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Firm Diversification and Performance: An Empirical Examination*

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Abstract

This paper examines several dimensions of the relationship between diversification and performance. Specifically, we investigate the link between related and unrelated diversification and performance. We also study the effect of the potential redeployment of 'plastic' assets on unrelated diversification. To investigate this, we estimated a dynamic panel on a data set of 2,396 diversified firms from the euro area, over the 2010-2017 sampling period. Empirical results indicate that an increase in the level of unrelated diversification, is significantly associated with an 0.65 percent improvement in performance, and related diversification with an 0.98 percent increase in performance. Additionally, we found that the level of unrelated diversification is positively and significantly impacted, 1.32 percent, by changes in the level of asset plasticity. Overall, our findings contribute to the corporate diversification literature by documenting that both, related and unrelated diversification, impact positively performance. Moreover, providing evidence consistent with the intuition that asset plasticity may be a positive factor for unrelated diversification strategies.

Keywords: firm performance; total/unrelated/related diversification; entropy measure of diversification; asset plasticity; multidivisional firm

JEL classification: C33; L22; L25; M10

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1. Introduction

Pioneering contribution by Ronald Coase (1937), related firm boundaries to resource allocative efficiency, as a result of a dynamic balance between the costs of market and hierarchical coordination. Additionally, Maksimovic and Phillips (2007, 425) argue that the problem of setting firm boundaries is embedded in «the relation between diversification and value».[1]

As argued in transaction cost economics, the organizational forms of economic activity are a continuum of production coordination technologies, spanning between markets and hierarchies (e.g., Gertner and Scharfstein 2013; Milgrom and Roberts 1992). Under this framework, firms emerge as a trade-off between the costs of using the price system and the costs of using a hierarchical management system (e.g., Demsetz 1997).

There is widespread agreement that economic activity carried out within the boundaries of firms is quantitatively more significant, in terms of transactions, value added, and employment, than the ones conducted through markets (Walker 2017; Gertner and Scharfstein 2013; Lafontaine and Slade 2007).[2]

The examination of diversified firms' behavior, and of the ICMs through which resources are allocated, has received a great deal of attention from economists (e.g., Glaser et al. 2013; Maksimovic and Phillips 2013; Agarwal et al. 2011). However, even today, and despite the theoretical arguments and the empirical findings on the allocative efficiency of diversified versus single-segment firms, the topic still remains a theoretical and empirical challenge for the economic analysis of business organizations.[3]

There is also abundant evidence documenting the importance of diversified firms and ICMs, through which they operate as an organizational platform to perform their productive activities. For example: (i) «diversified firms comprise 75% on average of the market value

[1] For comprehensive discussions on a firm's boundaries please refer to, e.g., Hart and Holmström (2010), Mullainathan and Scharfstein (2001), Demsetz (1997), and Williamson (1975), and references cited therein.

[2] According to Leland (2007, 765) «[p]ositive or negative operational synergies are often cited as a prime motivation for decisions that change the scope of the firm. A rich literature addresses the roles of economies of scope and scale, market power, incomplete contracting, property rights, and agency costs in determining the optimal boundaries of the firm».

[3] Hereafter we use, interchangeably, diversified firm, multidivisional firm, conglomerates and business group, as an organizational structure coordinating a set of diversified and legally independent firms.

of the S&P 500» (Hund et al. 2012, 1); (ii) «business groups are ubiquitous in many countries» (Carney et al. 2011, 437); (iii) «chaebols are large business conglomerates in South Korea. Since the 1960s, they have played a major role in developing the Korean economy» (Lee et al. 2009, 327); (iv) «conglomerate firm production represents more than 50 percent of production in the United States» (Maksimovic and Philips 2007, 424); (v) «[t]here is ample evidence that large corporations operate an internal capital market» (Inderst and Laux 2005, 215); (vi) «[a] striking feature of most emerging economies is the prominent role played by business groups» (Khanna and Rivkin 2001, 45); (vii) «[d]diversified business groups dominate private sector activity in most emerging markets around the world» (Khanna and Palepu 2000, 867); and (viii) «[i]n Belgium, as in many other European countries, financial and industrial groupings and combines play a crucial role in the accumulation and allocation of capital in the economy» (Deloof 1998, 945).[4]

Despite diversified firms being a ubiquitous form of economic organization in the contemporary corporate world, «there is surprisingly little direct evidence on the efficiency of their capital allocation» (Almeida et al. 2015, 2539). Therefore, additional research may be necessary to enhance the explanatory relevance of extant theoretical predictions, and to improve the generalization power of empirical findings.

Does firm diversification matter? Or, as questioned by Maksimovic and Phillips (2007, 425), «[…] does corporate diversification affect firm value?». The answer to these important questions seems to be intimately linked to where firm boundaries are actually set, and therefore, to the efficiency of the type and extent of the diversification behavior (e.g., Williamson 1975).[5]

A plethora of theoretical and empirically based arguments indicate that diversification may have ambivalent effects on value (e.g., Campa and Kedia 2002; Berger and Ofek 1995).

[4] For further recent research on the relevance of diversified firms in the business organization world see, e.g., Buchuk et al. (2014), Belenzon et al. (2013), Gugler et al. (2013), Faccio and Lang (2002).

[5] As suggested by Maksimovic and Phillips (2007, 425), «for corporate diversification to be of interest, it must be that the cost of carrying out transactions within the firm are affected if it contains more than one industry within its boundaries».

The economic performance of diversified firms with active ICMs, is related to the allocative efficiency of their investment and financing behavior (e.g., Gonenc et al. 2007).[6] Furthermore, as suggested by Williamson (1975), «"internal capital markets" in diversified firms can allocate capital more efficiently than external capital markets can, and that they can reduce wasteful investment at lower cost» (Liebeskind 2000, 58).

Therefore, furthering our understanding on the impact of diversification on the economic performance of business organizations has great practical relevance and is assumed as the generic research question for the paper.

This paper examines the relationship between firms' overall, unrelated and related diversification levels and accounting- and market-based performance measures, using a panel data set of 2,396 euro area firms, over the 2010-2017 sampling period, in a total of 19,168 testable firm-years. We also examine the redeployment of 'plastic' assets across different business units may increase change in firms' unrelated diversification levels.

This paper contributes to the literature and distinguishes from prior research in different ways. Firstly, unlike mainstream literature, predominantly focused on U.S. and Asian firms, findings, investigating the diversification - performance relationship using a sample of euro area diversified firms, therefore enhance the generalization power of the empirical regularities (e.g., Villalonga 2004a; Chakrabarti et al. 2007; Ferris et al. 2003). By examining the impact of euro area diversified business organizations on their economic performance, we aim to contribute to mitigating the problems associated with differences in economic, financial, legal and institutional features typically associated with multi-country research, and to enhancing the generalization power of the inferences drawn from empirical findings.

Secondly, by examining a sample composed of 90,1 percent of unlisted and 9,9 percent of listed firms, statistically larger than unlisted ones, we contribute to mitigate the size bias normally associated with this mainstream literature.

[6] According to Thakor (1993, 135), in an «idyllic setting», it is irrelevant whether allocative decisions are made: «in a centralized or decentralized capital budgeting environment [regardless of] whether the project is included as part of the firm's portfolio of assets or organized *outside* the firm, i.e., incorporated as a subsidiary with a legal delineation from the firm's existing assets [and] how the project is financed».

Thirdly, by analyzing the somewhat neglected relationship between asset plasticity and diversification, aiming at contributing to mitigating the misspecification problem associated with the omission of a potentially relevant independent variable from the empirical model.

The paper's main findings document that: (i) sampled diversified firms exhibit a positive and statistically significant relationship between the levels of overall, unrelated and related diversification and performance, which is consistent with prior research investigating U.S. and Asian listed firms (e.g., Giachetti 2012; Wan and Hoskisson 2003; Bettis 1981); (ii) a positive relation between overall, unrelated and related diversification and a market-based performance measure; and (iii) firms' asset plasticity levels exhibit a positive effect on the changes in the unrelated diversification levels, evidence that is consistent with prior research (e.g., Kim and Kung 2017; Shleifer and Vishny 1992; Williamson 1988).

The remainder of the paper is structured as follows: Section 2 discusses the relevant theoretical and empirical literature and formulates the hypotheses. Section 3 describes the data and the empirical implementation. Section 4 presents and analyzes univariate statistics and the results of econometric estimations. Section 5 documents robustness check results. Section 6 summarizes and provides concluding remarks.

2. Background and Hypotheses

2.1. Introduction

Beginning in the early 1920s, the U.S. witnessed the establishment of diversified business organizations – the 'M-Form' – pioneered by the DuPont Company and General Motors (Williamson 1975). Since then, this phenomenon has gained momentum, and diversified firms have gathered a geographically widespread significant economic role (e.g., Montgomery 1994).

A crucial question when studying diversification is naturally, why do firms diversify? According to extant literature, firms diversify in order to improve the economic performance of the resources they have under control (e.g., Giachetti 2012; Chatterjee and Wernerfelt 1991; Ramanujam and Varadarajan 1989). A distinct but related question asks

what are the reasons that may lead firms to become involved in diversifying their productive activities? The answer to this question has attracted the interest and has nurtured an ongoing debate among academics and practitioners alike.

Prior research has enlightened various arguments rationalizing firm diversification. A number of them anchored on the seminal contributions of Coase (1937) and Williamson (1975), on resource allocative efficiency in general, and on the diversified firm (M-form) in particular (see also Liebeskind 2000).[7] On this theoretical perspective, diversification is beneficial whenever the costs of carrying out transactions under an organizational arrangement of a group of coordinated 'hierarchies', is lower than carrying them out in a set of independent 'hierarchies'. Therefore, diversification may be a source of value creation (e.g., Rumelt 1974; Chandler 1962).[8]

However, and despite the accumulated research, still remains an empirical question whether resource usage is more efficient within a diversified organization, or through a set of contracts with independent firms.

Nonetheless, the theoretical and empirically based arguments suggesting that diversification may affect value ambivalently (e.g., Campa and Kedia 2002), findings from prior research document that firms involved in either diversification or refocusing strategies exhibit improvements in economic performance (e.g., Steiner 1997; Hansen and Wernerfelt 1989; Lecraw 1984).[9]

The most ubiquitous diversification strategies observed in the real corporate world include: (i) related versus unrelated diversification (e.g., La Rocca et al. 2018; Markides and Williamson 1994; Chatterjee and Wernerfelt 1991; Bettis 1981); (ii) domestic versus international diversification (e.g., Borda et al. 2017; Gaur and Kumar 2009; Freund et al. 2007; Thomas 2006; Lu and Beamish 2004; Capar and Kotabe 2003; Denis et al. 2002; Hitt et al. 1997; Riahi-Belkaoui 1996; Tallman and Li 1996; Kim et al. 1993); (iii)

[7] According to Coase (1937) and Williamson (1975), economies of scope in resources and capabilities can be reached by: (i) selling or licensing them to another firm; (ii) reallocating those resources, depending on their 'plasticity', to another activity (see also, Wade and Gravill 2003).

[8] According to Maksimovic and Phillips (2007, 425) «the relation between diversification and value arise naturally from the larger problem of determining how the boundaries of firms should be set».

[9] We use, interchangeably, refocusing, reverse diversification or downscoping.

diversification versus refocusing (e.g., Ferris et al. 2002; Matsusaka and Nanda 2002; Markides 1995; Hoskisson and Hitt 1994); and (iv) organic versus external diversification (e.g., Custódio 2014; Leland 2007; Goudie and Meeks 1982; Amihud and Lev 1981; Mueller 1977).[10, 11]

2.2. Firm Diversification and Performance

2.2.1. Determinants of Diversification

What are the main determinants of firm diversification behavior? Prior research has identified market structure and firm conduct, as major determinants of firms' diversification behavior, and ultimately of their economic performance implications (e.g., Scherer and Ross 1990; Greening 1980; Porter 1980; Bain 1959).

In this perspective, the competitive positioning of a firm is contingent upon the structure of the industry it integrates and on its own conduct, both yielding a random level of performance. As argued by Schumpeter (1942), a firm's competitors strive to erode its competitive advantage, creating the incentive for the firm to adopt innovative strategic and operating behavior, 'the conduct', aiming at sustaining or enhancing its economic performance, and therefore softening the adverse 'creative destruction' effects of the «Schumpeterian world of innovation-based competition, price/performance rivalry, [and] increasing returns» (Teece et al. 1997, 509).

The performance outcome of a firm's conduct in creative destruction competition world, may either have a 'bright side' or a 'dark side'. The former, resulting in sustaining or enhancing its competitive positioning, and therefore economic performance. The latter, unable to sustain its competitiveness, will underperform in terms of shareholder value creation. Therefore, and under the assumption that economic performance and share price

[10] In a related diversification strategy, a firm expands its activity to closely related industries, e.g., that share technological or commercial similarities. When a firm expands by adding new products or services, technologically or commercially unrelated to its current portfolio of business activities, it is adopting an unrelated diversification strategy. Firm's activities may be spread out across international borders when adopting an international diversification strategy. Related and unrelated diversification strategies may be implemented through internal / organic growth within the organization, using internal resources to develop new business areas, or acquiring growth externally, for example, through merger and acquisitions.

[11] For a more in-depth analysis of this topic, please refer to, among others, Erdorf et al. (2013), Martin and Sayrak (2003), Datta et al. (1991), and references cited therein.

are strongly and positively correlated, a firm could become an attractive proposition for 'firm value arbitrageurs', present in the market for corporate control (e.g., Manne 1965).[12]

The degree of competition in an industry depends on its underlying structure, represented by what Porter (1989, 1979) specified as the 'competitive forces', the collective interaction of which determines the potential economic performance of the industry.[13] A firm's exposure to those forces, influences its conduct in response to the industry structure (e.g., Porter 1981; Berry 1974).[14]

A firm's conduct is simultaneously impacted by exogeneous factors, the industry structure, and endogenous factors, the base of available organizational resources and capabilities. In this framework, the firm's performance depends on specific characteristics, namely, scarcity and imperfect mobility, of its resources and distinctive capabilities (e.g., Teece 1984; Wernerfelt 1984; Penrose 1959). Firms use those capabilities, competencies and other assets to accommodate the dynamics of rapidly changing environments (Teece *at al.* 1997), and by developing innovative and difficult-to-replicate combinations of organizational, functional and technological skills as sources of competitive advantage.[15, 16]

Diversification is a commonly used strategy for firms redeploying their assets in place or their growth assets (assets that the firm is expected to invest in the future), to their best usages. This asset reallocation, however, is contingent, among other factors, on the assets' level of 'plasticity'.[17] Alchian and Woodward (1988, 69) «call resources or investment "plastic" to indicate that there is a wide range of discretionary, legitimate decisions within which the user may choose». Therefore, the higher the degree of asset

[12] We are assuming the presence of semi-strong informationally efficient markets (Fama 1970).
[13] Threat of new entrants in the industry; Bargaining power of buyers; Bargaining power of suppliers; Threat of substitute products and services; and rivalry among market participants.
[14] Without loss of generality, henceforth, we will use 'market structure' and 'industry structure' interchangeably.
[15] According to Wang and Ahmed (2007), a firm's dynamic capabilities include factors such as adaptive capability, absorptive capability and innovative capability as well as firm-specific processes such as integration, reconfiguration, renewal, and recreation.
[16] Even though a firm does not possess a competitive advantage based on scarcity and imperfect mobility of its resources, it may still create value through 'sharing' resources and capabilities across different businesses. Sharing a common tangible or intangible resource, e.g., a single facility or brand, among several businesses, using a hierarchical governance, may confer economies of scope through the elimination of duplications and lowering marginal costs. For more details on dynamic capabilities, see also, Teece et al. (1997).
[17] See also Gossy (2008), Alchian and Woodward (1987), Franke (1987), Scott (1987), and Marschak (1938).

plasticity or redeployability, the larger the opportunity set for reallocating those resources to other business opportunities with higher growth prospects and / or lower expected business risk (e.g., Kim and Kung 2017; Montgomery 1994; Shleifer and Vishny 1992; Williamson 1988).

2.2.2. Determinants of Economic Performance

Value creation is a widely accepted metric for a firm's economic performance, the main determinants of which are market structure characteristics, industry affiliation, and organizational factors (e.g., Otley 1999; Stimpert and Duhaime 1997; Hansen and Wernerfelt 1989; Schmalensee 1985; Scherer 1980; Bain 1956).

Under this framework, the operating cash flow streams and the cost of capital are the key drivers of value creation associated with diversification strategies (e.g., Grant 2016; Morin and Jarrell 2000).

2.2.3. Diversification and Performance

Although it is an extensively researched topic, the literature still does not provide unambiguous, convincing and widely accepted evidence about the nature, the signal and the magnitude of the relationship between diversification and performance (e.g., La Rocca et al. 2018; Singh et al. 2007; Villalonga 2004a, 2004b; Campa and Kedia 2002; Palich et al. 2000; Berger and Ofek 1995; Lang and Stulz 1994).[18]

A stream of the literature, popularized as the 'bright side' of diversification, argues that diversification is positively related to performance, therefore promoting diversification allocative efficiency (e.g., Almeida and Wolfenzon 2006; Khanna and Tice 2001; Sapienza 2001). This proposition is anchored in the following arguments: (i) a portfolio of business units, a conglomerate, that generates imperfectly correlated operating cash flows across its members, will exhibit a lower overall business risk, than a single firm operating a comparable set of productive activities, the so-called coinsurance effect (e.g., Jia et al. 2013; Maksimovic and Phillips 2013; Tong 2012; Kim and McConnell 1977; Lewellen 1971); (ii) sharing resources and capabilities across business units, and benefiting from expanded business portfolio diversification gains, market power gains and bankruptcy risk

[18] For further findings see Villalonga (2003) and Graham et al. (2002) and references therein.

reduction, may generate operating and financial synergies (e.g., Gatzer et al. 2014; Hann et al. 2013; Fang et al. 2007; Leland 2007; Gomes and Livdan 2004; Liebeskind 2000; Montgomery 1985; Teece 1980; Kim and McConnell 1977; Williamson 1975; Lewellen 1971); (iii) increased monitoring incentives, greater availability and better information quality associated to headquarters exercising control rights (Khanna and Tice 2001; Scharfstein and Stein 2000; Lamont 1997; Stein 1997; Berger and Ofek 1995; Gertner et al. 1994; Hart and Moore 1990; Williamson 1985; Alchian 1969); (iv) the managerial headquarters' active winner-picking behavior (Stein 1997; Gertner et al. 1994; Williamson 1975); (v) effectiveness and efficiency in reallocating capital (e.g., Cline et al. 2014; Maksimovic and Phillips 2002; Matsusaka and Nanda 2002; Khanna and Tice 2001); (vi) the positive value-enhancing role that internal funding plays in adverse states of external capital markets (Santioni et al. 2017; Stein 1997; Williamson 1975); and (vii) 'softeners' of the financial constraints inherent to external capital markets (Maksimovic and Phillips 2007; Graham et al. 2002; Lee and Lee 2002; Erickson and Whited 2000; Lewellen 1971).

Empirical findings of another stream of research are consistent with the argument that the value of diversified firms may be discounted by the market, in relation to their fair value as a portfolio of comparable specialized firms (e.g., Anjos 2010; Servaes 1996; Berger and Ofek 1995; Lang and Stulz 1994). Potential failures of ICMs' financing and investment policies are often interpreted as the source of a 'conglomerate discount'.[19]

This stream of research espouses the diversification inefficient viewpoint, popularized as the 'dark side' of diversification, (e.g., Ozbas and Scharfstein 2010; Scharfstein and Stein 2000; Rajan et al. 2000).[20] This branch of literature suggests: (i) conflicts of interest, informational and incentive problems in the subsidiary's and headquarters' managerial agency relationships, that may lead to allocative inefficiency, for example, cross-subsidizing unprofitable projects (Cline et al. 2014; Ozbas and Scharfstein 2010; Wulf 2009; Yan 2006; Scharfstein and Stein 2000; Rajan et al. 2000; Lins and

[19] The literature documents a significant diversification discount of 10 percent in Japan, 15 percent in the UK, and no significant diversification discount in Germany. According to Lins and Servaes (1999), the diversification discount seems robust to different sampling periods and firms' geographical origin.

[20] For a more in-depth analysis of this topic, see, e.g., Maksimovic and Phillips (2013), Martin and Sayrak (2003), Stein (2003), and Gertner et al. (1994).

Servaes 1999; Rajan and Zingales 1998; Shin and Stulz 1998; Bodnar et al. 1997; Lamont 1997; Berger and Ofek 1995; Meyer et al. 1992; Jensen 1986); (ii) suboptimal capital allocation of diversified versus comparable single-industry firms (e.g., Billett and Mauer 2003, 2000; Shin and Stulz 1998; Berger and Ofek 1995); and (iii) corporate governance problems associated to centralized capital budgeting systems (e.g., Sautner and Villalonga 2010); and (iv) subsidiary managers may become involved in rent-seeking behavior, bargaining for larger suboptimal capital allocations for their units (Seru 2014; Glaser et al. 2013; Wulf 2009; Rajan et al. 2000; Scharfstein and Stein 2000; Meyer et al. 1992).

More recent research casts doubt on the diversification discount, based on evidence suggesting the presence of a 'diversification premium'. Furthermore, this stream of the literature suggests that previous findings may suffer from sample-selection bias (e.g., Hund et al. 2019; Villalonga 2004a, 2004b; and Graham et al. 2002), and measurement errors (e.g., Whited 2001). Moreover, as argued in Campa and Kedia (2002, 1731), the «documented discount on diversified firms is not per se evidence that diversification destroys value».[21]

Another line of research, documents that reverse diversification may be value-enhancing (e.g., Dittmar and Shivdasani 2003; Gertner et al. 2002; Berger and Ofek 1999; Markides 1995, 1992; and Hoskisson and Johnson 1992).

Firm diversification, and its implications in terms of value creation, may be 'reflected' in profitability (e.g., Palich et al. 2000; Rumelt 1974). Prior research documents that the levels of related and unrelated diversification are associated with different levels of firm profitability. According to, e.g., Wernerfelt and Montgomery (1988), Varadarajan and Ramanujam (1987), Palepu (1985), Rumelt (1974), related diversification should be more profitable than unrelated diversification. Bettis and Hall (1982) and Christensen and Montgomery (1981) argue that the differences in profitability between Rumelt's diversification categories could be mainly attributed to industry effects. The geographical scope of diversification may also have an impact on the relationship between

[21] Çolak (2010, 423) finds «no evidence of 'diversification discount' or 'refocusing premium'».

diversification and performance (e.g., Denis et al. 2002; Hitt et al. 1997; Tallman and Li 1996; Kim et al. 1993).

However, empirical findings on the relationship between the level of diversification and performance seems to be sensitive to choices concerning performance measures, sample choice, sampling period, variable specification, method of analysis, firms' characteristics, industry affiliation, and the effectiveness and efficiency of allocative features of, e.g., the financial and legal systems (e.g., Ahn 2011; Çolak 2010; Fauver et al. 2003).

Findings of non-U.S. firm samples, mostly Asian (e.g., Bae et al. 2011; Wade and Gravill 2003), and European (e.g., La Rocca et al. 2018; Luffman and Reed 1984), also suggest the presence of some kind of ambivalence.

2.2.4. Diversification and Performance Measures

In this study, we only focus on quantitative measures of diversification. The number of business activities in which a firm operates, is one of the most used quantitative diversification measures (e.g., Farjoun 1998; Montgomery 1982). However, due to the lack of information provided by this measure, other metrics are suggested in the literature, among them: (i) the product specialization ration (e.g., Rumelt 1974); (ii) the Herfindahl index (e.g., Hitt et al. 2006; Kor and Leblebici 2005; Denis et al. 2002; Lang and Stulz 1994; Grant et al. 1988; Utton 1977; Berry 1971); (iii) the concentric index (e.g., Wernerfelt and Montgomery 1988; Caves et al. 1980; Pomfret and Shapiro 1980); and (iv) the entropy index (e.g., La Rocca et al. 2018; Chakrabarti et al. 2007; Singh et al. 2007; Hitt et al. 1997; Markides 1995; Chatterjee and Wernerfelt 1991; Varadarajan and Ramanujam 1987; Palepu 1985; Jacquemin and Berry 1979).

Extant literature that focuses on an empirical examination of a firm's performance documents that the metrics of performance mostly used in prior research are, either market-based, or accounting-based. The former category encompasses the stock market reaction to the announcement of diversifying events; and the latter, includes profitability and associated risk measures, such as, the return on assets (ROA), the return on equity (ROE), and the return on sales (ROS).

2.3. Hypothesis Development

As argued by Williamson (1975), diversified firms may exhibit a better performance than undiversified firms, due to potential operating and financial synergies (e.g., Gatzer et al. 2014; Hann et al. 2013; Leland 2007; Gomes and Livdan 2004; Teece 1980; Kim and McConnell 1977; Lewellen 1971).

Findings using accounting-based performance measures, spanning a wide range of sampling periods, suggest the presence of a positive relationship between diversification and performance (e.g., George and Kabir 2012; Khanna and Rivkin 2001; Pandya and Rao 1998; Grant and Jammine 1988; Grant et al. 1988; Carter 1977). This pattern of findings seems more ubiquitous in tests of non-U.S. firm-level samples.

However, as argued in, e.g., Scharfstein and Stein (2000), Denis et al. (1997), and Jensen (1986), the presence of free cash-flow in diversified firms, may yield negative impacts on the level of their economic performance because of agency problems associated with managerial discretion. Empirical evidence, gathered through market-based performance metrics, spanning a wide range of sampling periods, documents a negative relationship between diversification levels and performance (e.g., Singh et al. 2007; Ferris et al. 2003; Lang and Stulz 1994; Montgomery and Wernerfelt 1988). This pattern of findings seems more ubiquitous in tests of U.S. firm-level samples.

Under the standard assumption that firms diversify with the aim of improving their overall economic performance (e.g., Giachetti 2012; Chatterjee and Wernerfelt 1991; Ramanujam and Varadarajan 1989; Teece 1984; Penrose 1959), and following the branch of literature that documents that the benefits of diversification outweigh the costs, (e.g., George and Kabir 2012; Khanna and Rivkin 2001; Grant et al. 1988), we hypothesize a positive relationship between diversification and performance levels − Hypothesis 1 (H1).

Conventional wisdom suggests that firms may undertake diversification strategies aiming at improving their performance in terms of value creation, by exercising diversification options, e.g., on assets-in-place or growth-opportunities. For example, by enlarging their boundaries into other related or unrelated products and/or markets, capturing operating and financial synergies, benefiting from market power, and / or reaping economies of scale (e.g., Hann et al. 2013; Devos et al. 2008; Leland 2007; Gomes and

Livdan 2004; Sapienza 2002; Liebeskind 2000; Kim and Singal 1993; Teece 1980; Kim and McConnell 1977; Williamson 1975; Lewellen 1971).

More recent research suggests that growth-opportunity diversification options may be helpful in explaining the diversification-performance relationship (e.g., de Andrés et al. 2017, 2016, 2014; Borghesi et al. 2007).

La Rocca et al. (2009), Menéndez-Alonso (2003), and Bergh (1997), among others, argue that the coinsurance effect is expected to be more intense in unrelated diversified firms (see also Chatterjee and Wernerfelt 1991).

Prior research, based on accounting-based performance measures, reports that related diversified firms exhibit higher levels of performance than unrelated diversified firms (e.g., Wade and Gravill 2003; Palich et al. 2000; Wernerfelt and Montgomery 1988; Varadarajan and Ramanujam 1987; Palepu 1985; Lecraw 1984; Bettis 1981). Another stream of this literature documents that unrelated diversified firms perform better compared to related diversified firms (e.g., La Rocca et al. 2018; Bae et al. 2011; Hoskisson 1987; Luffman and Reed 1984; Michel and Shaked 1984).

Since related diversification appears to be more associated with positive operating synergies, and unrelated diversification more associated with positive financial synergies, we hypothesize a positive relationship between diversification, both unrelated and related, and firm performance (e.g., Leland 2007; Gomes and Livdan 2004; Teece 1980; Lewellen 1971) − Hypothesis 2 (H2).

Diversification strategies may, arguably, improve the performance of portfolios of firm-specific organizational, functional and technological resources and capabilities. Additionally, redeploying firms' assets may be helpful in allocating them to their most efficient usages (e.g., Teece at al. 1997).

However, asset reallocation is contingent on their degree of 'plasticity' (e.g., Kim and Kung 2017; Montgomery 1994; Alchian and Woodward 1988; Williamson 1988). We expect that, the higher the degree of asset plasticity, the larger the set of opportunities for reallocating those resources to other business opportunities with higher value creation prospects. To test the theory that reallocating 'plastic' assets across different business units increases the unrelated level of diversification, we hypothesize a positive relationship

between the degree of asset plasticity and the unrelated level of diversification − Hypothesis 3 (H3).

3. Data Description and Empirical Specification

3.1. Sample Selection and Data Description

For this empirical investigation, we developed a sample of diversified firms from euro area countries drawn from Bureau van Dijk's Amadeus database, for the 2010-2017 sampling period.

In this essay, we espouse the concept of a business group, as an entity coordinating a set of diversified and legally independent firms with a network of business and financial relationships of varying degrees and kinds (e.g. Khanna and Rivkin 2001).[22]

Amadeus database contains financial data of European diversified firms and their European subsidiaries. It also includes ownership data on subsidiaries outside European countries, but not their financial statement data. Therefore, our sample consists of data of euro area diversified firms and their euro area subsidiaries only.

To be included in the sample, firms had to satisfy the following criteria: (i) to be a non-financial Global Ultimate Owner (GUO), and other diversified firms that although they were not a GUO, hold, directly and / or indirectly, a minimum 50.01 percent ownership in any subsidiary, and own two or more subsidiaries;[23] (ii) to be established in the euro area; (iii) to be active for the entire sampling period, with at least 6 to 8 years of data for all the variables, to ensure a balanced panel;[24] and (iv) to have annual sales revenue higher than 20

[22] Like other papers with a similar focus and that used the Amadeus database, subsidiaries' data do not include segment data reported on 'behalf' of the 'parent' firm. Most papers on diversified firms use firm segment data (U.S. conglomerate information) that may introduce measurement errors in variables. See, e.g., Whited (2001) for more details.

[23] This classification criterion is based on a strong concept of ownership, which enables us to observe situations in which the parent firm has enough authority to control the investment and financing choices of its subsidiaries.

[24] Similar studies included in their samples only firms that had data available for the whole period or for at least six consecutive years (e.g., Dewaelheyns and Van Hulle 2012; La Rocca et al. 2009).

million Euros.[25] All financial service firms, education and regulated utilities were excluded from the sample.

Using the abovementioned selection criteria, we build our sample of diversified firms including 2,396 parent firms with 19,168 firm-year observations. In our sample, the average number of subsidiaries per diversified firm is 5, and the max is 139.[26]

The specification of the firm-specific variables is presented in subsection 3.2. In order to mitigate the potential influence of extreme observations, data were winsorized according to the following criterion: whenever both market-to-book ratio and Tobin's *q* were greater than 15 the firm was dropped from the sample (e.g., George et al. 2011; Cleary 1999).

3.2. Implementation Design and Testing

This subsection describes the specification of the empirical model, the variables and the methodology applied in hypotheses testing.

To test the effect of the firm diversification level on firm performance (H1), we estimated the following regression model:

$$Performance_{it} = \beta_1 Performance_{it-1} + \beta_2 LD_{it} + \beta_3 FinLev_{it} + \beta_4 Size_{it} + \beta_5 Tang_{it} + \\ + \beta_6 MtoB_{it} + \varepsilon_{it} \quad (1)$$

where $Performance_{it}$ denotes firm performance; LD_{it}, firm diversification level; $FinLev_{it}$, financial leverage; $Size_{it}$, firm size; $Tang_{it}$, firm tangibility; $MtoB_{it}$, growth opportunities; industry and time dummy variables; subscripts refer to firm *i* at time *t*; and, ε_{it} is a disturbance term (e.g., George and Kabir 2012; Khanna and Palepu 2000). See table 1 for variables specification, and expected and estimated variable coefficient signs.[27]

[Insert Table 1 here]

[25] We exclude very small firms from our estimation sample, whose ownership and financial data may miss and may cause bias.

[26] Compared with previous studies, our sample, in general, focuses on an increased number of business groups, and is also based on a longer period (e.g., La Rocca et al. 2018; George and Kabir 2012; Kim et al. 2004; Khanna and Palepu 2000; Chatterjee and Wernerfelt 1991; Grant et al. 1988; Varadarajan and Ramanujam 1987; Montgomery 1985; Palepu 1985; Lecraw 1984).

[27] Since larger firms can take more advantage from, e.g., economies of scale and, *ceteris paribus*, be more profitable, size and tangibility of a firm may have a positive impact on a firm's performance level. Due to the trade-off between tax shields and bankruptcy costs, leverage may have a negative relationship with accounting measures of performance and a positive relationship with market measures (see, e.g., George and Kabir 2012; Khanna and Palepu 2000).

Despite the context and the methodological implementation, a firm performance variable proxied through an accounting-based measure should be anchored in a risk-return framework. Therefore, for this study we adopted adjusted asset betas, for a firm's specific financial leverage, as the accounting-based risk measure, scaling all regressed variables by this risk measure:[28] we estimated the systematic risk of a firm's assets, the asset beta (β_A), as a measure of the operating cash-flow relative volatility generated in a business activity and represented by the coefficient of variation of operating cash flow (e.g., Kale et al. 1991; Gabriel and Baker 1980; and Beaver and Manegold 1975).

Underlying this procedure is the assumption that firms in the same industry tend to exhibit similar business risk levels (e.g., He and Kryzanowski 2007; Kaplan and Peterson 1998; Alexander et al. 1996). Accordingly, firms in our sample were grouped into industry categories according to their NACE code, and for each industry an asset beta was estimated as the weighted (by total net assets) average of the individual firm's business risk.

Asset betas were then adjusted for a firm's specific financial leverage, using Hamada's (1972) procedure:

$$\beta_E = \beta_A \left(1 + (1-t)\left(\frac{D}{E}\right)\right) \qquad (2)$$

where β_A denotes the asset beta, the β_E the equity beta, D the market value of debt, E the market value of equity and t the marginal corporate tax rate on the firm's income, specified as the income tax expenses divided by income before tax.. Hamada's approach simply adjusts the asset beta (business risk) for the firm's after tax financial risk measured by its debt-equity ratio.

The explanatory variable total diversification level for firm i, LD, measures a firm's diversification levels using the 'entropy diversification index', firstly proposed by

[28] This transformation also allows the cross-section heterogeneity to be mitigated, like the transformation commonly applied in the literature of dividing all the measures included in a regression by the same firm measure, e.g., its total net assets.

Jacquemin and Berry (1979), to analyze the relationship between corporate diversification and growth, (see also, e.g., Palepu 1985).[29]

The entropy index as a measure of a firm's diversification level, simultaneously considers the number of subsidiaries in which a diversified firm operates, the distribution of a firm's total sales across industry subsidiaries, and the identification of the degree of relatedness among the various subsidiaries. According to, e.g., La Rocca et al. (2018, 65), the entropy index allows «the objectivity of the product-count measures to be combined with the ability to apply the relatedness concept categorically, weighting the businesses by the relative size of their sales» (see also Palepu 1985). This measure provides three diversification indices for each firm: (i) the total diversification index; (ii) the related diversification index; and (iii) the unrelated diversification index.

Following Palepu (1985), we estimated the total entropy diversification index (*LD*), as:

$$LD = \sum_{i=1}^{N} P_i \times \ln\left(1/P_i\right) \tag{3}$$

where *P* refers to the share of the i^{th} subsidiary in the total sales of the diversified firm.[30]

As hypothesized, we expect a positive relationship between, both unrelated and related diversification levels, and firm performance (H2). To test this hypothesis, we estimated the following version of model 1:

$$Performance_{it} = \beta_1 Performance_{it-1} + \beta_2 RD_{it} + \beta_3 UD_{it} + \beta_4 FinLev_{it} + \beta_5 Size_{it} + \beta_6 Tang_{it} + \\ + \beta_7 MtoB_{it} + \varepsilon_{it} \tag{4}$$

where RD_{it} denotes the related diversification index, estimated from subsidiaries in different 3- or 4-digit businesses within a 2-digit industry group; and UD_{it} the unrelated diversification index estimated from subsidiaries in different 2-digit industry groups (e.g., Palepu 1985; and Jacquemin and Berry 1979).

[29] As argued by Pomfret and Shapiro (1980, 145), «[o]ther measures of diversification could be calculated, but the reward is small because the measures tend to be correlated».

[30] For more details on the entropy measure see Palepu (1985) and Jacquemin and Berry (1979).

To test the argument that a higher degree of asset plasticity may increase the set of opportunities for reallocating those resources to other business opportunities with higher value creation prospects, and increasing the level of unrelated diversification (H3), we estimate the following regression model (e.g., Shyu and Chen 2009):

$$\Delta UD_{it} = \beta_1 \Delta UD_{it-1} + \beta_2 \Delta Performance_{it} + \beta_3 \Delta FinLev_{it} + \beta_4 \Delta Size_{it} + \beta_5 \Delta AssetPlasticity_{it} + \varepsilon_{it} \quad (5)$$

where ΔUD_{it} denotes change in the firm's unrelated diversification levels; and $\Delta AssetPlasticity_{it}$ denotes change in the firm's degree of asset plasticity, with asset plasticity proxied by Tobin's *q* ratio (as specified in Lang and Stulz 1994; Wernerfelt and Montgomery 1988; Lindenberg and Ross 1981). A higher Tobin's *q* ratio implies that the market value of a firm's assets is higher than its replacement cost, i.e., the market perceives that a firm's assets are worth more than what it costs to replace them (Lindenberg and Ross 1981). Since an asset with a higher degree of plasticity may present a wide range of options in its reallocation to business opportunities with higher growth prospects, the market may value a 'plastic' asset more when compared to the cost of its replacement. Thus, a firm with higher asset plasticity may also have a higher Tobin's *q* ratio. This reallocation of more 'plastic' assets may potentially help to increase sales in the subsidiaries to which they are relocated or 'shared', which also increases the unrelated level of diversification of a conglomerate.

To be consistent with hypothesis (3), the estimated coefficient of the change in levels of a firm's asset plasticity, β_5, should exhibit a positive sign for our sample of diversified firms.

3.2.1. Endogeneity Problems

Since diversification has an impact on performance, but performance also influences diversification decisions, as examined in several prior studies (e.g., Graham et al. 2002; Hyland and Diltz 2002; and Lang and Stulz 1994), we expect an endogenous relationship between the level of diversification and firm performance. Thus, an estimation method has to be selected in order to mitigate endogeneity (e.g., Kahn and Whited 2018).

Panel data estimation using the Generalized Method of Moments (GMM) procedure, allows the dynamic nature of performance at firm level to be analyzed and controlled for endogeneity problems.

According to a non-negligible stream of the empirical literature, instrumental variables (IV) applied in GMM estimators may help to lessen endogeneity problems (e.g., Roberts and Whited 2013).

4. Empirical Results

4.1. Univariate Statistics Analysis

Table 2 presents sample characteristics in terms of data distribution by industry and country.

[Insert Table 2 here]

Panel A of table 2 shows that all major non-financial industries are represented in the sample, with an emphasis on manufacturing and trade.

Panel B presents the details of the distribution of the 2,396 diversified firms by country, for the sampling period. The distribution, by country, documented Italy, Spain and France as having the highest representations (73.87 percent of all the diversified firms in the sample), while Finland, Austria and Portugal exhibit the lowest representations (accounting for 8.51 percent of the total of sampled firms).

Table 3 reports the summary statistics for the variables used to test our hypotheses for the 2010-2017 sampling period.

[Insert Table 3 here]

To test for differences in means and medians of the variables included in the empirical model, we conducted parametric tests for the equality of means, and Wilcoxon-Mann-Whitney tests for the equality of medians. Table 4 reports the means (on the left side) and medians (on the right side) of those variables, and statistics for equality tests across the sample. Section 1 and 2 compare the descriptive statistics, sorting the sample by unrelated diversified *vs* related diversified firms and unlisted *vs* listed diversified firms, respectively.

[Insert Table 4 here]

Testing for differences between the variables used to test our hypotheses in the unrelated diversified and related diversified firm subsamples for the 2010-2017 sampling period (section 1 of table 4), our results document that: (i) The means and medians of return on assets ($Performance$), financial leverage ($FinLev$), and return on equity (ROE), are not statistically different; (ii) Unrelated diversified firms exhibit statistically significant, at the 1 and 5 percent levels, higher asset tangibility (*Tang*), market-to-book (*MtoB*), plasticity of assets (*AssetPlasticity*) and risk index (*RI*) than related diversified firms; (iii) Related diversified firms exhibit larger level of diversification (LD) and size (*Size*) than unrelated diversified firms, with differences statistically significant at the 1 and 10 percent levels.

Means and medians of market-to-book (*MtoB*) and risk index (RI), are not statistically different when comparing unlisted and listed diversified firms. Unlisted diversified firms exhibit larger level of financial leverage ($FinLev$) than listed diversified firms, with differences statistically significant at the 5 percent level. Listed diversified firms exhibit a higher, and statistically significant at the 1 and 5 percent levels, return on assets ($Performance$), level of diversification (LD), level of unrelated diversification (UD), level of related diversification (RD), size ($Size$), tangibility ($Tang$) and plasticity of assets ($AssetPlasticity$) than unlisted diversified firms (section 2 of table 4). Overall, all these findings are consistent with extant empirical literature (e.g. La Rocca et al. 2018; Wade and Gravill 2003; Chatterjee and Wernerfelt 1991; Bettis 1981).

Table 5 reports the Pearson correlation coefficients between the variables (scaled by the adjusted asset betas, for firms' specific financial leverage, as the accounting-based risk measure) used to estimate our hypotheses, showing that the correlation coefficients range from 0.0514 to 0.8146 in the subsidiaries' subsample, at the 1 percent level of statistical significance.

Scaling all the regressed variables by a risk index and using several explanatory variables simultaneously may raise multicollinearity problems among them, potentially yielding, e.g., less accurate estimators. To test for the existence of multicollinearity, we performed the variance inflation factor (VIF) test. The larger individual VIF is 9.16, and the mean VIF for our empirical models - Eq(1), Eq(4), Eq(5), Eq(6.1) and Eq(6.2) – are

respectively, 4.55, 3.93, 1.48, 4.06 and 3.42, which are below the critical value of 10, potentially revealing the non-existence of collinearity (Table 5).

[Insert Table 5 here]

4.2. Regression Results

Equation (1) tests the effect of the firm's overall diversification level on the firm's performance (H1). Equation (4) tests whether diversified firms exhibit a positive relationship between, both unrelated and related diversification levels, and their performance (H2).

Table 6 reports the regression results on equation (1) and equation (4), for a sample of diversified firms, estimated using GMM estimators (Blundell and Bond 1998). We used the lag of all the right-hand-side variables and their first differences as instruments in our SYS-GMM estimations.

[Insert Table 6 here]

The assumption of no serial correlation in the error terms was verified testing for the absence of a second-order serial correlation in residuals. In our models, this hypothesis of second-order serial correlation was always rejected.

The statistic for the Hansen test, for the null hypothesis of instruments that are uncorrelated with the disturbances and instruments that are valid, as well as the AR(2) test, suggested that our models, to test hypotheses H1 and H2, were valid, well-specified, and consistent. These test results are reported in the final two pairs of rows in table 6.

Regression results document a statistically significant, at the 1 percent level, positive relationship between the firm's overall diversification level and the firm's performance. The SYS-GMM estimate is 0.004 percent, consistent with previous evidence in the literature (e.g., Giachetti 2012; Wan and Hoskisson 2003; Palich et al. 2000; Palepu 1985; Bettis 1981).

Findings from our regression analysis also show a dynamic pattern of performance, which is expressed through the positive coefficient of the lagged dependent variable, at the 1 percent level of statistical significance. Additionally, the negative and statistically significant, at the 1 percent level, coefficient of the financial leverage, and the positive and statistically significant, at the 1 percent level, coefficients of tangibility and growth

opportunities are consistent with the findings of prior empirical research, e.g., La Rocca et al. (2018), Giachetti (2012), Chakrabarti et al. (2007), Wan and Hoskisson (2003).

In summary, these empirical results, document that diversified firms, arguably due to, among other factors, the potential operating and financial synergies, exhibit a positive relationship between overall diversification and their performance levels (β_2), which is consistent with H1.

Since related diversification appears to be more related to positive operating synergies, and unrelated diversification more associated with positive financial synergies, the effect of both related and unrelated diversification levels should exhibit a positive sign (β_2 and β_3) – H2. Equation (4) tests the effect of both unrelated and related diversification levels on diversified firms' levels of performance.

Column (2) of table 6 reports the estimated coefficients (β_2 and β_3) of the effects of unrelated and related diversification on diversified firms' performance (UD_{it} and RD_{it}). Regression results document positive relationships between unrelated (0.065 percent) and related (0.0098 percent) diversification levels and diversified firms' performance, as they are both statistically significant at the 1 percent level. Our results are consistent with H2 and with prior research, e.g., La Rocca et al. (2018), Bettis (1981).

Overall, these findings suggest that both operating and financial synergies, associated with related and unrelated diversification, respectively, may have an important and positive effect on a firm's performance level.

To test the argument that a higher degree of asset plasticity may increase the set of opportunities for reallocating those resources to other business opportunities with higher value creation prospects, and increasing the level of unrelated diversification, we estimated equation (5). To be consistent with H3, the estimated coefficient of the change in firms' levels of their asset plasticity, β_5, should exhibit a positive sign for our sample of diversified firms.

Findings from our regression analysis show a positive and statistically significant coefficient (0.0132 percent), at the 1 percent level, for the effect of change in firms' degrees of asset plasticity on change in their unrelated diversification levels. Table 7 reports the regression results on equation (5).

[Insert Table 7 here]

Our results indicate that the change in firms' asset plasticity level exhibits a positive effect on the change in the level of unrelated diversification (β_5), which is consistent with H3. These findings suggest that the higher the degree of asset 'plasticity', the larger the opportunity set for reallocating those assets to other business opportunities with higher value creation prospects and the greater the potential for increasing firm performance is through increasing unrelated diversification.

5. Robustness Checks

To test for robustness, we firstly adjusted asset betas for firms' financial leverage, using the book value of equity in Hamada's (1972) procedure. Secondly, we scaled all the variables by a 'risk index' adapted from Hannan and Hanweck (1988): $\left[ROA + \left(E/A\right)\right] / \sigma ROA$, where *ROA* denotes the return on assets, *E/A* the equity-total net assets ratio, and σ_{ROA} the standard deviation of *ROA*.[31] Thirdly, we scaled all the variables by the coefficient of variation of the return on assets. Fourthly, we used the return on equity (*ROE*), specified as the ratio of earnings before interest, tax, depreciation, and amortization (EBITDA) to equity, as a proxy for firm performance, following, e.g., Singh et al. (2007), Grant et al. (1988), Christensen and Montgomery (1981). Fifthly, we used the Tobin's *q* ratio as a surrogate for growth opportunities, according to, e.g., Freund et al. (2007). Sixthly, to mitigate potential errors in our regression results, we included a variable to control for the non-included data concerning both foreign subsidiaries and subsidiaries without reported data on the database, such as, the number of foreign subsidiaries and subsidiaries without reported data per each diversified firm in our sample. Lastly, we used the number of subsidiaries per each diversified firm as a proxy for a firm total diversification level, following, e.g., George and Kabir (2012), Giachetti (2012), Wade and Gravill (2003), Denis et al. (2002).

[31] The risk index expresses, in units of the ROA standard deviation, how much the accounting earnings can fall before becoming negative, i.e, before a situation of accounting insolvency.

As an additional check of robustness for H1 and H2, we tested the relationship between total, unrelated and related diversification levels and performance using a market-based performance measure, estimating the following regression models:

$$MtoB_{it} = \beta_1 LD_{it} + \beta_2 FinLev_{it} + \beta_3 Size_{it} + \beta_4 Tang_{it} + \varepsilon_{it} \quad (6.1)$$

and

$$MtoB_{it} = \beta_1 UD_{it} + \beta_2 RD_{it} + \beta_3 FinLev_{it} + \beta_4 Size_{it} + \beta_5 Tang_{it} + \varepsilon_{it} \quad (6.2)$$

The regression results for the performed robustness checks, are reported in tables 8, 9, 10, 11 and 12. Column (1) of tables 8, 9, 10 and 12, and also column (3) of table 12, report, for the purpose of comparison, the estimated coefficients of the baseline models used to test our hypotheses H1, H2 and H3. Column (2) of tables 8, 9 and 10 reports the estimated coefficients of testing our hypotheses H1, H2 and H3, respectively, adjusting the risk index, asset betas, for firms' specific financial leverage, using E as the book value of equity in Hamada's (1972) procedure. Column (3) of tables 8, 9 and 10 reports the estimated coefficients of testing our hypotheses H1, H2 and H3, respectively, scaling all the variables by a RI adapted from Hannan and Hanweck (1988). Additionally, column (4) of tables 8, 9 and 10, and columns (2 and 4) of table 12, report the estimated coefficients of testing our hypotheses H1, H2 and H3, respectively, scaling all variables by the coefficient of variation of the return on assets. The regression results on H1, H2 and H3 hypotheses testing using the *ROE* ratio as a proxy for firm performance are reported in column (5) of tables 8, 9 and 10, respectively. Column (6) of tables 8 and 9, displays the regression results estimated using Tobin's *q* ratio as a surrogate for growth opportunities, on testing our hypotheses H1 and H2. The regression results on H1 and H2 hypotheses testing using a variable to control for the non-included data on both foreign subsidiaries and subsidiaries without reported data on the database are reported in column (7) of tables 8 and 9, respectively. Column (8) of table 8 reports the estimated coefficients of testing our hypotheses H1 using the number of subsidiaries per each diversified firm as a proxy for a firm total diversification level. These findings provide support for earlier results in terms of coefficient signs, magnitude, and statistical significance.

[Insert Tables 8 to 12 here]

The finding of a positive relationship between a firm's total diversification level and a firm's performance (β_2), holds for almost all the robustness checks performed and the estimation methods and empirical specifications used, reinforcing the baseline model results obtained for H1. When using the number of subsidiaries per each diversified firm as a proxy for a firm's total diversification level, our results also report a positive and statistically significant coefficient of the relationship between diversification level and performance.

The robustness check results document, considering all the alternative specifications of variables and estimation methods we used, a positive relationship between both unrelated and related diversification levels and diversified firms' performance, which are consistent with the results from H2 testing. However, it should be noted that in a few specifications, results were not statistically significant.

The results, on the robustness checks for H3**,** show a positive effect of the change in firms' asset plasticity level on the change in the unrelated diversification level, which are consistent with the baseline model results obtained for H3.

Regression results on equations 6.1 and 6.2, to check the robustness of results for H1 and H2 using a market-based performance measure, are reported in tables 11 and 12. The reported empirical findings suggest that firms' total diversification level exhibit a positive effect (0.3504 percent) on the market-based performance, statistically significate at the 1 percent level. Additionally, regression results also indicate that the unrelated and related diversification levels exhibit a positive effect on market-based performance, 0.5469 and 0.2394 percent, statistically significant at the 1 and 10 percent levels, respectively. These results strengthen the results obtained in the empirical testing of H1 and H2.

6. Conclusions

This paper carries out an empirical examination of the relationship between firms' total diversification levels, and also of both unrelated and related diversification levels, and the performance levels of diversified firms, using both accounting- and market-based performance measures. Additionally, we also test the argument that reallocating 'plastic' assets across different business units increases unrelated diversification.

Regression results document that euro area diversified firms exhibit a positive and statistically significant relationship between their diversification level and performance, providing support to hypothesis 1. Under the standard assumption that firms diversify with the aim of improving their overall economic performance and that the benefits of diversification outweigh the costs, our findings are consistent with that of a positive relationship between diversification and performance levels.

Regression results also show that sampled euro area diversified firms exhibit positive and statistically significant relationships, between unrelated and related diversification levels and diversified firms' performance. This evidence is consistent with the argument that horizontally diversified firms may have a positive relationship between financial synergies and performance, and vertically integrated diversified firms may exhibit a positive relationship between operating synergies and performance, both providing support for hypothesis 2.

Empirical testing also provides evidence supporting the hypothesis that firms' overall, unrelated and related diversification levels exhibit a positive and statistically significant effect on the market-based performance. These empirical results are consistent with the prediction that the market-based performance measure (as well as the accounting-based performance measure) may be determined by firms' diversification behavior.

Empirical findings also support the argument that a higher degree of asset plasticity may increase the level of unrelated diversification, to potentially take advantage of an increase in the set of opportunities for reallocating those resources to other business opportunities with higher value creation prospects, consistent with hypothesis 3. Regression results show a positive and statistically significant effect of change in firms' degrees of asset plasticity on the change in its unrelated diversification levels.

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Tables

Table 1. Variables specification, and expected and estimated variable coefficient signs

Variables	Specification	Expected Sign	Estimated Sign
Dependent			
Performance: Return on Assets (ROA)	Ratio of earnings before interest, tax, depreciation, and amortization (EBITDA) to total net assets (e.g., La Rocca et al. 2018; George and Kabir 2012; Chakrabarti et al. 2007; Singh et al. 2007; Kim et al. 2004; Khanna and Palepu 2000).		
Independent			
Firm diversification level (LD)	Total entropy diversification index as in Palepu (1985) and Jacquemin and Berry (1979).	+	+
Related diversification level (RD)	Related diversification index, as specified in Palepu (1985), Jacquemin and Berry (1979).	+	+
Unrelated diversification level (UD)	Unrelated diversification index, as specified in Palepu (1985), Jacquemin and Berry (1979).	+	+
Financial leverage (FinLev)	Ratio of long-term debt plus short-term loans to total net assets (e.g., La Rocca et al. 2018; George and Kabir 2012; Giachetti 2012; Muñoz-Bullón and Sánchez-Bueno 2012; Lu and Beamish 2004).	-/+	-
Size (Size) and Tangibility of assets (Tang)	Natural logarithm of total net assets, and ratio of tangible fixed assets to total net assets, respectively.	+	-[a]
Growth opportunities (MtoB)	Market-to-book ratio as the equity market value to its book value both in time t (e.g., George et al. 2011; Adam and Goyal 2008; Wei and Zhang 2008; Lev and Sougiannis 1999; Hoshi et al. 1991).	+	+
Asset Plasticity (AssetPlasticity)	Proxied by Tobin's *q* ratio, as specified in Lang and Stulz (1994), Wernerfelt and Montgomery (1988), and Lindenberg and Ross (1981).	+	+

Note: [a] Coefficient sign partially not statistically significant

Table 2. Characteristics of the sample

The industry classification was based on the NACE Rev. 2's main section and is according to the aggregation of Fama and French's (1997) industry classification presented by Dewaelheyns and Van Hulle (2012).

Panel A: Industry composition		
Industry	Number of firms in sample	%
Agriculture, forestry and fishing; Mining and quarrying; Electricity, gas, steam and air conditioning supply; Water supply; sewerage, waste management and remediation activities (Industry 1)	111	4.63%
Manufacturing (Industry 2)	953	39.77%
Construction (Industry 3)	126	5.26%
Trade (Wholesale and Retail) (Industry 4)	518	21.62%

Transport and Communications (Industry 5)	200	8.35%
Other (Accommodation and food service activities; Professional, scientific and technical activities; Administrative and support service activities; Human health and social work activities; Arts, entertainment and recreation; Other service activities) (Industry 6)	488	20.37%
	2396	

Panel B: Country composition

Country	Number of firms in sample	%
Austria	39	1.63%
Belgium	176	7.35%
Finland	130	5.43%
France	432	18.03%
Germany	246	10.27%
Italy	836	34.89%
Portugal	35	1.45%
Spain	502	20.95%
	2396	

Table 3. Summary statistics of the variables used to test our hypotheses

The diversified firms' sample consists of 19,168 firm-year observations from the 2010 to 2017 Amadeus files. This table reports the number of observations (N), mean, median, standard deviation (Std. Dev.), coefficient of variation (cv), minimum (Min), maximum (Max) of the variables considered in the empirical applications to test hypotheses. The variables used to test hypotheses were described in detail in subsection 3.2 and in table 1.

Variables	N	Mean	Median	Std. Dev.	CV	Min	Max
$Performance_{it}$	18769	0.10505	0.09466	0.06458	0.61479	-0.18144	0.77319
LD_{it}	19164	0.80529	0.69100	0.57028	0.70817	0.00000	3.68681
UD_{it}	19164	0.42782	0.37786	0.39290	0.91838	0.00000	2.17244
RD_{it}	19164	0.37747	0.22826	0.44785	1.18645	0.00000	2.99603
$FinLev_{it}$	18878	0.23852	0.22554	0.16332	0.68471	0.00000	0.99874
$Size_{it}$	18878	11.71462	11.47015	1.60741	0.13721	2.70805	19.86097
$Tang_{it}$	18811	0.23358	0.19604	0.18467	0.79061	0.00000	0.97403
$MtoB_{it}$	13337	5.95538	5.22215	3.59264	0.60326	0.00169	14.99460
$AssetPlasticity_{it}$	15812	3.03286	2.45607	2.27088	0.74876	0.00145	14.99832
RI_i	2314	28.04614	21.17888	25.42068	0.90639	1.25667	455.3691
ROE_{it}	18663	0.33265	0.25795	0.87870	2.64155	0.00008	106.9022
$N\_euro\_area\_subsidiaries_i$	19168	5.24708	3.00000	7.27691	1.38685	2	139
$N\_foreign\_subsidiaries_i$	19168	8.94616	3.00000	26.94797	3.01224	0	383

Table 4. Parametric tests for equality of means and nonparametric tests for equality of medians between the variables used to test our hypotheses

The variables used to test our hypotheses were described in detail in in subsection 3.2 and in table 1. *, ** and *** indicate significance of the coefficients at 10%, 5% and 1% level, respectively. A statistically significant difference, upward or downward, can be proved through the one-sided t-test for mean comparison of two independent subsamples, and assuming unequal variances: diff > 0*** representing a difference between the mean of the two groups that is statistically significantly greater than zero; diff < 0*** representing a difference between the mean of the two groups that is statistically significantly less than zero.

Section 1: Parametric tests for equality of means and nonparametric tests for equality of medians between the variables used to test our hypotheses – 10,915 unrelated diversified firm-year observations *vs* 8,253 related diversified firm-year observations

	Mean	Median

	Unrelated diversified	Related diversified	Two-sided t-test	One-sided t-test	Unrelated diversified	Related diversified	Wilcoxon-Mann-Whitney test	Nonparametric equality-of-medians test
$Performance_{it}$	0.1048	0.1054	-0.6967		0.0951	0.0940	-0.375	0.99
LD_{it}	0.7649	0.8587	-11.0103***	diff < 0***	0.6793	0.7436	8.315***	96.69***
$FinLev_{it}$	0.2383	0.2388	-0.1782		0.2276	0.2229	-0.388	1.45
$Size_{it}$	11.6980	11.7366	-1.6252	diff < 0*	11.4728	11.4651	0.985	0.06
$Tang_{it}$	0.2363	0.2300	2.3090**	diff > 0**	0.2003	0.1902	-3.627***	5.11**
$MtoB_{it}$	6.0199	5.8697	2.3996**	diff > 0***	5.2683	5.1787	-1.973**	1.12
$AssetPlasticity_{it}$	3.0897	2.9551	3.7024***	diff > 0***	2.5297	2.3672	-3.897***	17.12***
RI_i	29.1489	26.1613	2.929***	diff > 0***	21.6702	20.5957	-0.974	4.14**
ROE_{it}	0.3390	0.3242	1.2659		0.2605	0.2546	-1.290	2.03

Section 2: Parametric tests for equality of means and nonparametric tests for equality of medians between the variables used to test our hypotheses – 2,160 unlisted *vs* 236 listed firms

	Mean				Median			
	Unlisted	Listed	Two-sided t-test	One-sided t-test	Unlisted	Listed	Wilcoxon-Mann-Whitney test	Nonparametric equality-of-medians test
$Performance_{it}$	0.1033	0.1208	-11.1335***	diff < 0***	0.0925	0.1128	-13.76***	168.95***
LD_{it}	0.7606	1.2144	-27.5283***	diff < 0***	0.6806	1.1545	-28.19***	509.26***
UD_{it}	0.4046	0.6405	-22.2318***	diff < 0***	0.3455	0.6465	-22.93***	298.69***
RD_{it}	0.3560	0.5738	-17.6230***	diff < 0***	0.1860	0.5254	-19.93***	222.22***
$FinLev_{it}$	0.2393	0.2313	2.2579**	diff > 0**	0.2256	0.2255	0.698	0.0006
$Size_{it}$	11.4822	13.8171	-50.3929***	diff < 0***	11.3369	13.6062	-47.91***	1200.00***
$Tang_{it}$	0.2324	0.2439	-2.4568**	diff < 0***	0.1944	0.2118	-2.13**	5.58**
$MtoB_{it}$	5.9565	5.9457	0.1125		5.2142	5.2939	-0.74	0.63
$AssetPlasticity_{it}$	3.0214	3.1364	-1.9094*	diff < 0**	2.4437	2.5754	-2.641***	4.52**
RI_i	29.9648	31.3538	-0.6128		20.8695	25.0015	-2.637***	3.49*
ROE_{it}	0.3339	0.3212	1.4352	diff > 0*	0.2532	0.2839	-7.148***	75.44***

Table 5. Pearson correlation coefficients between variables used to test our hypotheses and variance inflation factor (VIF)

This table reports the Pearson correlation coefficients between the variables (scaled by the *RI*) used to test our hypotheses, and the variance inflation factor (VIF) to test for possible multicollinearity problems. Definitions of the variables are listed in subsection 3.2 and in table 1. *, ** and *** indicate significance of the coefficients at 10%, 5% and 1% level, respectively.

	1	2	3	4	5	6	7	8	9
	$Performance_{it}$	LD_{it}	UD_{it}	RD_{it}	$FinLev_{it}$	$Size_{it}$	$Tang_{it}$	$MtoB_{it}$	$AssetPlasticity_{it}$
1	1.0000								

2	0.2091***	1.0000							
3	0.1709***	0.6555***	1.0000						
4	0.1281***	0.7537***	-0.0023	1.0000					
5	0.0087	0.0920***	0.0627***	0.0672***	1.0000				
6	0.4625***	0.5159***	0.3800***	0.3524***	0.2049***	1.0000			
7	0.2562***	0.1069***	0.1036***	0.0514***	0.3115***	0.3807***	1.0000		
8	0.6088***	0.1929***	0.1713***	0.1031***	0.2619***	0.5121***	0.2746***	1.0000	
9	0.7088***	0.2081***	0.1980***	0.1032***	0.1347***	0.4994***	0.2783***	0.8146***	1.0000

Equation 4.1								
VIF	-	3.57		3.13	9.11	2.81	4.15	
1/VIF	-	0.2803		0.3198	0.1098	0.3559	0.2412	
Mean VIF	4.55							

Equation 4.4								
VIF	-	2.43	1.92	3.13	9.16	2.81	4.15	
1/VIF	-	0.4110	0.5209	0.3196	0.1092	0.3555	0.2409	
Mean VIF	3.93							

Equation 4.5								
VIF	1.85	-		1.05	1.21			1.82
1/VIF	0.5417	-		0.9531	0.8241			0.5498
Mean VIF		1.48						

Equation 4.6.1								
VIF		3.56		3.05	6.82	2.80	-	
1/VIF		0.2809		0.3284	0.1466	0.3577	-	
Mean VIF							4.06	

Equation 4.6.2								
VIF		2.43	1.91	3.05	6.91	2.80	-	
1/VIF		0.4110	0.5228	0.3283	0.1448	0.3573	-	
Mean VIF							3.42	

Table 6. Parameter estimates from panel regressions on the effect of the firm's overall, unrelated and related diversification levels and performance – Eq. (1) and Eq. (4) – H1 and H2

This table summarizes the estimations on the effect of the firm's overall diversification level on the firm's performance (H1) – column (1) – and the effect of both unrelated and related diversification levels on diversified firms' performance (H2) – column (2) – generated by Blundell and Bond's (1998) system, the GMM estimation method. The data were drawn from the 2010 to 2017 Amadeus files. Definitions of the variables are listed in subsection 3.2 and in table 1. The final two pairs of rows report results for the AR(2) test for the null hypothesis of no second-order serial correlation and Hansen test for the null hypothesis of instruments that are uncorrelated with the disturbances and instruments that are valid (over-identifying restrictions). *, ** and *** indicate significance at 10%, 5% and 1%, respectively. Values enclosed in parentheses are the *t* or *z* statistics for coefficients, and values in square brackets are the *p*-values for test

statistics.

Independent Variables	(1) $Performance_{it}$ **H1**	(2) $Performance_{it}$ **H2**
$Performance_{it-1}$	0.5283***	0.4574***
	(6.08)	(4.39)
LD_{it}	0.0040***	
	(3.81)	
UD_{it}		0.0065***
		(3.65)
RD_{it}		0.0098***
		(6.61)
$FinLev_{it}$	-0.0757***	-0.0821***
	(-9.28)	(-9.09)
$Size_{it}$	-0.0007	-0.0024**
	(-1.35)	(-2.58)
$Tang_{it}$	0.0202***	0.0282***
	(4.60)	(5.29)
$MtoB_{it}$	0.0064***	0.0073***
	(13.89)	(16.26)
Observations	10823	10823
AR(2) test	0.86	0.75
	[0.389]	[0.452]
Hansen test	18.16	17.13
	[0.111]	[0.104]
Year dummies	Yes	Yes

Table 7. Parameter estimates from panel regressions on the relationship between change in firms' levels of asset plasticity and the change in the unrelated diversification levels – Eq. (5) – H3

This table summarizes the estimations on the change in the levels of firm's asset plasticity on the change in its unrelated diversification levels (H3), generated by Blundell and Bond's (1998) system, the GMM estimation method. The data were drawn from the 2010 to 2017 Amadeus files. Definitions of the variables are listed in subsection 3.2 and in table 1. The final two pairs of rows report results for the AR(2) test for the null hypothesis of no second-order serial correlation and Hansen test for the null hypothesis of instruments that are uncorrelated with the disturbances and instruments that are valid (over-identifying restrictions). *, ** and *** indicate significance at 10%, 5% and 1%, respectively. Values enclosed in parentheses are the t or z statistics for coefficients, and values in square brackets are the p-values for test statistics.

Independent Variables	(1) ΔUD_{it} **H3**
ΔUD_{it-1}	-0.1788*** (-5.06)
$\Delta Performance_{it}$	-0.5370** (-2.00)
$\Delta FinLev_{it}$	0.0010 (0.01)
$\Delta Size_{it}$	0.0249*** (6.12)
$\Delta AssetPlasticity_{it}$	0.0132*** (2.63)
Observations	10107
AR(2) test	0.67 [0.503]
Hansen test	23.95 [0.004]
Year dummies	Yes