A market-implied approach to measuring corporate diversification

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Abstract

The standard literature provides mixed results on the effects of corporate diversification on shareholder value with a tendency towards a diversification discount. Among other factors, differences in the measurement techniques may explain these mixed results on the valuation effects. In industrial organization, corporate diversification is commonly operationalized using business count measures, such as the number of business units or Berry-Herfindahl indices. Irrespective of their advantages for quantitative research, these measures are widely criticized for their dependency on segment data and Standard Industrial Classification codes.

In this study, we introduce a market-implied diversification measure which uses standardized regression coefficients instead of industry classification schemes to identify the business activities that a firm is engaged in. The coefficients are obtained through forward stepwise regressions within which a firm's stock market return is regressed against a set of ten STOXX® EUROPE 600 sector indices. Thereby, we assume that the degree of diversification is likely to be a negative function of the amount of unsystematic variation. Using a representative sample of firms listed in the STOXX® EUROPE 600 index over the years 2010 to 2015, we compare our measure to commonly used business count measures.

Keywords: *Corporate diversification, business count measure, market-implied diversification measure*

JEL Classification: G32, G12

1 Introduction

Ever since the seminal work of Rumelt (1974), the nature of the relationship between corporate diversification and shareholder value has been at the center of research studies of strategic management and industrial organization (Instead of many, see Dess et al., 1995; Martin and Sayrak, 2003). On the one hand, corporate diversification can provide additional shareholder value through debt coinsurance effects or an increased efficiency of internal capital markets (Hann et al., 2013; Lewellen, 1971; Stein, 1997). On the other hand, diversification is said to amplify existing agency problems and impose further coordination costs on the firm (Amihud and Lev, 1981; Jensen, 1986; Rajan et al., 2000; Rawley, 2010).

Empirical studies on the relationship between corporate diversification and shareholder value provide mixed results ranging from "Diversification destroys shareholder value" to "Diversification creates shareholder value" (Instead of many, see Erdorf et al., 2013; Martin and Sayrak, 2003). The reasons for the mixed evidence on the valuation effects of corporate

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diversification include time-variant effects and the use of various performance indicators (Hoskisson and Hitt, 1990; Keats, 1990; Ramanujam and Varadarajan, 1989). Additionally, the proliferation of diversification measures and the limited information on a single measure's construct validity constrain our understanding of the valuation effects of diversification (Chatterjee and Blocher, 1992; Hoskisson et al., 1993, Robins and Wiersema, 2003).

In industrial organization, the total diversity of a firm's business units is commonly estimated using the business count approach which determines diversity either by simply counting the business units which a firm operates in or by employing comprehensive indices. Using objective, secondary data to allocate a firm's reporting units to well-established industry classification schemes, they benefit from high reliability and objectivity (Montgomery, 1982). Moreover, the ease of computation and the possibility to handle large data samples are further arguments for business count measures. However, using business count measures based on industrial classification schemes for the determination of the relatedness may lead to low levels of construct validity as they are unable to simultaneously reflect the level and the type of diversification (Hoskisson et al., 1993). By way of construction, the SIC classes do not adequately differentiate between industries (Fan and Lang, 2000; Montgomery, 1982) and, therefore, offer "only limited information on the types of strategic interrelationships" (Robins and Wiersema, 1995). Additionally, due to the "implicit assumption of equal 'dissimilarity' between distinct SIC classes" (Rumelt, 1974), numerical differences between SIC codes cannot be interpreted on an interval or ratio scale (Montgomery, 1982; Nayyar, 1992). Moreover, business count measures require a somewhat arbitrary decision about the level of refinement, which is likely to offset the advantage of higher objectivity received from publicly available data. Last, they are likely to be exposed to the risk of strategic accounting as they build on segment data (Villalonga, 2004). As Robins and Wiersema (1995) note: "These assumptions can be relaxed only by going beyond the SIC system and employing additional sources of information".

We contribute to the growing body of literature devoted to the measurement of diversification by promoting an alternative measure of diversification. Our market-implied diversification measure utilizes stock market data to group a firm's business activities into homogenous groups instead of relying on an industry classification system. This way, we can avoid the limitations inherent in the SIC system and, at the same time, take advantage of the benefits of quantitative measures. The remainder of the paper is organized as follows: Section 2 presents the methodology underlying the market-implied diversification measure. Section 3 describes the data. Section 4 presents the results of a comparison between MDIV and traditional business count measures. Section 5 concludes.

2 Market-based approach to valuing corporate diversification

We build on the stock-market based measure of corporate diversification by Barnea and Logue (1973). Following Sharpe's (1963) single-index model, Barnea and Logue (1973) show that "the degree of diversification is a direct function of the amount of residual unsystematic variation that remains in a combination of risky assets" and promote the proportion of explained variance (R^2) and the standard error of the estimate as measures of diversification. We further refine the measurement approach of Barnea and Logue (1973) in two aspects: First, instead of using a broad market portfolio, we employ a set of ten STOXX® EUROPE 600 sector indices to gather information about the extent of diversification. Second, we introduce a weighting vector based on a Herfindahl index.

The starting point for constructing the market-implied diversification measure is the following regression model in which the stock market return of firm i in year t (r_{it}) is regressed against the multivariate return series of ten STOXX® EUROPE 600 sector indices during the period commencing 250 days before and ending on the last trading day prior to the individual firm's fiscal year end:

$$r_{it} = \sum_{j=1}^{10} \beta_{jt} * X_{jt} + \varepsilon \tag{1}$$

$MDIV_{it}$ is then the maximum of the proportion of unexplained variance that remains after controlling for systematic valuation factors ($1-R^2$) and the value of a Herfindahl index based on standardized regression coefficients:

$$MDIV_{it} = \max(1 - R^2, \sum_{j=1}^{J} \beta_{jit}^2 / B_{it}^2) \tag{2}$$

Analogous to the stock-market based measure by Barnea and Logue (1973), the first element of the maximum function of equation (2) represents the level of unsystematic variance in the regression model. It contains information about the relative use of diversification effects in the corporate portfolio. The sector indices stand proxy for the market portfolio and, thus, provide information about the extent to which equity risks are diversifiable. Consequently, higher values of R^2 indicate a greater level of diversification. Statistical inferences about R^2 are based on Huber-White standard errors. The second element of the maximum function of equation (2) is a Herfindahl measure made of regression coefficients that are obtained through forward stepwise regressions of equation (1). The boundaries for the removal and the addition of a sector index are $p \geq .1$ and $p \leq .05$, respectively. More formally, the Herfindahl index is equal to the sum of the squares of the standardized regression coefficients divided by the squared sum of the absolute regression coefficients B_{it} Standardized regression coefficients contain information about the relative strength of the predictors of the model and, henceforth, are predestined to take over the role of the primary weighting vector from the SIC industry segments or groups. MDIV converges towards one as the firm becomes more focused. The maximum function, thereby, ensures that the sector indices jointly explain a high proportion of the variance of the stock market return of the firm in question. Assuming all else is constant, the level of corporate diversification is a positive function of r-squared. For instance, consider the case of three significant indices with homogenous beta-coefficients which would per the second element of equation (2) mean a high degree of diversification (33%). Nevertheless, r-squared could be relatively small, resulting in higher values for MDIV and, thus, a lower level of corporate diversification.

The market-implied diversification measure goes beyond the limitations of the SIC system. It reflects the full range of the diversification concept by considering both the extent of diversification and the type of relatedness. Instead of assuming equal dissimilarities between distinct SIC classes, MDIV exclusively relies on the market mechanisms to determine the coherence between a firm’s business units. Consequently, MDIV returns the *market-implied* level of corporate diversification. Moreover, MDIV is not inversely influenced by strategic accounting and accounts for interaction effects between different lines of operations, irrespective of whether they are reported as segregated segments (Davis and Duhaime, 1992; Martin and Sayrak, 2003). Given its low data requirements compared to traditional diversification measures, MDIV offers a simplified and less cumbersome measure of corporate diversification.

3 Sample and Data

We construct our sample from all firms included in the STOXX® EUROPE 600 index as of 2010. During the validation process, we will compare MDIV with traditional business count measures, the estimation of which requires firm-specific segment data. For this reason, we restrict our sample to the most recent periods of 2010 to 2015. Although the membership in the STOXX® EUROPE 600 index is reviewed on a quarterly basis, there will be now rebalancing to avoid a survivorship bias. Firms falling under the sector “financials” per the ICB sector classifications will be removed from the sample data. We justify the removal by the differences in capital structure and restrictive regulatory requirements that apply to financial firms. Moreover, we stipulate that the sum of the segment sales is within 10% of the total sales of the firm and that the sum of common equity and preferred stock is positive. Last, the sample is truncated at the 95% confidence level to remove outliers from the exogenous variables. The sample selection process is illustrated in Table 1.

STOXX® EUROPE 600 index	2010	2011	2012	2013	2014
Basic population:	600	600	600	600	600
- financials	136	136	136	136	136
- segment sales / neg. equity firms	3	1	12	10	9
- lack of data / outliers	43	53	66	73	81
Sample population:	418	410	386	381	374

Table 1. Sample selection process.

4 The relationship between MDIV and SIC-based diversification measures

We concentrate on two dimensions of the validity of the market-implied diversification measure: Convergent validity and predictive validity.

Measure	P50	max	min	sd	Spearman
MDIV	0.670	1.000	0.217	0.211	1.000
COUNT2	2	7	1	1.11	-0.074***
COUNT4	3	9	1	1.41	-0.071***
H2DIV	0.898	1.000	0.182	0.228	0.087***
H4DIV	0.648	1.000	0.149	0.259	0.077***
LARGEST2	0.946	1.000	0.243	0.185	0.085***
LARGEST4	0.778	1.000	0.173	0.223	0.076***

Note: Spearman correlation regarding MDIV, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2. Summary statistics and convergent validity.

Convergent validity. Convergent validity refers to the extent to which indicators of the same construct coincide with one another (Hoskisson et al., 1993). Besides MDIV, the following tests comprise a selection of widely used diversification measures. The most straightforward measures involve numerically counting the number of business units defined through two- and four-digit SIC codes (COUNT2, COUNT4). Moreover, we consider two revenue-based Herfindahl indices which can formally be expressed as the sum of the firm's squared output in the g^{th} industry group (H2DIV) and j^{th} industry segment (H4DIV), respectively, to the firm's squared total output across all business units. Finally, we include the share of the largest business defined as the ratio of a firm's primary industry output to total firm output, where the primary industry is again identified by two-digit (LARGEST2) and four-digit SIC codes (LARGEST4). Table 2 reports summary statistics and Spearman correlation coefficients among the business count measures that were employed in this study. MDIV varies from a maximum of 1 (single-segment) to a minimum of .22 (high degree of diversification), indicating a broad range of different diversification strategies among the sample firms. The median diversification level is 0.67 and falls in between the median levels of H2DIV and H4DIV. Regarding standard deviation, the results of the various business count measures are also very similar. A different picture is obtained by looking at the Spearman correlation coefficients between MDIV and the continuous measures. Although there is a significant relationship for most of the SIC-based measures, the coefficients are close to zero, which suggests a rather low level of convergent validity. To underpin the results from the Spearman correlation coefficients, factor analysis is performed on all diversification measures. From omitted Shapiro-Wilk tests, we infer that the assumption of normal distribution for all measures is breached. Accordingly, we will use the natural logarithm of MDIV (positively skewed) as well as the power transformation 1/x for variables H2DIV, H4DIV, LARGEST2, and LARGEST4 (negatively skewed). The number of relevant factors are extracted using the Very Simple Structure Criterion (VSS). The results indicate a two-factor solution from a varimax rotation which accounts for 73% of the variance. Diversification measures focusing on industry groups (two-digit SIC codes) have high factor loadings on the first factor, while measures on industry segments (four-digit SIC codes) load heavily on the second factor. MDIV, however, does not load on any of the two factors and its commonality is close to zero, again indicating low convergent validity.

Predictive validity. Predictive validity concerns the measure's ability to predict future performance of the construct and is commonly examined using correlation analysis. Instead of pure correlation coefficients, we investigate regression coefficients obtained from two-way fixed effect regressions (within-estimator) to gather information on MDIV's predictive validity. The domain of interest is the financial performance, which we operationalize through return on assets (ROA), return on equity (ROE), and return on sales (ROS).

Diversification measure	Factor 1	Factor 2	Uniqueness
MDIV	-0.035	-0.096	0.990
COUNT2	0.662	0.345	0.443
COUNT4	0.386	0.697	0.365
H2DIV	0.927	0.368	0.005
H4DIV	0.420	0.905	0.005
LARGEST2	0.921	0.334	0.040
LARGEST4	0.387	0.899	0.042
Proportional variance explained	0.375	0.355	
Cumulative variance explained	0.375	0.730	

Note: Likelihood Chi Square = 5256.715 (p < 0), RMSR = 0.079, RMSEA = 0.2819.

Table 3. Uniqueness: Confirmatory factor analysis.

Panel regression analysis		Regression coefficient	Hausman Test	F-Stat.	Within R²
Return on asset (ROA)	MDIV	-0.02	655.08***	3.15***	0.34
	H2DIV	-0.01	653.15***	2.75***	0.34
	H4DIV	0.01	652.95***	2.80***	0.34
Return on equity (ROE)	MDIV	-0.04**	187.04***	10.45***	0.06
	H2DIV	0.01	189.52***	8.98***	0.06
	H4DIV	0.01	189.08***	8.96***	0.06
Return on sales (ROS)	MDIV	0.00	715.75***	1.62	0.37
	H2DIV	-0.01	716.08***	1.55	0.37
	H4DIV	0.00	715.48***	1.58	0.37

Note: P-values based on robust standard errors, *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Predictive validity: Panel regression analysis.

Therefore, our study provides only some support for the prevalent finding of no or possibly a negative relationship between diversification and accounting performance as concluded by Hoskisson and Hitt (1990). This may be due to an increased efficiency of internal capital allocation during the financial crisis (Kuppuswamy and Villalonga, 2015).

Table 4 presents the panel regression results for MDIV and both Herfindahl measures. The other diversification measures are not included in this analysis as they are highly correlated with all of the Herfindahl measures (> 0.6). The natural logarithm of both total assets as a proxy for firm size and the debt to equity capital ratio are included as control variables. A significant relationship is found only for the combination of MDIV and ROE, indicating higher returns for diversified firms. Although not significant, the signs for the other performance indicators are in the same direction. Notwithstanding the lack of significance, while the coefficient estimates for H2DIV indicate that focused firms have higher accounting returns compared to diversified firms, the sign for H4DIV shows an opposite result.

Summary and conclusions

This study introduces a continuous diversification measure that solely builds on stock market data to operationalize the corporate portfolio strategy. Formally, the market-implied diversification measure is the maximum of the proportion of unexplained variance that remains after controlling for systematic valuation factors and the value of a Herfindahl index based on standardized regression coefficients. By focusing on stock market returns, both the limitations of standardized industrial classification schemes, such as the SIC system and distortions induced by segment data can be reduced.

Using a sample of non-financial firms included in the STOXX® EUROPE 600 index during the period 2010 through 2015, we investigate the characteristics of MDIV regarding convergent validity and predictive validity. The correlation coefficients between MDIV and traditional diversification measures indicate a low level of convergent validity. The results from a two-factor analysis, where MDIV shows a commonality close to zero, support the findings of the correlation analysis. Moreover, the results of the panel regression analyses suggest a higher predictive validity of MDIV compared to traditional business count measures, although its predictive validity is rather low. The coefficient estimates, thereby, indicate significantly higher returns for diversified firms when performance is measured through return on equity.

The theoretical arguments for MDIV (content validity) as well as the tests for convergent and predictive validity suggest that MDIV offers an alternative measurement approach. However, the results also demonstrate that there is a need for further investigations. For instance, the causes for the low correlation coefficients between traditional business count measures and MDIV remain unanswered. Additionally, the results of the panel regression models call for further assessments of the coherence between MDIV and accounting as well as market based performance measures. Moreover, we focus on a rather small sample of European non-financial firms over a recent period. To reinforce the findings, further investigations with an increased firm sample and for different time periods may provide additional insights.

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