an easy thesis student and was not able to attend walk in hours they still found time to meet me, often on very short notice. Furthermore, I would like to thank the small group of students in my bachelor thesis circle for their feedback throughout the whole process of writing my thesis. Lastly, I would like to thank the Corporate Finance department of KPMG for granting me the opportunity to write my thesis with them, their support and patience.

7. APPENDIX

7.1 Hausman Test

	Tobin's Q (ID)				Tobin's Q (IndNum)			
	Coefficients		(b-B)	sqrt(diag(V_b-V_B))	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	Fe (b)	Re (B)	Difference	S.E.	Fe (b)	Re (B)	Difference	S.E.
ID	0.048	0.063	-0.015	0.052				
INUM					-0.05	-0.028	-0.022	0.033
Size	-0.491	-0.191	-0.3	0.078	-0.487	-0.184	-0.303	0.078
Growth Opp.	0.03	0.021	0.009	0.006	0.029	0.02	0.009	0.006
Profitability	0.189	0.141	0.048	0.019	0.188	0.139	0.048	0.019
Leverage	-0.419	-0.42	0.001	0.009	-0.421	-0.421	0	0.009
	chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 16.76				chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 17.40			
	Prob>chi2 = 0.0050				Prob>chi2 = 0.0038			

	Adjusted Q (ID)				Adjusted Q (IndNum)			
	Coefficients		(b-B)	sqrt(diag(V_b-V_B))	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	Fe (b)	Re (B)	Difference	S.E.	Fe (b)	Re (B)	Difference	S.E.
ID	-0.281	-0.336	0.055	0.046				
INUM					-0.215	-0.236	0.021	0.03
Size	1.235	0.3	0.935	0.089	1.243	0.313	0.93	0.088
Growth Opp.	-0.729	-0.718	-0.012	0.003	-0.73	-0.718	-0.012	0.003
Profitability	-0.115	-0.021	-0.094	0.007	-0.116	-0.023	-0.093	0.007
Leverage	-0.445	-0.443	-0.002	0.007	-0.449	-0.447	-0.002	0.007
	chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 111.63				chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 110.90			
	Prob>chi2 = 0.0000				Prob>chi2 = 0.0000			

	EV (ID)				EV (NumInd)			
	Coefficients		(b-B)	sqrt(diag(V_b-V_B))	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	Fe (b)	Re (B)	Difference	S.E.	Fe (b)	Re (B)	Difference	S.E.
ID	0.087	-0.145	0.231	0.1				
INUM					-0.153	-0.172	0.019	0.078
Size	0.591	0.065	0.526	0.125	0.565	0.085	0.479	0.125
Growth Opp.	0.151	0.193	-0.42	0.011	0.147	0.189	-0.042	0.012
Profitability	0.077	0.099	-0.022	0.056	0.078	0.097	-0.019	0.057
Leverage	-0.389	-0.39	0.001	0.012	-0.391	-0.393	0.002	0.012
	chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 27.64				chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 21.03			
	Prob>chi2 = 0.0005				Prob>chi2 = 0.0008			

7.2 Wooldridge´s autocorrelation test

Tobins Q (ID)	Tobins Q (IndNum)
Ho: no first order autocorrelation	Ho: no first order autocorrelation
F (1, 334) = 22.873	F (1, 334) = 22.999
Prob > F = 0.0000	Prob > F = 0.0000

Adjusted Q (ID)	Adjusted Q (NumInd)
Ho: no first order autocorrelation	Ho: no first order autocorrelation
F (1, 334) = 1.297	F (1, 334) = 1.329
Prob > F = 0.2555	Prob > F = 0.2498

EV (ID)	EV (NumInd)
Ho: no first order autocorrelation	Ho: no first order autocorrelation
F (1, 196) = 6.202	F (1, 974) = 6.207
Prob > F = 0.0109	Prob > F = 0.0136

7.3 Modified Wald test for group wise heteroscedasticity in fixed effect regression model

Tobins Q (ID)	Tobins Q (NumInd)
Ho: sigma(i)^2 = sigma^2 for all i	H0: sigma(i)^2 = sigma^2 for all i
chi2 (352) = 7.5e+33	chi2 (244) = 7.2e+31
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Adjusted Q (ID)	Adjusted Q (NumInd)
Ho: sigma(i)^2 = sigma^2 for all i	H0: sigma(i)^2 = sigma^2 for all i
chi2 (352) = 8.2e+33	chi2 (352) = 6.4e+33
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

EV (ID)	EV (NumInd)
Ho: sigma(i)^2 = sigma^2 for all i	H0: sigma(i)^2 = sigma^2 for all i
chi2 (244) = 1.5e+33	chi2 (244) = 1.5e+33
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

7.4 Wilcoxon rank-sum test

Two-sample Wilcoxon rank-sum (Mann-Whitney) test Tobin's Q

Diversification	obs	rank sum	expected
0	1802	1821601	1809208
1	205	193427	205820
combined	1985	1971105	1971105
unadjusted variance	60390950		
adjustment for ties	0		
adjusted variance	60390950		

Ho: AdjustedQ(Divers~e==0) = AdjustedsQ(Divers~e==1)
z = 2.233
Prob > |z| = 0.0255

Two-sample Wilcoxon rank-sum (Mann-Whitney) test Adjusted Q

Diversification	obs	rank sum	expected
0	1780	1784896	1767540
1	205	186209	203565
combined	1985	1971105	1971105
unadjusted variance	61814607		
adjustment for ties	0		
adjusted variance	61814607		

Ho: TobinsQ(Divers~e==0) = TobinsQ(Divers~e==1)
z = 1.576
Prob > |z| = 0.1150

Two-sample Wilcoxon rank-sum (Mann-Whitney) test EV

Diversification	obs	rank sum	expected
0	941	526318.5	513315.5
1	149	68276.5	81279.5
combined	1090	594595	594595
unadjusted variance	12747335		
adjustment for ties	-.82683634		
adjusted variance	12747334		

Ho: Excess~e(Divers~e==0) = Excess~e(Divers~e==1)
z = 3.642
Prob > |z| = 0.0003

Two-sample Wilcoxon rank-sum (Mann-Whitney) test Size

Diversification	obs	rank sum	expected
0	1802	1741569	1809208
1	205	273459	205820
combined	2007	2015028	2015028
unadjusted variance	61814607		
adjustment for ties	-.41289808		
adjusted variance	61814606		

Ho: LogAss~s(Divers~e==0) = LogAss~s(Divers~e==1)
z = 2.233
Prob > |z| = 0.0255

Two-sample Wilcoxon rank-sum (Mann-Whitney) test Growth Opp.

Diversification	obs	rank sum	expected
0	1780	1776276.5	1766650
1	204	192843.5	202470
combined	1984	1969120	1969120
unadjusted variance	60066100		
adjustment for ties	-.13844493		
adjusted variance	60066100		

o: Growth~s(Divers~e==0) = Growth~s(Divers~e==1)
z = 1.242
Prob > |z| = 0.2142

Two-sample Wilcoxon rank-sum (Mann-Whitney) test Prof.

Diversification	obs	rank sum	expected
0	1789	1770563	1784528
1	205	218452	204487.5
combined	1994	1989015	1989015
unadjusted variance	60971356		
adjustment for ties	-.18457027		
adjusted variance	60971356		

Ho: Profit~y(Divers~e==0) = Profit~y(Divers~e==1)
z = -1.788
Prob > |z| = 0.0737

Two-sample Wilcoxon rank-sum (Mann-Whitney) test NumInd

Diversification	obs	rank sum	expected
0	1802	1625847	1809208
1	205	389181	205820
combined	2007	2015028	2015028
unadjusted variance	61814607		
adjustment for ties	-44240821		
adjusted variance	17573785		

Ho: NumInd(Divers~e==0) = NumInd(Divers~e==1)
z = -43.740
Prob > |z| = 0.0000

7.5 Correlation Matrix

Table 3: Correlation matrix

	TobinsQ	EV	MV/Sales	ID	NumInd	Size	Growth opp.	Profitability
TobinsQ	1							
EV	0.505	1						
Adjusted Q	0.578	0.681	1					
ID	-0.040	-0.138	-0.085	1				
NumInd	-0.054	-0.119	-0.075	0.820	1			
Size	-0.228	-0.099	-0.034	0.211	0.262	1		
Growth opp.	-0.006	0.067	-0.291	-0.012	-0.010	-0.001	1	
Profitability	0.030	0.078	0.024	0.007	0.009	0.115	0.029	1
Leverage	-0.486	-0.436	-0.360	0.070	0.036	0.193	0.016	-0.050

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