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THE RELATIONSHIP BETWEEN DIVERSIFICATION AND FIRM'S PERFORMANCE: IS THERE REALLY A CAUSAL RELATIONSHIP?

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Abstract

Firms' boundaries have been one of the central questions in several research domains, but it is possible to affirm that a definitive consensus has not been reached to determine the relationship between diversification and a firm's performance. We study this relationship according to the main empirical finding in strategy and finance but controlling for the persistence of abnormal returns. Through longitudinal studies, using both accounting and market indicators, we conclude that this relationship is not causal but attributable to factors other than the degree of relatedness among business units and the degree of efficiency of the internal capital market. The persistence of abnormal returns has a greater explanatory power: we find that some diversified firms persistently create shareholder value, beat the market index and have lower market volatility, while others persistently reach opposite results. Moreover, we find that higher performance is associated with an unrelated portfolio of business segments.

JEL Classification: L25

Keywords: diversification, abnormal return persistence, shareholder value and risk, efficient internal capital market, business segment relatedness.

NOTE: This research has been conducted at IESE by Federico Marinelli (Former IESE Post Doctoral Research Fellow) under the supervision of Professor Jose Manuel Campa.

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Introduction

Firms' boundaries have been one of the central questions in several research domains, but, despite almost 40 years of research identifying the dark and bright sides of corporate diversification, it is possible to affirm that a definitive consensus has not been reached to determine whether diversification strategy is positive correlated with firm performance and shareholder value or, in other terms, whether a firm has to diversify or needs to remain focused on its core activities. Questions about the relation between diversification and firm performance arise naturally from the larger problem of determining how firms' boundaries should be set. Coase (1937) argues that boundaries are set at the point at which the costs of carrying out transactions within a firm equal those of carrying them out in the open market or in another firm. Gains from diversification come from economies of scales (Chandler; 1977) or from increased debt capacity (Lewellen 1971) or from exploitation of firm-specific assets in several businesses (Wernerfelt and Montgomery; 1988).

A testament to corporate diversification strategies is the 2006's M&A[1] wave just before the 2007 credit crunch, indicating that firms still consider diversification as a path to value creation. Moreover, conglomerate firm production represents more than 50 percent of production in the United States; hence, understanding the costs and benefits of this form of organization has important implications. Much of the recent research on the relationship between diversification and firm performance has been developed in the field of strategic management and finance with different focus and research questions.

The finance literature on diversification took off with the discovery of the conglomerate discount in the range of 13-15% of firm value (Lag and Stulz, 1994; and Berger and Ofek, 1995). They focus their research on whether a single segment or a single business firm is better off alone or within a conglomerate. Or, in other terms, whether shareholders actually do gain from diversification, where gain is measured by the relative value of the diversified firm compared to single-segment firm. These papers decomposed conglomerate firms into their constituent industry segments and then valued these segments using the "comparables"

[1] Financial Times, 21/12/2006, "M&A in 2006 beats tech boom".

approach to valuation. They show unambiguously that the value of diversified firms is less than the sum of its parts. This result implies that, "on average", managers of conglomerate firms destroy value, and firms are better off if they remain focused on a single business segment: the benefits of the relaxation of financial constraints from the internal capital markets are offset by greater agency costs than within single segment firms (Jensen, 1986; Berger and Ofek, 1995; Denis, Danis and Sarin, 1997; Raian, Servaes and Zingales 2000; Sharfstein and Stain 2000). Subsequent research suggests that this relationship is not causal: the discount is attributable to factors other than diversification per se (Campa and Kedia, 2002; Graham, Lemmon and Wolf, 2002; Villalonga, 2004a); in addition, diversified firms follow a neoclassical profit maximization model (Maksimovic and Phillips, 2002).

In the field of strategic management, the research question is focused on the identification of the type of diversification strategies that lead to superior performance; in other words, whether diversification is related or unrelated. In line with the resource-based view of the firm, Palich, Cardinal and Miller (2000), studying 55 quantitative studies of the diversification performance linkage, confirm that this linkage appears to have an inverted-U curvilinear relationship with performance, but the choice of measurement method of diversity or "*relatedness*" presents scholars with a degree of subjectivity (Martin and Sayrak, 2003), and hence with the possibility of influencing research results (Hall and John; 1994; Robin and Wieserma, 2003). For example, if McDonalds diversified into clothing retail, would diversification be related or unrelated? We could consider it related because of the retail business, but unrelated because clothing is not food. Moreover, Bergh (1995), Bergh and Holbain (1997), and Bergh (2007) argue that the statistical validity of several studies in the relationships between diversification and performance could be highly vulnerable to type I statistical errors. This relationship might appear positive when data is pooled, averaged or tested in cross-section, but when testing over time, controlling for time invariant firm-specific effect and heteroskedasticity, this relationship might become insignificant, thus leading to theoretical misinterpretations.

In this research, similar to Campa and Kedia (2002), Graham, Lemmon and Wolf (2002), and Villalonga (2004a), we argue that the relationship between diversification and shareholder value is not causal but attributable to factors other than diversification. We base our research assumptions on one of the key fundamental pieces of empirical evidence in industrial organization economics and strategic management literature: the existence of persistence of abnormal return, defined as a statistically significant above- or below-average performance relative to a reference set (such as an industry) that persists over the long term (Mueller, 1977; Jacobsen, 1988; Schohl, 1990; Waring, 1996; McGahan and Porter, 1999; Maruyama and Odagiri, 2002; Wiggins and Ruefly, 2002; McGahan and Porter, 2003; Yurtoglu, 2004; Benzen, Strojer Madsen, Valdemart and Dilling-Hansen, 2005; Wiggins and Ruefly, 2005; Kaplan and Schoar, 2005). In other words, if the competitive advantage (from a specific position in the industry or because of strategic assets) had been sustainable only in the short term, it would have triggered a serious reconsideration, especially in the field of strategic management science.

This implies that some diversified firms persistently perform above industry average, while others persistently perform below. We find that the persistence of abnormal return explained the relationship between diversification and performance although we find evidence of the impact on performance according to the degree of efficiency of the internal capital market and the degree of unrelatedness of the firm's business segments. In addition, without arguing the statistical validity of the existence of the diversification discount, we believe that looking for a diversification discount or premium would be an extremely relevant indicator if the firm's performance did not follow any specific pattern over time. But because of firms' outstanding performance heterogeneity, finding an average indicator of discount or premium might not unambiguously indicate whether diversification is negative for the firm.

Our contribution can be summarized as follows. In the field of strategic management, our findings are much closer to Grant and Jammine (1988) than to Palich, Cardinal and Miller (2000). We do not confirm the inverted-U relationship between diversification and performance, but rather we find opposite results: diversified firms in the top quintile have business segments in different industries. Moreover, we confirm our findings using a longitudinal study with panel data through a system GMM in order to control the time invariant firm's specific effect (autocorrelation) as well as controlling for heteroscedasticity (Bergh and Holbain, 1997). We also analyze the market risk of diversified firms. Because of the non-normality of the returns' distribution, we use a generalized autoregressive conditional heteroskedasticity model to measure the daily conditional volatility or daily total risk. Differing with Lubatkin and Chatterjee (1994), we find lower volatility in diversified firms in which the positive abnormal return is positively correlated with a number of business segments in several industries (subsectors defined at 3 digits NAICS code).

We contribute to the field of finance by demonstrating that there exists a statistically consistent persistence of performance above and below industry average among diversified firms. Hence we believe that looking for a diversification discount or premium would be an extremely relevant indicator if the firm's performance does not follow any specific pattern over time. But, because of the persistent heterogeneity of abnormal returns, we argue that an average indicator of a diversification discount or premium might not unambiguously indicate whether diversification has negative results for shareholders, suggesting therefore an additional perspective on the relationship between diversification and shareholder value.

This rest of the paper is organized as follows. In the next session we briefly discuss related literature in strategic management and in finance. Section II describes the data and the sample selection. Section III describes how we calculate the outstanding performance, shows the preliminary results, and finally tests the persistence of performance heterogeneity among diversified firms using different econometrics techniques and the Markov conditional probabilities. Section IV calculates and compares top and bottom quintile firms by the following indicators: (i) the shareholder value in terms of return and unconditional risk, (ii) Jensen's alpha, (iii) Fama and French's three-factor model, and (iv) the conditional risk. Section V attempts to explain the persistence of abnormal returns according to the degree of efficiency of the internal capital market and according to the degree of relatedness among business segments. Within each section, the findings are discussed. Finally, Section VI concludes.

Section I: review of the literature

Despite the substantial number of empirical studies in both finance and strategic management, research on the relationship between diversification and performance has not yet reached a definitive consensus on whether firms are better off remaining focused or diversifying in different businesses (Martin and Sayrak, 2003).

Strategic management literature

Most studies in the field of strategic management were centered on the idea that certain types of diversification strategies lead to distinctive performance (Rumelt, 1974; Bettis, 1981; Rumelt, 1982; Palepu, 1985; Wernerfelt and Montgomery, 1988), but in this paper the research question is focused on the identification of the diversification strategy, or rather the type of diversification by comparing diversified firms. Palich, Cardinal and Miller (2000), studying 55 quantitative studies of the diversification performance linkage, confirm that this linkage appears to have an inverted-U curvilinear relationship with performance, consistent with the theory of the resource-based view of the firm. A positive effect occurs as firms move from a single business strategy to a related diversification strategy, but negative effects occur as firms move from a related strategy to an unrelated strategy in which the benefit of synergies are offset by the cost of diversification. The central question here seems to be the choice of measurement method of diversity or relatedness that influences research results (Hall and John; 1994; Robin and Wieserma, 2003), and the statistical econometrics methodologies used to measure the relationship between diversification and firm performance (Bergh, 1995; Bergh and Holbain, 1997; Bergh, 2007), with findings highly vulnerable to statistical errors (type I) and, therefore, drawing theoretical conclusions not based on solid statistical evidence. Attempts to measure the extent and type of firm diversity have followed two main avenues: at one extreme there are simple but objective, replicable indicators (e.g., continuous measurement developed from SIC codes, such as the Hertfindahl index) but with the shortcoming of not being able to tap fully into the dimension of relatedness, and at the other extreme there are more sophisticated indicators that are able to represent in more detail the degree of relatedness among business units; their relatedness constructs are based on cross-business synergies arising from, for example, product relatedness (Rumelt, 1974), manufacturing relatedness (John and Harrison, 1999), technological relatedness (Robins and Wiersema, 1995; Silverman, 1999), R&D relatedness (Chatterjee and Wernerfelt, 1991), marketing relatedness (Capron and Hulland, 1999), advertising relatedness (Chatterjee and Wernerfelt, 1991), managerial relatedness (Ilinitch and Zeithaml, 1995; Prahalad and Bettis, 1986), human resource relatedness (Farjoun, 1994), and resource-based view relatedness (Markides and Williamson, 1994). Robin and Wieserma (2003) raised the issue related to the "*content validity*"[2] of the related diversification indexes, and Tanriverdi and Venkatraman (2005) point out the difference between potential relatedness and actual relatedness: potential synergies may not be exploited by the firm; hence, when using potential relatedness as a proxy for actual relatedness, the interpretation of results might be difficult.

Finance literature

In finance literature most of these studies were centered on the research question: is a segment of business better off alone or within a conglomerate? Does this enables researchers and scholars to determine if "*on average*" diversification creates or destroys shareholder value?

Business segments within a conglomerate are supposed to benefit from the internal capital market, and the headquarters is considered an effective financial intermediary through "*winner picking*" behavior (Williamson, 1975; Stain, 1997): the business segment benefits from higher rights control over the projects, and this allows better information flow, higher asset re-

[2] The authors mention the definition of Zaller and Carmines (1980) that describes the content validity as: "*fundamentally content validity concerns the extent to which a set of items taps the content of some domain of interest. To the degree that the items reflect the full domain of content they are said to be content-valid*".

deployability, and relaxation of credit constraints (Gertner, Sharfstein and Stein, 1994). These benefits are supposed to offset the internal capital market's flip-side, identified as the reduction of managers' entrepreneurial incentive, the effort dilution factor and agency argumentation of on-the-job consumption (Jensen, 1986), in which projects receive a lower level of funding than they could obtain alone because of the cross-subsidization in which good performing divisions subsidize poor performing divisions, which destroys shareholder value (Lang and Stulz, 1994; Berg and Ofek, 1995; Denis, Danis and Sarin, 1997; Raian, Servaes and Zingales, 2000; Sharfstein and Stain, 2000).

In order to answer that specific question, Lang and Stulz (1994), through a firm's industry adjusted Tobin's *q*, and Berg and Ofek (1995), through an excess value methodology, find that the value of the diversified firms is, on average, lower than the comparable portfolios of specialized firms, finding a diversification discount explained by the inefficiency of the internal capital market. They conclude that diversification is not a successful path to higher performance because the value of the diversified firm is less than the sum of its parts by an average discount factor of 13-15% (Berg and Ofek, 1995). Moreover, complementary evidence about the valuation of conglomerate firms is provided by Comment and Jarrell (1995): firms that increase in focus, subsequent to asset sales, increase in value. The portfolio method of specialized firms, or "pure play firms" (Lang and Stulz, 1994; Berg and Ofek, 1995), suffers from several drawbacks including sample selection (Campa and Kedia, 2002; Villalonga, 2004a), measurement errors, and data artifacts (Graham, Lemmon and Wolf, 2002; Schoar, 2002; Mansi and Reeb, 2002; Villalonga, 2004b; Emms and Kale, 2006; Stowe and Xing, 2006). Once these biases are corrected, the diversification discount becomes very small or even turns into a premium. Campa and Kedia (2002) and Villalonga (2004a) find that the diversification discount was explained by endogeneity (diversifying firms are poor performers prior to conglomeration) and, once the endogeneity was corrected, they found empirical evidence that diversification might be a value-enhancing strategy. Graham, Lemmon and Wolf (2002) and Emms and Kale (2006) found that target firms were already discounted firms, hence the comparison between divisions of conglomerate and stand-alone firms overestimates the magnitude of the diversification discount. Mansi and Reeb (2002) argue that measurements of the firm's value based on book value of debt would systematically undervalue diversified firms, and Stowe and Xing (2006), using the excess value methodology, find that part of the diversification discount was explained by controlling the firm's growth opportunities, concluding that growth opportunities might account for at least one part of the diversification discount. Villalonga (2004), using excess value methodology, finds that the diversification discount was due to a data artifact (over-evaluation of the assets and sales industry multiples). Using industry case studies and econometric analyses, Khanna and Tice (2001), Campello (2002), and Guedj and Scharfstein (2004) identify several specific advantages of internal capital markets. Finally Santalo and Becerra (2008) show that the effect of diversification on performance is not homogeneous across industries: diversified firms perform better in industries with a small number of non-diversified competitors.

To summarize, in both fields of research there is no strong consensus (i) whether a business segment is better off within a diversified firm or standing alone, or (ii) what type of diversification strategies increase a firm's performance. But on the other hand, they have highlighted consistent and specific performance characteristics of diversified firms.

On the positive side, diversified firms benefit more than single segment firms from an efficient internal capital market (Williamson, 1975; Shin and Stulz, 1988; Stain, 1997) and from cheaper access to the external source of funds (Mansi and Reeb, 2002; Mansi and Reeb, 2006; Peyer, 2002), especially in situations of higher information asymmetry between the corporate headquarters and the external capital market (Maksimovic and Phillips, 2002; Khanna and Tice, 2002; Campello, 2002; Guedji and Scharfstein, 2004; Hyland and Diltz, 2002). In addition, diversified firms follow a neoclassic value maximization model, searching for new growth opportunities (Goold and Campbell, 1987; Chandler, 1991; Campa and Kedia, 2002; Maksimovic and Phillips, 2002; Schoar, 2002; Stowe and Xinx, 2006), maximizing synergies across the business (Palich, Cardinal and Miller, 2000), acquiring poor performing firms (Graham, Lemmon and Wolf, 2002; Emms and Kale, 2006), and improving the productivity of target companies through higher management capabilities (Schoar, 2002).

On the negative side of diversification, empirical findings have shown its drawbacks (in term of value destruction), especially driven by agency arguments that divert funds from their best uses (Jensen, 1986; Denis, Danis and Sarin, 1997; Sharfstein and Stain, 2000; Raian, Servaes and Zingales, 2000; Hyland and Dilz, 2002), by the development of business segments lacking in potential synergies (Palich, Cardinal and Miller, 2000) or because the firm is too big and becomes unmanageable (Stain, 1997).

Section II: data and sample selection

The sample includes diversified firms available from Compustat's North America Industrial Annual file and Compustat's Segments file. The Compustat's Segments file is used to retrieve data on a firm's business segments, while the Compustat's North America Industrial Annual file is used to ensure the integrity of the segment data using the Berger and Ofek's (1995) convention.

The new segment reporting standard SFAS 131 was issued by the Financial Accounting Standards Boards (FASB) in June 1997 and is effective for fiscal years commencing after December 15, 1997. According to the SFAS 131, a firm needs to report disaggregated information by line of business unless they organize themselves that way for purposes of performance evaluation. In addition, the information provided under the new standard about segment definition would be less subjective than what was provided under the previous SFAS 14 and it induces companies to more fully reveal their diversification and fund transfer strategies, hence reflecting any underlying agency problem (Berger and Hann, 2003).

Because a firm's size directly influences stock returns (Fama and French, 1995), we attempt to control for the "size effect" by introducing a minimum sample limit of $500 million turnover and removing all firms that fall below this threshold. The resulting sample comprises 317 diversified firms, representing 42% of the population of diversified firms with a turnover higher than $500 million, taken from Compustat Industry Segment (CIS) during the period 1999-2006 is examined.

Because our research is based on the empirical evidence of the persistence of "abnormal returns" within diversified firms, we collect data only from firms that remain diversified during the entire time series. In addition, testing the persistence of abnormal returns requires balanced panel data; thus, firms missing one or more years of data cannot be included in the sample. Although we had to exclude a certain number of firms, we were able to retain 42% of the population of diversified firms, which allowed us to generalize our findings to the entire population of diversified and single-segment firms. With this study method, we have introduced a survival bias in our sample (i.e., we exclude diversified firms that either refocus to improve performance or are bought).

The length of this time series (8 years) is justified by the aim of the research question: to compare diversified and single-segment firms that retain their status during the entire time period. A longer time series (e.g., 15-20 years), as used in previous studies, may increase the self-selection bias effect, especially for diversified firms, given that poor-performing diversified firms may choose to refocus on one business in order to improve performance (Wernerfelt and Montgomery, 1988; Comment and Jarrel, 1995), leaving only high-performing diversified firms in the sample. Moreover, the requirement related to the use of balanced panel data shortens the time series: a longer time series would have caused difficulties in generalizing our empirical findings, as it would have led to more companies being excluded due to missing data.

To enable a comparison with previous studies in finance, firms belonging to agriculture (SIC 100-900), regulated industries (SIC 4900-4999), financial services (SIC 6000-6900), depositary receipts (SIC 8888), international affairs (SIC 9721), and non-operating establishments (SIC 9995), are excluded. Diversified firms do not always fully allocate accounting items in their reported business segments, and this lack of consistency in reporting may lead to problems with the use of business segment data. Therefore, we have adopted Berger and Ofek's (1995) convention of requiring that the sum of segment sales (assets) be within 1% (25%) of the consolidated firm total reported in Compustat's North America Industrial Annual file. For those firms that meet these criteria, any unallocated assets are explicitly allocated to it; for example, if a firm's asset level is 10% smaller (larger) than the sum of the segment assets, each segment's assets are reduced (increased) by 10%. Moreover, the corporate segment data (sales, assets, capital expenditure, operating income and depreciation) are allocated to the segments on an asset-weighted basis. These adjustments should mitigate the shortcomings highlighted by Berger and Hann (2003) in the use of SFAS 131. Firms that have segments in the financial industry or in a regulated industry are not excluded; rather, just that particular segment is excluded from the analysis. Around 37 firms in the sample have activities in the financial industry. Most of the time this financial segment is represented by leasing activities and, given the interest spread between diversified firms' cost of debt and the final lending interest, it is assumed that this activity is profitable. Hence, excluding these types of firms may introduce a bias in the sample selection, given that diversified firms enjoy greater debt capacity, lower cost of debt, and debt tax shield relative to single-segment firms due to lower risk (Lewellen, 1971; Mansi and Reeb, 2002).

Section III: identification of performance measurements and test of persistence of outstanding performance

3.1. Variables

In order to measure the persistence of superior performance, defined as an above- or below-average return relative to a reference set, the performance indicator we used here is the "abnormal return" or "outstanding performance". This indicator of a firm's performance indicates whether the firm performs above or below its industry average. The average is calculated using data from all firms operating in that particular industry, whether they were single-segment and diversified firms. This implies that this indicator might take a positive or negative value, depending on whether the firm performs above or below its industry average. Because diversified firms operate in more than one industry, the outstanding performance is simply the sum of the asset-weighted averages of the performance of its segments relative to the industry average. We consider that this indicator of outstanding performance (or performance relative to the industry average) controls for industry effects and, hence, it allows us to identify, rank, and compare which firms belong to the top and bottom performer quintiles from different industries with different levels of performance.

We identify three indicators of outstanding performance, OROA, OSALES/ASSETS and OOP/SALES, that measure performance in the return on assets, return on sales, and operating profits/sales ratio relative to industry averages, respectively:

(i) $OROA_{it} = \sum_{i=1}^{n} (ROA_{jit} - ROA_{indjt})(\frac{A_{jit}}{A_{it}})$

where ROA_{jit} represents the ROA of the industry *j* defined by a 6-digit NAICS code of the segment of firm *i* during period *t* and ROA_{indjt} represents the asset-weighted average ROA of the same industry *j* during period *t*. A_{jit} /A_{it} represents the portion of the assets of segment *j* within firm *i* during period *t*. In order to calculate a consistent industry benchmark (ROA_{indjt}), we follow the methodology in the financial literature on the diversification discount used to construct industry multiples (Lang and Stulz, 1994; Berg and Ofek, 1995). At least 5 segments are required with the same industry defined by a 6-digit NAICS code. If this condition is not fulfilled, the industry is then defined by a 5-digit NAICS code and then by a 4-digit NAICS code until this condition is fulfilled.

The other two indicators of outstanding performance -the sales to total assets ratio and the return on sales (ROS) ratio- are constructed by applying the same logic as $OROA_{it}$:

(ii) OSALES/ASSETSit $= \sum_{i=1}^{n} (\frac{SALES_{jit}}{ASSETS_{jit}} - \frac{SALES_{indjt}}{ASSETS_{indjt}})(\frac{A_{jit}}{A_{it}})$

where $SALES_{indjt}/ASSETS_{indjt}$ represents the asset-weighted average total assets to sales ratio of the same industry *j* during period *t*.

(iii) OROSit $= \sum_{i=1}^{n} (ROS_{jit} - ROS_{indjt})(\frac{A_{jit}}{A_{it}})$

where ROS_{indjt} represents the asset-weighted average operating profit/sales ROS ratio of the same industry *j* during period *t*.

Table I summarizes the descriptive statistics of the three outstanding performance indicators of diversified firms. On average, diversified firms slightly underperform their industry sectors for all three indicators of outstanding performance. However, the standard deviation indicates that there is a substantial dispersion around averages values, making these values not the strongest indicators for studying the relationship between diversification and performance.

Table I

Descriptive statistics of performance indicators of diversified firms

Three measures of outstanding performance are developed: outstanding ROA (OROA), outstanding SALES/ASSETS and outstanding Operating Profit/Sales (OROS). They enable to compare the performance of diversified firms in different industries assessing whether the firm performs below or above their industry average.

	Mean	Med	σ	Max	Min
Assets	8225	1905	21526	265680	779
Outstanding ROA (ROA)	-0.01	-0.01	0.08	0.73	-0.95
Outstanding SALES/ASSETS	-0.03	-0.09	0.87	20.12	-4.62
Outstanding ROS (OROS)	-0.01	0.00	0.43	3.89	-16.84

3.2. Test of persistent performance

To test persistence of outstanding performance, first we used an autoregressive model AR (1) such as:

$$Y_{it} = \alpha + \beta Y_{i(t-1)} + (\eta_i + \nu_{it})$$

The test was carried out using several econometric techniques. Y_{it} is the observation of the outstanding performance indicators of firm *i* in period *t*, $Y_{i(t-1)}$ is the outstanding performance of the previous period, η_i is the stochastic unobserved firm-specific time-invariant effect, ν_{it} is the error component and α is the constant term. The value of β is estimated using different econometric measurements and the Hausman test (null hypothesis $E[Y_{it}\eta_i] = 0$) is performed.

Table II

Autoregressive model AR(1) of persistence of outstanding performance

To test the persistence of outstanding performance, an autoregressive model AR(1) such as: $Y_{it} = \alpha + \beta Y_{i(t-1)} + (\eta_i + \nu_{it})$ is used to determine, applying various econometric techniques, the value of the autoregressive coefficient β: pooled OLS, Within-Group and the instrumental variables (IV) 2SLS. To select the most efficient econometric model, the Hausman test (null hypothesis $E[Y_{it}\eta_i] = 0$) is used to assess the presence of firm's time-invariant specific effect η_i. The Hausman test indicates whether the Pooled OLS provides a consistent estimate of β. In brackets are indicated the t value of the coefficient.

	Pooled OLS	Within-group	IV 2SLS
Outstanding ROA	0.6973 (20.96)	0.2115 (5.73)	0.2104 (3.62)
Adjusted R^2	0.48	0.4553	
Hausman test	$\chi 2 = 310.20$*		
Outstanding SALES/ASSETS	0.8112 (26.21)	0.4281 (4.06)	0.8461 (2.72)
Adjusted R^2	0.7661	0.1967	
Hausman test	$\chi 2 = 151.83$*		
Outstanding ROS	0.3045 (9.91)	0.0564 (3.17)	0.2213 (2.07)
Adjusted R^2	0.0913	0.0568	
Hausman test	$\chi 2 = 219.78$*		

* $p < 0.001$

Table II shows that all the autoregressive models AR(1) give a consistent positive value of β that confirms the hypothesis of a persistent outstanding performance for all three outstanding performance indicators: OROA with a range between 0.69-0.21, OSALES/ASSETS with a range 0.81-0.42 and a OROS with a range 0.30-0.056. This means that firms that achieved above industry average performance continued to do so during our time series, and, conversely, firms that achieved below industry average performance continued to do so during our time series.

For all three indicators of outstanding performance, the Hausman test rejects the null hypothesis, hence the pooled OLS is rejected and the persistence of performance is computed through the WG indicator and the Two-Stages Least Squared (2SLS). As suggested by Bond (2002) and Arellano (2003), AR(1) through pooled OLS is inconsistent and biased upwards since the explanatory variable Y_{it-1} is positively correlated with the error term $(\eta_i + v_{it})$ due to the presence of the firm time-invariant specific effect η_i. The Within-Group estimator eliminates the sources of inconsistency by transforming the equation to eliminate the firm time-invariant specific effect η_i. However, this transformation introduces a negative correlation of order 1/(t-1) between the transformed lagged dependent variables and the transformed error term, suggesting that, except for time series with *t* greater than or equal to 15 (Arellano, 2003), the Within-Group estimator is biased downwards and therefore is not efficient. The correlation between Y_{it} and η_i indicates that the consistent estimation of β is represented only by model 3 through the autoregressive first difference Two-Stage Least Squared (2SLS) developed by Anderson and Hsiao (1981), in which the firm-specific effects are eliminated and, hence, the estimator is consistent. For the entire sample and for both single-segment and diversified firms, we find strong empirical evidence of consistent, outstanding performance between time *t* and time *t-1*.

3.3. Composition of diversified firms' portfolio

The value of the autoregressive coefficient β confirms the existence of a persistent outstanding performance. Due to this empirical evidence, we compare the difference in shareholder value between portfolio of top and bottom performers, as follow: firms are ranked according to their outstanding performance indicators for every year, classes of quintiles are formed and the Markov conditional probability of remaining in the same quintile from time *t* to *t+1* during the times series 1999-2006 is calculated. The null hypothesis (absence of persistent outstanding performance) would assume equal probability, around 20%, of remaining in the same quintile or migrating to one of the other four quintiles. Our results show a persistently outstanding performance for all three indicators.

Table III

Markov conditional probability

An additional measurement of the persistence of outstanding performance is the conditional Markov probabilities. For all indicators of outstanding performance, and during each year of the time series 1999- 2006, all firms are sorted into performance quintiles and the Markov conditional probability that indicates that a firm will either stay in the same performance quintile, or move into one of the other four quintiles in the following year (t+1) is determined. For the hypothesis H_0 (absence of persistence of outstanding performance), the Markov conditional probabilities would have been around 20%, which indicates that at time *(t+1)* a firm has the same probability of staying in the same quintile as it does of moving into one of the lower or upper quintiles. For the hypothesis H_1 (existence of a persistence of outstanding performance between time *t* and time *t+1*), the value of the Markov conditional probability would be different from 20%.

Diversified Firms					
Outstanding ROA (OROA)					
	Top Quintile (%)	II Quintile (%)	III Quintile (%)	IV Quintile (%)	Bottom Quintile (%)
Top Quintile	63	20	8	3	5
II Quintile	21	40	23	10	6
III Quintile	8	26	32	23	10
IV Quintile	3	9	26	40	22
Bottom Quintile	4	5	12	26	52
Outstanding OSALES/ASSETS					
	Top Quintile (%)	II Quintile (%)	III Quintile (%)	IV Quintile (%)	Bottom Quintile (%)
Top Quintile	73	17	5	1	4
II Quintile	19	45	24	8	4
III Quintile	4	26	42	23	4
IV Quintile	4	9	23	47	17
Bottom Quintile	2	3	8	21	65
Outstanding OROS					
	Top Quintile (%)	II Quintile (%)	III Quintile (%)	IV Quintile (%)	Bottom Quintile (%)
Top Quintile	62	17	7	8	5
II Quintile	22	42	22	8	6
III Quintile	5	23	40	22	9
IV Quintile	4	10	24	42	20
Bottom Quintile	7	6	10	21	56

The null hypothesis is rejected for all three performance indicators: diversified firms in the top (and bottom) quintile have at least a 52% chance of remaining in those quintiles and at most a 7% chance of moving to the bottom (and top) quintile. Our results are consistent with Mueller (1977), firms starting out with the highest and lowest profitability levels have a greater than expected probability of remaining in their initial grouping. Conversely, firms in the center of the distribution have a greater than expected probability of movement out of the center. For example, for the indicator outstanding ROA (OROA), the probability of the top and bottom quintiles remaining in their quintile is 63% and 52%, respectively, while for the second, third and fourth quintiles, this percentage is 40%, 32% and 40%, respectively. This also suggests that differing convergence process patterns out of the initial grouping is much more likely for firms starting nearer the center than firms starting nearer the distribution tails.

We find similar figures for the two indicators of outstanding performance. The Markov conditional probabilities confirmed the previous findings using econometric techniques: we find a significant persistence of outstanding performance for all performance indicators. Firms that outperform during time *t* have a high probability of outperforming during time *t+1* and firms that underperform during time *t* have a high probability of underperforming during time *t+1*. This empirical evidence provides the basis for our research. This also strengthens our argument that, when studying the relationship between diversification and performance, the use of average indicators (i.e., the diversification discount) should also be considered in conjunction with the evidence of the persistence of outstanding performance.

We use this finding of persistent outstanding performance to find empirical evidence that the relationship diversification and performance is not causal: we estimate and compare shareholder value and market performance between top and bottom quintiles of diversified firms. We form equally weighted portfolios (one portfolio contains shares of the firms belonging to the top quintile and the other portfolio contains shares of the firms belonging to the bottom quintile), based on the ranking obtained from the OROA performance indicator. We selected the OROA indicator instead of the other two indicators of outstanding performance (OSALES/ASSETS and OROS) because of its higher correlation against a firm's Tobin's *q*, this last being considered as an index of corporate performance; see Table IV.

Table IV

Simple regression among outstanding performance variables and Tobin's *q*

Table III shows that for all three indicators of performance the Markov conditional probability shows strong empirical evidence. In order to select the more appropriate performance indicators to construct portfolios of top and lower quintiles, each indicator is regressed against the Tobin's *q* in comparison to the other two indicators OSALES/ASSETS and OOP/SALES. The following table shows that the OROA has a higher correlation wit h the Tobin's *q*, hence the portfolios of top and lower diversified firms will be built according to the ranking on the OROA indicators.

	OSALES/ASSETS	OOP/SALES	OROA	Tobin's *q*	ROA
OSALES/ASSETS	1				
OOP/SALES	0,0028	1			
OROA	0,1352	0,0646	1		
Tobin's *q*	0,0284	0,0127	0,2248	1	
ROA	0,0878	0,042	0,6504	0,3379	1

Section IV: shareholder value, market performance and risk for single-segment and diversified firms

Using empirical evidence on the persistence of outstanding performance, we can calculate and compare shareholder value through the market performance of equal-valued share portfolios of the top and bottom quintile of diversified firms. We compare shareholder value between top and bottom by (i) comparing the market performance computing the returns, the unconditional risk (σ), and the Jensen's alpha, and (ii) regressing the portfolio return against the asset pricing model of Fama and French, and computing the daily conditional risk (conditional σ). We perform this analysis for every year and for each portfolio of top and bottom quintiles in order to confirm that the persistence of outstanding performance found at accounting data level is also reflected at market data level. For every year, two equally weighted portfolios are constructed and the shareholder return is evaluated. As previously explained, the portfolios are constructed according to the ranking of the OROA indicator of outstanding performance: the first portfolio with firms that belong to the top quintile of diversified firms and the second portfolio with firms that belong to the bottom quintile of diversified firms.

4.1. Risk and total return

For each portfolio and for every year, the portfolio's total return and standard deviation (σ), as a measure of unconditional volatility, are calculated. Table V shows the results. During the entire time series, we find that the top quintile portfolio reached a statistically significant higher performance than the bottom quintile portfolio, either with equal return and lower volatility or with higher return and equal volatility, while in 3 out of 8 years top quintiles outperform the bottom quintiles on both return and volatility.

Table V

Shareholder value of top and bottom quintiles of diversified and single-segment firms: total return, and standard deviation

Daily market data, for each year and for each portfolio of top and bottom quintiles of diversified firms, are used to calculate the total return and the total unconditional risk (the standard deviation σ). Daily market data are taken from Thomson Financial and the total return has been taken into consideration. Panel A shows the yearly return and conditional risk for the two portfolios: top quintile diversified firms, and bottom quintile diversified firms. Panel B shows the difference in yearly returns and its statistical significance at 95% (*t* statistics indicated in brackets), and the difference in unconditional risk and the statistical significance (p value) of the inequality of the standard deviations (σ). The difference is calculated between portfolios of different quintiles (top quintile compared with bottom quintile).

Panel A

Top quintile diversified firms (%)								
	1999	2000	2001	2002	2003	2004	2005	2006
Return	16.06	11.97	11.82	-6.76	37.53	23.07	14.65	19.60
Unconditional risk (σ)	11.23	17.98	16.14	16.96	13.18	10.55	12.55	14.61
Bottom quintile diversified firms (%)								
	1999	2000	2001	2002	2003	2004	2005	2006
Return	2.41	-13.67	-0.27	-26.64	40.11	12.75	-8.11	11.64
Unconditional risk (σ)	12.56	16.39	19.18	22.59	16.96	14.37	13.36	14.86

Panel B

Difference in return and risk between top and bottom quintile of diversified firms (%)								
	1999	2000	2001	2002	2003	2004	2005	2006
Difference in Total Return	13.65 (5.34)	25.64 (7.63)	12.09 (3.46)	19.88 (4.92)	-2.58 (0.85)	10.32 (4.22)	22.76 (8.87)	7.96 (2.55)
Difference in Unconditional risk (σ)	-1.33	1.59	-3.04	-5.63*	-3.78***	-3.82**	-0.81	-0.25

*p< 0.01, **p < 0.05, ***p < 0.10.

4.2. Jensen's alpha

Jensen's alpha (Jensen, 1969) measures the systematic risk-adjusted excess return with respect to a selected reference market according to the formula:

$$R_p - R_f = \beta_p (R_m - R_f) + \text{Alpha}$$

$$\text{Alpha} = R_p - \beta_p (R_m - R_f) - R_f$$

R_p represents the return of the top and bottom quintile portfolios, R_f is the risk-free rate, R_m is the market return and β_p is the covariance of the portfolio's returns scaled by the variance of the return on the market.

Jensen's alpha is calculated according to the S&P 500 Composite; the data are taken on a daily basis.

Table VI

Jensen's alpha of the top and bottom quintiles in diversified and single-segment firms

Daily market data, for each year and for each portfolio of top and bottom quintiles of diversified and single-segment firms, are used to calculate Jensen's alpha in order to compare the financial performance with a market reference. Daily market data are taken from Thomson Financial and the total return has been taken into consideration. Jensen's alpha is calculated according to the following formula: Alpha = $R_p - \beta_p (R_m - R_f) - R_f$, where R_p represents the return of the top and bottom quintile portfolio, R_f is the risk-free rate, R_m is the market return and β_p is the covariance of the portfolio's returns scaled by the variance of the market return. The S&P 500 Composite index has been taken as reference market (market index). The correlation R^2 between the market index and the portfolio is shown in brackets.

Top quintile diversified firms (%)								
	1999	2000	2001	2002	2003	2004	2005	2006
Jensen's alpha	10.83	19.31	22.31	8.35	21.04	14.65	12.74	7.70
	(0.34)	(0.58)	(0.70)	(0.75)	(0.78)	(0.75)	(0.75)	(0.69)
Bottom quintile diversified firms (%)								
	1999	2000	2001	2002	2003	2004	2005	2006
Jensen's alpha	-4.59	-5.83	10.19	-7.25	20.26	3.71	-9.80	0.04
	(0.26)	(0.48)	(0.49)	(0.70)	(0.68)	(0.68)	(0.52)	(0.63)

From Table VI it is possible to conclude that the difference and persistence of performance found in section 1 is reflected as well at shareholder value level. The Jensen's alpha difference between the top quintile portfolio and the bottom quintile portfolio is always positive. Comparing the performance of the two portfolios with the market performance through Jensen's alpha, the top quintile portfolio consistently beat the market index during the entire time series, while the bottom quintile portfolio underperformed the market index (negative value of α) during 4 years over the period.

4.3. Fama and French's three-factor model

To discover the top and bottom quintile firm characteristics, especially in terms of the degree of business relatedness of the firm's business portfolio and on the ability of the firm to position its business portfolio within an industry with growth opportunities, for every year of the time series each portfolio is regressed against Fama and French's asset pricing model to explain the portfolio's extra return (the portfolio's return minus the risk-free rate), taking into account the extra return or "risk premium" that investors ask for with respect to a "size premium" and "value premium", in addition to the premium related to the systematic risk. This multifactor model was motivated by the empirical finding that the size (SMB) and ratio of book to market equity (HML) have consistent and significant explanatory power of stock returns (Fama and French 1992).

The Fama and French three factor model follows this formula:

$$R_p = R_f + b_i(R_m - R_f) + s_i\mathrm{SMB} + h_i\mathrm{HML}$$

with:

Factor R_m-R_f: market premium, equal to the CAPM (Sharpe, 1964). This measurement allows comparing, for both portfolios, the systematic risk known as the market risk or the risk that cannot be diversified away; not specific to individual stock.

Factor *SMB* (Small Minus Big) accounts for "size premium" and conditionally it is also related to profitability (Fama and French, 1992). It is designed to measure the additional return that investors have historically received by investing in stocks of companies with relatively small market capitalization. Logically, this factor should be expected to be more sensitive to many risk factors as a result of their relatively undiversified nature and their reduced ability to absorb negative financial stock. Fama and French (1992) notice that the recession of 1981 and 1982 turned into a prolonged earning depression for small stocks and they notice that, for some reason, on average, small stocks did not participate in the boom of the middle and late 1980s. Through this factor we aim to gain insight into the nature of the degree of relatedness of business segment with diversified firms. From the construction of the sample, taking into consideration firms with a turnover greater than $500 million, we assume that firms with a highly related business (or business segment with high correlation among the cash flow among of its business segments) might be considered to have risk exposure to many risk factors as a result of their relatively poor diversification strategy and, hence, difficulty in absorbing negative financial stock; in other words, the correlation among business segments' cash flow can be considered as an indirect indicator of relatedness among business segments.

Factor *HML* (High Minus Low) accounts for "value premium" and is more related to profitability than the SMB factor (Fama and French, 1992). It is designed to measure the additional return provided to investors for investing in companies with high book-to-market values. Fama and French (1995) show that book-to-market equity and the slope on HML proxy of distress: weak firms with persistently low earnings tend to have high BE/ME (book equity/market equity) ratio and a positive slope on HMT, while strong firms with persistently high earnings have low BE/ME and a negative slope to HML. Through this factor we aim to gain an insight into the ability of the diversified firm to position its business portfolio within industries with growth opportunities, rather than focus on industries with lower growth opportunities.

Table VII shows the results.

Table VII

Regression of top and bottom quintile returns against the Fama and French three-factor model

The daily return of the top and bottom quintile portfolios of diversified and single-segment firms is regressed against the Fama and French three-factor model according to the formula $(R_p\text{-}R_f) = \alpha + bi(R_m\text{-}R_f) + s_i\text{SMB} + h_i\text{HML}$. Rm is the return on the value-weighted index of NYSE, Amex, and Nasdaq stocks on day *t*; R_{ft} is the beginning-of-month three-month T-bill yield on day *t*, SMB_t is the return on small firms minus the return on large firms on day *t*, and HML_t is the return on high book-to-market stocks minus the return on low book-to-market stocks on day *t*. The factor definitions are described in Fama et al. (1993).

The regression is performed for every year and for the entire time series 1999-2006. T-statistics are in brackets. Panel A contains the results of the regressions for the top quintiles. Panel B contains the results of the regressions for the bottom quintiles. Regression is computed using daily observations.

Panel A: Top Quintiles

Top quintile diversified firms (yearly)								
Coefficients	1999	2000	2001	2002	2003	2004	2005	2006
R^2	0.51	0.65	0.80	0.86	0.86	0.85	0.91	0.84
b(Market)	0.0082 (14.37)	0.0088 (15.46)	0.0080 (24.79)	0.0075 (36.75)	0.0079 (37.76)	0.0083 (27.12)	0.0094 (34.82)	0.10 (22.43)
s(SMB)	0.0047 (7.00)	0.0015 (2.50)	0.0038 (7.15)	0.0038 (9.02)	0.0028 (8.11)	0.0032 (7.54)	0.0054 (12.89)	0.0057 (8.83)
h(HLM)	0.0058 (8.03)	0.0051 (6.00)	0.0036 (7.31)	0.0042 (8.61)	0.0024 (3.80)	0.0015 (3.12)	0.0038 (7.51)	0.0033 (3.41)
α	0.00036 (1.17)	0.00015 (0.035)	0.0005 (1.76)	0.0001 (0.63)	0.0003 (1.63)	0.0003 (2.20)	0.0003 (2.02)	0.0001 (0.58)
Top quintile diversified firms (1999-2006)								
R^2	0.76							
b(Market)	0.0083 (73.16)							
s(SMB)	0.0036 (21.82)							
h(HLM)	0.0048 (24.62)							
α	0.00026 (2.65)							

Panel B: Bottom Quintiles

Bottom quintile diversified firms (yearly)								
	1999	2000	2001	2002	2003	2004	2005	2006
R^2	0.61	0.55	0.69	0.84	0.77	0.82	0.67	0.81
b(Market)	0.011 (19.95)	0.0075 (13.02)	0.0098 (20.62)	0.0101 (34.78)	0.0096 (27.73)	0.0089 (21.56)	0.0080 (14.57)	0.0093 (18.63)
s(SMB)	0.0070 (10.42)	0.0021 (3.56)	0.0078 (9.84)	0.0063 (10.37)	0.0037 (6.23)	0.0057 (9.92)	0.0062 (7.25)	0.0073 (10.11)
h(HLM)	0.0099 (13.83)	0.0047 (5.52)	0.0072 (9.84)	0.0067 (9.46)	0.0036 (3.44)	0.0011 (1.71)	0.0037 (3.60)	0.0067 (6.10)
α	-0.0001 (0.58)	-0.0010 (2.33)	-0.0005 (1.26)	-0.0006 (1.66)	0.0002 (0.65)	0.00006 (0.28)	-0.0006 (2.20)	-0.0004 (1.79)
Bottom quintile diversified firms (1999-2006)								
R^2	0.71							
b(Market)	0.0094 (66.27)							
s(SMB)	0.0049 (23.69)							
h(HLM)	0.0069 (27.85)							
α	-0.0004 (3.95)							

In Panel A, we analyze the top quintile portfolios and in panel B the bottom quintile. For both panels, the yearly regression suggests high value and statistical significance in the regression coefficients with an intercept statistically indistinguishable from zero except for 2004 and 2005 for diversified firms, but economically indistinguishable from zero for the entire time series. This indicates that the Fama and French model's risk factors are able to capture the difference in performance within top and bottom quintiles.

The first factor from the model, the CAPM $b_i(R_m\text{-}R_f)$ confirms the previous finding on the volatility (σ) of the top and bottom quintiles: the portfolio constructed on the top quintile shows a lower systematic risk than the portfolio constructed on the bottom quintile.

The second factor from the model, s_iSMB, represents the "size premium" and indicates the additional return investors have historically received by investing in stocks of companies with relatively small market capitalization, given their reduced ability to absorb negative financial stock, also explained by their lower degree of diversification which, in turn, increases cash flow volatility. The bottom quintile portfolio shows consistently higher value than the top quintile portfolio. Because we have included in the sample of diversified firms only diversifiers with a sales turnover of at least $500 million, we believe that most of the small capitalization should not have been included. This result suggests that diversified firms belonging to the top quintile smooth their cash flow and earnings through diversification, indicating a certain degree of unrelated business, especially in terms of cash flow correlations or cash flow volatility, hence a higher ability to absorb negative financial shock. We also conclude that diversified firms belonging to the bottom quintile have a higher relatedness of business segment explained by the higher cash flow correlation and volatility.

The third factor from the model h_iHML, represents the "value premium". The lower coefficients found for firms belonging to the top quintile portfolio, compared to the bottom quintile portfolio, suggest that firms in the top quintile were able to position their business portfolio within industries with higher growth opportunities and higher ROA than firms belonging to the bottom quintiles, which seem more focused on mature industries.

The comparison of the values of (i) the risk and total return, (ii) the Jensen's alpha, and (iii) the HML factor of the Fama and French model confirms that the persistent outstanding performance is also present through market-based indicators. It sustains our hypothesis that the relationship between diversification and performance is not causal but depends on the ability of the firm to remain ahead of the competition (positive abnormal return) or inability of the firm to perform at industry averages (negative abnormal return). In addition, the findings related to the SMB factors is an indication that firms which belong to the bottom might have a higher degree of business relatedness, especially in term of correlation of earning and cash flow, hence, to some extent, not confirming the inverted-U relationship between diversification and performance. Finally the finding related to the third factors of Fama and French's asset pricing model suggests that diversified firms belonging to the top quintile are able to position their portfolio of business segment within industries with higher growth opportunities.

4.4. Risk measurement: conditional variance

When the Fama and French asset pricing model is applied to the portfolios returns, we find that the investors consider the bottom quintile portfolios more risky than the top quintile portfolios, asking for higher return related to the market premium, a size premium, and a value premium.

Moreover, the top quintile portfolios have lower risk, measured as the daily standard deviation of the distribution of the returns (unconditional variance), 0.091% related to top quintiles, compared to 0.010% related to bottom quintiles, as shown in Table VIII. The latter result assumes that the returns follow a normal distribution but this is not the case: as can be seen from the distribution parameters in Table VIII, normality tests of Kolgomorof-Swirnov and Shapiro-Wilk reject the hypothesis 0 of normality distribution of portfolio returns during our time series 1999-2006: all distributions have a fat tail (kurtosis higher than 3) and, except for the bottom quintile of diversified firms (negatively skewed), the other portfolios are positively skewed instead of 0, as shown in Figure I. This implies that, in order to assess the risk related to the portfolios, it would be more appropriate to use a model of unconditional volatility that assumes the non-normality of the return distribution.

Table VIII

Distribution and basic statistics of returns

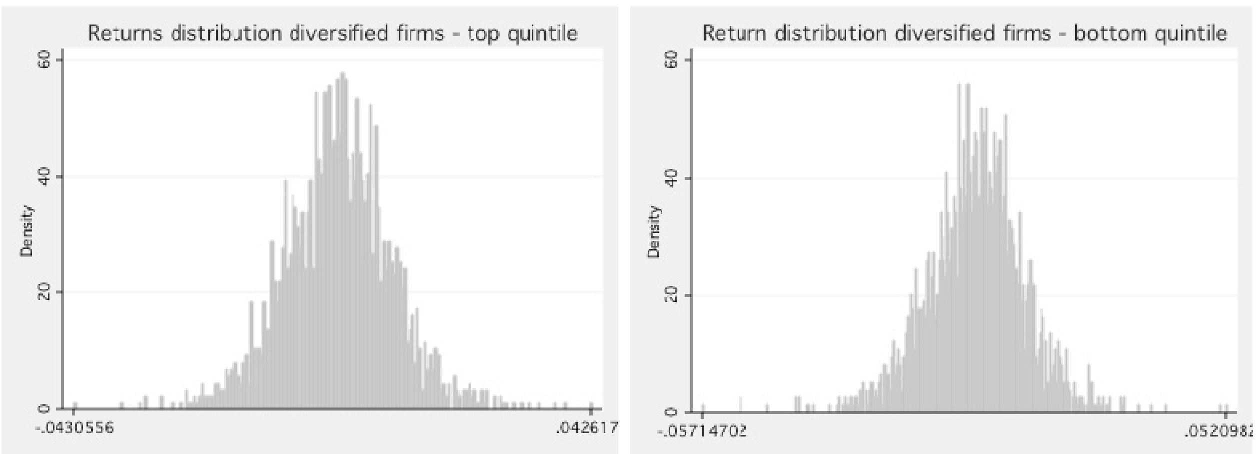
The table shows the mean, standard deviation, skewness, kurtosis, maximum and minimum of the daily returns for the top and bottom quintile portfolios. We can see that the distribution of returns is not normal: a normal distribution implies zero skewness (symmetric distribution) and kurtosis equal to 3 (normal peaks, not fat tails).

Statistic	**Diversified firms Top Quintile**	**Diversified firms Bottom Quintile**
µ	0.0006211	-0.0000234
Σ	0.0091273	0.0104531
Skewness	0.0061088	-0.1537581
Kurtosis	4.177992	4.83263
Max	0.0428319	0.0522806
Min	-0.0430556	-0.057147
Kolgomorof-Swirnov test	11,84*	20,55*
Shapiro-Wilk test	0,9416*	0,9416*

* P = 0,001

Figure 1

Distribution of daily returns of top and bottom quintiles during time series 1999-2006



Hence, to compute and compare the risk of top and bottom quintiles, we estimate daily conditional variance through the generalized autoregressive conditional heteroskedasticity model GARCH (1,1) which describes the dynamic behavior of the conditional variance, determining its value at each specific time as a function of its value one day before, the value of the (squared) innovations one day before, and the long term average variance. The term (1,1) indicates that the conditional variance is based on the most recent observation of the squared return, and the most recent estimate of the variance rate (both lags = 1). The model is represented by the following the formula:

$$\sigma_t^2 = \omega + \alpha R_{t-1}^2 + \beta \sigma_{t-1}^2$$

in which ω is the long-term variance γV_L (a sort of unconditional variance), γ is the weight assigned to the long-term variance, α is the weight of the volatility related to the innovations (R^2_{t-1}) of latest news at day *t-1*, and β is a weight of the previously estimated conditional variance σ_{t-1} that represents the persistence of volatility.

Table VII and Figure 2 show the results. It can be seen that, except for the years 2000 and 2005, the daily volatility within the top quintile is lower than the daily volatility within the bottom quintile. The term σ_L representing the long-term volatility (a kind of unconditional volatility) is higher for the top quintile than the bottom quintile, (1.21% compared to 1.01%), and we find similar results for the parameter α that indicates that the volatility of the top quintile portfolio is more sensitive to market news than the volatility of the bottom quintile portfolio (0.088 compared to 0.062). By contrast, the term value of the parameter β, which measures the persistence of the volatility σ at time (t-1), is higher for bottom quintile (0.905 compared to 0.886).

Table IX

Parameters of the daily conditional variance model GARCH (1,1)

The GARCH (1,1) model describes the dynamic behavior of the conditional variance, determining its value at each specific time as a function of its value one day before, the value of the (squared) innovations one day before, the long-term average variance and the “leverage effect”. The latter effect is explained by the fact that negative returns due to the arrival of bad news increase the variance rate more than positive returns of the same magnitude.

The formula of the conditional variance is:

$$\sigma_t^2 = \omega + \alpha R_{t-1}^2 + \beta \sigma_{t-1}^2$$

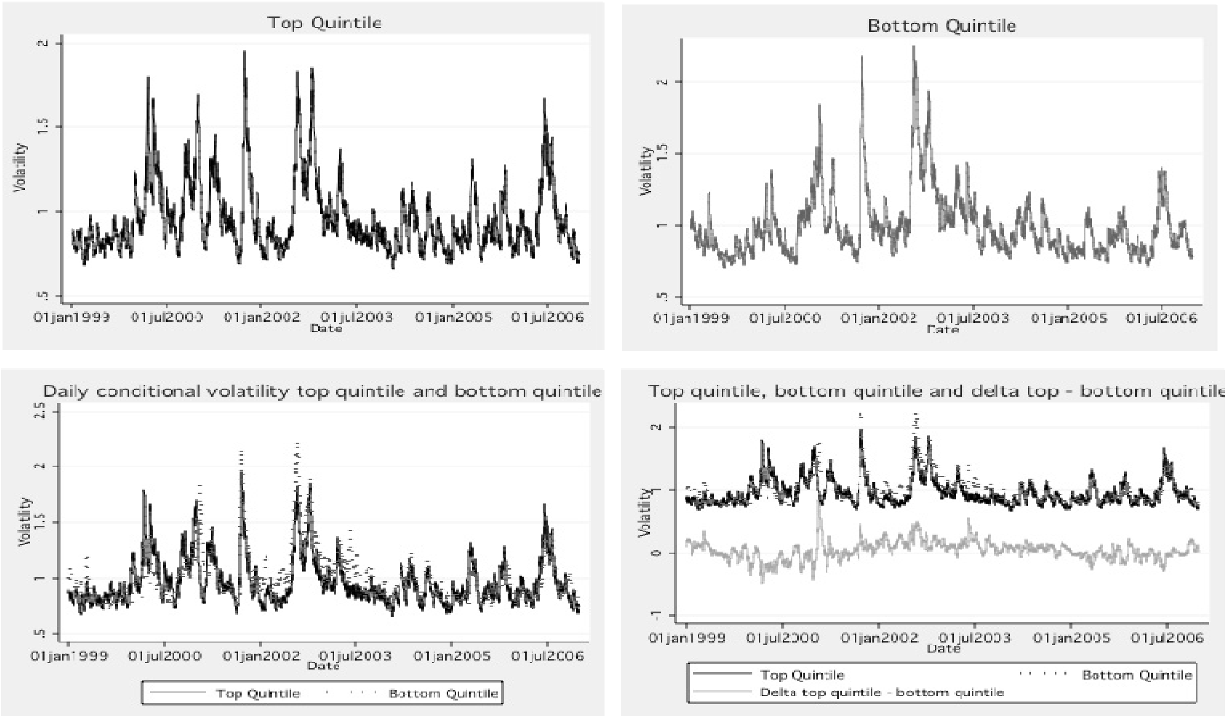
The term (1,1) indicates that the conditional variance is based on the most recent observation of the squared return, and the most recent estimate of the variance rate (both lags = 1). In all cases $\alpha + \beta < 1$; this is required for a stable GARCH (1,1). Otherwise, the weight assigned to VL would be negative and the process would be mean fleeing rather than mean reverting.

GARCH (1,1)		Top Quintile	Bottom Quintile
Parameter Estimates	w*	3.64E-06	3.19E-06
	α*	0.0889629	0.0629463
	β*	0.8861894	0.9058103
γ		0.0248477	0.00785070
VL		0.000146492	0.000102093
σL		0.012103406	0.010104095

*p< 0.01

Figure 2

Daily conditional volatility according to the GARCH (1,1) model



Section V: outstanding performance, efficient internal capital market, and degree of relatedness among business segments

Previous sections have demonstrated that the relationship between diversification and firm performance is not causal, but depends on the ability of the firm to persistently perform above its industry: some diversified firms persistently reach a performance above their industry peers, creating shareholder value and beating the market index. Conversely, other diversified firms are persistently unable to achieve similar results: they persistently perform below their industry average, have higher market volatility, and perform below the market index. From these results we now attempt to quantify the impact on the abnormal return through the main findings in strategy and in finance: the degree of relatedness of the business segment within a diversified firm and the degree of efficiency of the internal capital market.

In the field of strategy, the explanation of the relationship between diversification and performance is deeply-rooted in the resource-based view of the firm: the degree or relatedness among business segments is highly correlated with the ability to develop synergies among businesses. Therefore, from this theoretical perspective, there is a positive relationship between related diversification and performance. In the field of finance, on the other hand, the main justification of the diversification discount among diversified firms is mainly driven by the degree of efficiency of the internal capital market: the diversification discount is mainly explained by agency costs leading to a misallocation of internal funds from more highly profitable business segments to less-profitable business segments.

This section attempts to quantify, using panel data, the variation of the dependent variable, outstanding ROA (OROA), through the independent variables that represent (i) the degree of efficiency of the internal capital market according to the conditions of efficiency identified by Shin and Stulz, (1998), and (ii) the degree of the diversified firm's segments' relatedness.

Econometric model selection

Bergh (1995), Bergh and Holbain (1997), and Bergh (2007) highlighted the relevance of using longitudinal studies when attempting to evaluate the relationship between performance and degree of business relatedness in order to control for firm-specific effects and heteroscedasticity. Hence, the econometrics model used needs to take into account three critical considerations: (i) the existence of the time invariant firm's specific effect η_i as shown in section 3 (the Hausman test rejects the null hypothesis), (ii) the need to control for heteroscedasticity, and (iii) the length of the time series (8 years, 1999-2006) that makes the standard candidate in case presence of η_i, (the Within Group indicator) inefficient because of the negative correlation of order $1/(t\text{-}1)$ between the transformed lagged dependent variables and the transformed error term. Arellano and Bond (1991) suggest, for a mean stationary process where $E[\Delta Y_{it}\ \eta_i] = 0$, using the dynamic panel data model using the instrumental variables (IV) system's generalized method of moments (GMM) that eliminates a firm's specific effect and gives an efficient value of parameters for large sample and limited time series. In addition, this econometric model allows the researcher to manage the endogeneity related to the independent variables with the use of longer lags as instruments when needed. The sample selected is composed of large diversified firms with turnover higher than $500 million. Hence, it is correct to assume that the delta performance ΔY_{it} of the firms in the sample selected follows a mean stationary process.

Independent variable construction

Independent variables are developed to represent the efficiency of the internal capital market and the degree of relatedness among business segments.

Efficient internal capital market

Shin and Stulz (1998) developed three conditions for identifying an efficient internal capital market: (i) it gives priority in the allocation of funds to the segments with best investment opportunities, (ii) the segment's investment is less sensitive to its own cash flow as well as to the other segments' cash flow, and (iii) the allocation of funds to a segment falls when other segments have better investment opportunities.

The first and third conditions are directly related to the firm's performance or, in our case, the firm's outstanding performance; hence the following independent variables are constructed to test these two conditions. To test the first condition (the allocation of funds is directed to the best performing segments), we developed four dependent variables that are the combination of two types of efficient and inefficient investment allocation behaviors of the firm. The first behavior is to invest in business segments in which their performance is above (efficient investment behavior) or below (inefficient investment behavior) the industry average ROA*ind*. The second behavior is to invest in business segments in which their performance is above (efficient investment behavior) or below (inefficient investment behavior) the firm's assets weighted ROA. We thus get 4 the dependent variables. The variable MAXMAX, that computes the proportion of (i) investments in segments that perform above industry average ROA*ind* and above the firm's assets weighted ROA, and (ii) disinvestments in segments that perform below industry average ROA*ind* and below the firm's assets weighted ROA. At the opposite end, we have the variable MINMIN that computes the proportion of (i) investments in segments that perform below industry average ROA*ind* and below the firm's assets weighted ROA, and (ii) disinvestments in segments that perform above industry average ROA*ind* and above the firm's assets weighted ROA. We also construct two intermediate variables MAXMIN and MINMAX. MAXMIN computes the proportion of (i) investments in segments that perform above industry average ROA*ind* but below the firm's assets weighted ROA, and (ii) disinvestments in segments that perform below industry average ROA*ind* but above the firm's assets weighted ROA. Finally, MINMAX computes the proportion of (i) investments in segments that perform below industry average ROA*ind* but above the firm's assets weighted ROA, and (ii) disinvestments in segments that perform above industry average ROA*ind* but below the firm's assets weighted ROA.

We therefore construct the four variables as following:

$$\text{MAXMAX}_{it} = \sum_{j=1}^{n} (I_{jit} + DIS_{jit}) / (I_{jit} - DIS_{jit})$$

where I_{jit} is the investment in segment j of the firm i in time t of the following formula: ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$ when this sum is > 0. With the same logic, DIS_{jit} is the disinvestment when this sum is < 0. In the denominator is considered the total investments (I_{it}) minus the disinvestments (DIS_{it}) of the firm i during time t, given that it aims to represent the whole amount of the investment and disinvestment decisions of the firm. I_{it} is always > 0, DIS_{it} is always < 0 and, hence, in the formula $I_{it} - \text{DIS}_{it}$ is always > 0. This variable measures the proportion of efficient investments and disinvestments and, hence, in the numerator is considered only the sum of investments and disinvestments within segments that have the ROA respectively > ROA_{ind} and > the firm's weighted asset average ROA for investments, and < ROA_{ind} and < the firm's weighted asset average ROA for disinvestments.

According to of Shin and Stulz's (1998) first condition of internal capital market efficiency, we can expect a positive coefficient of MAXMAX (investments in highly performing segments with segment ROA both > ROA_{ind} and > the firm's weighted asset average ROA, and disinvestments in low performing segments with ROA both < ROA_{ind} and < the firm's weighted asset average ROA) and a negative coefficient of MINMIN (investments in low performing segments with segment ROA both < ROA_{ind} and < the firm's weighted asset average ROA and disinvestments in high performing segments with ROA both > ROA_{ind} and > the firm's weighted asset average ROA). Two additional intermediary independent variables are constructed: MAXMIN (investments within segments that have the ROA > ROA_{ind} but < the firm's weighted asset average, and disinvestments within segments that have the ROA < ROA_{ind} but > the firm's weighted asset average ROA), and MINMAX (investments within segments that have the ROA < ROA_{ind} but > the firm's weighted asset average ROA, and disinvestments within segments that have the ROA > ROA_{ind} but < the firm's weighted asset average ROA). The last two variables have both a positive and negative connotation in relation to the first condition of internal capital market efficiency; hence, we do not expect a statistically significant sign and value of the coefficients related to MAXMIN and MINMAX, but we include it in our econometric models.

b) To test the third condition of the efficiency of the internal capital market (allocation to a specific segment falls when other segments have better investment opportunities), we construct the CFINV_{it} independent variable which always considers the proportion of efficient and inefficient investment behavior of the firm (investments and disinvestments), but works according to a particular condition of efficient internal capital market indicated by the variable CFGROWTH. We construct CFINV as follows:

$$\text{CFINV}it = \sum_{j=1}^{n}(I_{jit} + DIS_{jit}) / (I_{jit} - DIS_{jit})$$

where I_{jit} is the investment in segment *j* of the firm *i* in time *t* of the following formula: ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$ when this sum is > 0. With the same logic, DIS_{jit} is the disinvestment when this sum is < 0. In the denominator is considered the total investments (I_{it}) minus the disinvestments (DIS_{it}) of the firm *i* during time *t*, given that it aims to represent the whole amount of the investment and disinvestment decisions of the firm. I_{it} is always > 0, DIS_{it} is always < 0 and, hence, in the formula $I_{it} - \text{DIS}_{it}$ is always > 0. CFINV_{it} works according to the logic described by the variable CFGROWTH_{jit} that captures the relative performance of each segment in comparison with the rest of the firm's business segment portfolio.

$$\text{CFGROWTH}_{jit} = (CF_{jit} / A_{jit}) / (CF_{ji(t-1)} / A_{ji(t-1)}) - \sum_{j=1}^{n}(CF_{-jit} / A_{-jit}) / (CF_{-ji(t-1)} / A_{-ji(t-1)})$$

and it behaves according to the following logic:

- if $\text{CFGROWTH}_{jit} > 0$ than we compute I_{jit} according to its formula in CFINV_{it}
- if $\text{CFGROWTH}_{jit} < 0$ and (ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$) < 0 we are in a situation of an "efficient" disinvestment, hence we compute the disinvestment amount DIS_{jit} according to its formula in CFINV_{it}
- if $\text{CFGROWTH}_{jit} < 0$ and and (ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$) > 0 we are in a situation of an "inefficient" investment, hence we set the investment I_{jit} to 0

CFGROWTH takes into consideration whether investment and disinvestment decisions are efficient, so CFGROWTH > 0 indicates that an investment has been performed because the profitability of the segment *j* under the formula $(CF_{jit} / A_{jit}) / (CF_{ji(t-1)} / A_{ji(t-1)})$ is higher than the rest of the portfolio *-j* under the formula $\sum_{j=1}^{n}(CF_{-jit} / A_{-jit}) / (CF_{-ji(t-1)} / A_{-ji(t-1)})$ When CFGROWTH < 0 then we have two sub-cases: if (ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$) < 0 the internal capital market is efficient because a disinvestment has been performed given that the profitability of the segment *j* is lower than the rest of the firm's business segment portfolio *-j*. In the second case, when (ASSET_{jit} + $\text{DEPRECIATION}_{jit}$ - $\text{ASSET}_{ji(t-1)}$) > 0 the internal capital market is inefficient because an investment has been performed in segment *j* although the profitability of this segment is lower than the rest of the firm's business segment portfolio *-j*, hence we set the value of the investment I_{jit} to 0.

CF_{jit} is the cash flow (the sum of the operating profit plus depreciations) of the segment *j* of firm *i* during time *t*, CF_{-jit} represents the total cash flow (the sum of the operating profit plus depreciations) of the segments of the firm minus the segment *j*. A_{jit} is the value of the assets allocated to the segment *j* of firm *i* during time *t* and A_{-jit} is the value of the assets allocated to all segments except segment *j* of firm *i* during time *t* and finally and *(t-1)* represents one lag period.

According to Shin and Stulz's (1998) third condition of internal capital market efficiency, the value of CFINV_{it} varies from value 1 (100% of the investment and disinvestment decisions are efficient) to value 0 (0% of the investment and disinvestment decisions are efficient). Overall it is expected to have a positive coefficient between the independent variable $CFINV_{it}$ and the dependent variable OROA.

Degree of segment relatedness

Here, in order to assess the validity of the inverted-U curvilinear relationship between diversification and performance (Markides and Williamson, 1994; Palich, Cardinal, and Miller, 2000), we prefer not to use sophisticated indicators of relatedness; while they would certainly be able to tap into the degree of relatedness among business segments, they may also invoke a certain degree of subjectivity (Martin and Sayrak, 2003). Hence the following indicators will be used: (i) Herfindahl index, (ii) simple count-of-industry approach, and (iii) entropy indicators (Jacquemin and Berry, 1979; Papelu, 1985). An additional argument for not using sophisticated indicators of relatedness is also motivated by the time series selection and by the use of the NAICS codification. In the time series selected (1999–2006), segment information is disclosed according to the new segment reporting standard SFAS 131, in which firms need to report disaggregated information by line of business unless they organize themselves that way for the purposes of performance evaluation. This induces companies to more fully reveal their diversification and fund transfer strategies. Moreover the information provided under the new segment definition standard would be less subjective than what was provided under the previous SFAS 14 (Berger and Hann, 2003). Thus, the use of the NAICS codification rather than the SIC codification allows to capture a certain portion of the degree of relatedness among business segments because of their construction logic.

The indicators are:

HERFINDAHL $INDEX_{it}$ = $1- \sum_{j=1}^{n} S_{jit}^{2}$ where S = $SALES_{jit} / \sum_{j=1}^{n} SALES_{jit}$

DT_{it} (Diversification Total entropy indicator of firm i in time t) = $\sum_{j=1}^{n} P_j \ln(1/P_j)$

where P_j is the proportion of business (sales) of segment j defined by the 6-digit NAICS code.

DU_{it} (Diversification Unrelated entropy indicator of firm i in time t) = $\sum_{j=1}^{n} (S_j \ln(1/S_j))$ where

S_j is the proportion of business (sales) of segments j defined according to the first 3 digits of the NAICS code.

DR_{it} (Diversification Related entropy indicator of firm i in time t) = DT_{it} - DU_{it}

$NBSEG_{it}$ = Number of segments reported by firm i in time t.

$NBSEC_{it}$ = Number of subsectors defined by the first 3 digits of the NAICS code of firm i in time t.

$NBIND_{it}$ = Number of industries defined by the first 4 digits of the NAICS code of firm i in time t.

Moreover, we control the effects for the firm leverage and for firm sizes that are considered affecting firm's performance with diversified firms (Lewellen, 1971: Mansi and Reeb, 2002: Chandler, 1977). We therefore introduce two control variables: (LEVERAGE) that represents the firm's leverage and (ASSETS) computed as the logarithm of the firm's assets.

The results of the instrumental variables (IV) system GMM dynamic panel data econometric models are shown in table X.

Table X

Instrumental variable (IV) system GMM econometric models results

Model 1 and 2 are oriented toward the degree of efficiency of the internal capital market with instruments with lag (t-2) for the fund allocation independent variables on variable given the presence of the firm's specific effect η_i. Model (3) to (5) are oriented toward the test of the degree relatedness with the performance. Also here the lag (t-2) is taken into consideration given the presence of the firm's specific effect η_i. Instrument with lag (t-3) is taken for the variable Yi(t-1) to obtain satisfying results of the Sargan test. The Sargan test and the Hansen tests confirm the orthogonality restrictions of the instruments used, hence reliable instruments are used. The Arellano Bond test confirms the absence of first order and second order correlation in the residuals. All models control for heteroskedasticity and the t statistics of the coefficients are indicated in brackets.

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5
OROA (t-3)	**0.6660*** (10.33)	**0.6863*** (10.53)	**0.6164*** (7.81)	**0.5460*** (7.18)	**0.5887*** (7.72)
MAXMAX (t-2)	**0.0313*** (3.08)	**0.0343*** (2.94)	**0.0198** (1.45)	**0.0345*** (3.03)	**0.04215*** (3.38)
MAXMIN (t-2)	**-0.0035** (-1.21)	**-0.0036** (-1.15)			
MINMAX (t-2)	**0.0063** (0.98)	**0.0073** (1.03)			
MINMIN (t-2)	**-0.0044** (0.62)	**-0.0051** (0.70)			
CFINV (t-2)	**0.0167**** (1.88)	**0.0147**** (1.75)			
LEVERAGE (t-2)	**-0.0004 (-0.67)**				
LOGASSETS (log) (t-2)	**-0.0257**** (-1.75)	**-0.0280** (-1.78)		**-0.0316**** (1.79)	**-0.0375*** (1.99)
HERFINDAHL INDEX (t-2)	**0.0001** (0.83)				
DT (t-2)				**-0.0032** (-0.29)	
DU (t-2)					**0.0019 (0.29)**
DR (t-2)					**0.0111 (0.65)**
NBSEG (6 digits NAICS code) (t-2)			**-0.076*** (1.98)	**-0.0192** (-0.43)	
NBSEC (3digits NAICS code) (t-2)			**0.0204*** (2.03)		
NBIND (4 digits NAICS code) (t-2)				**0.0192*** (2.31)	
Sargan test	0.616	0.494	0.161	0.192	0. 151
Hansen test	0.297	0.175	0.298	0.631	0. 614
Arellano Bond residual AR(1)	0.000	0.000	0.000	0.000	0.000
Arellano Bond residual AR(2)	0.015	0.018	0.044	0.020	0.025

*P < 0.001 ** P < 0

All 5 models confirm a strong persistence of outstanding performance based on the outstanding ROA (OROA) indicator through coefficient βY_{it-1} within the range 0.54 to 0.68 as found in section III. We confirm the two efficient internal capital market conditions (Shin and Stulz's (1998): positive abnormal returns are explained by the degree of efficiency of the internal capital markets. The coefficients β_i for the independent variable MAXMAX and CFINV are positive and statistically significant, within the ranges 0.0421 to 0.031 and 0.0167 to 0.0147 respectively. We do not find an inverted-U curvilinear relationship between diversification and performance as assumed in the literature in strategic management. Rather, we find the opposite results: the coefficients β_i related to the independent variables NBSEC and NBIND are positive and statistically significant, within the range 0.0204 to 0.0192. The coefficient related to NBSEG has a negative value of -0.076. We also notice that entropy indexes and the Herfindahl index do not reach statistical significance.

We conclude, therefore, that past outstanding performance or past relative performance remains the variable with the greatest explanatory power of the persistence of abnormal return within diversified firms.

For all models, the values of the Sargan and Hansen tests, as well as the Arellano Bond autoregression test AR(1) and AR(2) of the residuals (absent for both AR(1) and AR (2)), confirm the statistical validity of the econometric models. Moreover, all models control for heteroscedasticity.

Our results confirm our assumption that the relationship between diversification and firm performance is not causal but depends on the ability of the firm to position itself ahead its competitors (positive abnormal return) or inability to perform at industry average level (negative abnormal return). We also confirm the main assumption in the finance literature regarding the benefits related to the internal capital market. But comparing the value the coefficient β_i related to the degree of internal capital market efficiency with the coefficient related to the past abnormal return, we notice as expected that the latter indicator has a much higher contribution than the former. We affirm therefore that the relationship between diversification and performance is more sophisticated than simply efficiently managing the capital budgeting process within diversified firms, allocating funds to best performing business segments. However, we do not confirm the main assumption in strategic management. We find that business relatedness is negatively related with firm performance. This evidence is also confirmed by the combination of the negative sign of the coefficient of the independent variable NBSEG (number of business segments of the firm) with the positive sign of the coefficients related the number of subsectors and number of industry (NBSEG AND NBIND defined by the 3- and 4-digit NAICS codes, respectively). This combination effectively captures the business portfolio of a “highly related” diversified firm: a highly related diversified firm has a “high” number of segments (NBSEG high) but a low number of subsectors and industry defined at 3 or 4 NAICS digits code. From our results this combination is negatively related with the firm’s abnormal return. To strengthen our conclusions we reiterate that, according the new segment reporting standard SFAS 131 of June 1997, firms need to report disaggregated information by line of business unless they organize themselves that way for the purposes of performance evaluation. It induces companies to more fully reveal their diversification and funds transfer strategies, hence reflecting any underlying agency problem (Berger and Hann, 2003). Finally, this result is also confirmed when we regressed the upper and lower quintile of diversified firms to the SMB factors of Fama and French’s three factor model.

Campa and Kedia (2002) and Villalonga (2004a), argue that the “diversification discount” is mainly driven by endogeneity in which poorly performing firms choose a related diversification strategy as a safe way to move away from a declining industry, hence they still perform poorly. This would certainly help to explain the negative relationship between related diversification and firm performance. This is why we interpret our result as a testament of correlation and not causation. Following this line of thought we can explain the positive relationship between unrelated diversification and firm performance.

Section VI: conclusion and future research

We study the relationship between diversification and firm performance according to the main empirical findings in strategy and finance but controlling for the persistence of abnormal returns. We conclude that this relationship is not causal but attributable to factors other than the degree of relatedness among business units and the degree of internal capital market efficiency, which have a statistically significant contribution but a marginal explanatory power to explain the persistence of positive or negative abnormal return. The persistence of abnormal returns has a grater explanatory power: some diversified firms (top quintile) consistently create shareholder value, beat the market index and have lower market volatility, while the opposite holds true for the bottom quintile of diversified firms.

We confirm that top performers efficiently manage their internal capital markets but we find a negative relationship between diversification and performance: related diversified firms are associated with lower performance.

Our results clearly confirm that the positive relationship between diversification and performance goes far beyond the simple explanation of an efficient internal capital market or a certain degree of relatedness among business segments. Our results suggest that, in order to study the relationship between diversification and performance, more complete models including firm's strategies and management skills, for example, should be also taken into consideration.

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