Diversification Relatedness and Economic Performance: Does the Resource Plasticity Channel Matter?*

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ABSTRACT

This paper explores the link between corporate diversification relatedness and economic performance, through the resource plasticity channel. To that end, we estimate a dynamic data panel of 15,054 diversified firms from the European Union (EU) over the 2011-2019 period. We found that considering the sensitivity of unrelated / related diversification relationship with resource plasticity, a percentage point increase in the level of unrelated / related diversification, is significantly associated with a 1.8 / 1.39 percent improvement in performance, respectively. These findings contribute to the 'bright side' of the diversification literature. Additionally, we provide evidence on the positive relationship between diversification relatedness and performance. Furthermore, evidence is also consistent with the proposition that this relationship is sensitive to resource plasticity. Our results hold after controlling for endogeneity bias and are robust to alternative variable specifications.

Keywords: M-firm; related/unrelated diversification; performance; resource plasticity.
JEL codes: C33; L22; L25; M10.

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THERE IS ROBUST EVIDENCE that diversified firms are a ubiquitous coordination platform used to carry out productive economic activities. The importance of the productive economic activities carried out within their boundaries gathered significant economic importance worldwide, in terms of transaction volume, value added, and employment. (e.g., Buchuk et al., 2014; Belenzon et al., 2013; Gertner & Scharfstein, 2013; Gugler et al., 2013; Lafontaine & Slade, 2007; Faccio & Lang, 2002; Khanna & Palepu, 2000).

Abundant evidence documents the importance of diversified firms. For example: (i) "diversified firms comprise 75% on average of the market value of the S&P 500" (Hund et al., 2012, p.1); (ii) "business groups are ubiquitous in many countries" (Carney et al., 2011, p.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, p.327); (iv) "conglomerate firm production represents more than 50 percent of production in the United States" (Maksimovic & Philips, 2007, p.424); (v) a "striking feature of most emerging economies is the prominent role played by business groups" (Khanna & Rivkin, 2001, p.45); (vi) "diversified business groups dominate private sector activity in most emerging markets around the world" (Khanna & Palepu, 2000, p.867).[1]

During the last decades, the relationship between corporate diversification and value has attracted a great deal of attention from, namely, strategy and financial economics researchers (see, e.g., Chatterjee & Wernerfelt, 1991).

However, extant research has produced mixed results suggesting that diversification may have an ambivalent effect on value (e.g., Maksimovic & Phillips, 2007; Villalonga, 2004a). For example, advocates of the 'bright side' branch of this literature argue that diversification is positively related to performance, (e.g., Hann et al., 2013; Khanna & Tice, 2001; Sapienza, 2001).[2]

Partisans of the 'dark side' view espouse the viewpoint that the value of diversified firms may be discounted by the market, in relation to their fair value as a portfolio of comparable single-industry firms (e.g., Anjos, 2010; Ozbas & Scharfstein, 2010; Scharfstein & Stein, 2000; Rajan et al., 2000).

Therefore, the topic remains a challenge for the economic analysis of business organizations (e.g., Glaser et al., 2013; Maksimovic & Phillips, 2013, 2007; Agarwal et al., 2011; Campa & Kedia, 2002; Berger & Ofek, 1995).[3]

[1] For further recent research on the relevance of diversified firms in the business organization world see, e.g., Almeida et al. (2015), Buchuk et al. (2014), Belenzon et al. (2013), Gugler et al. (2013), Faccio & Lang (2002).

[2] Findings of non-U.S. samples, mostly Asian (e.g., Bae et al. 2011; Wade & Gravill 2003), and European (e.g., La Rocca et al., 2018; Luffman & Reed, 1984), also document the presence of ambivalence.

[3] Hereafter, we use interchangeably diversified firm, multidivisional firm, multi-industry firm, multi-segment firm, conglomerate, and business group, as the business organizational structure coordinating a set of diversified and legally independent firms.

This paper examines the generic research question of whether the effect of resource plasticity on diversification relatedness matters for economic performance. Specifically, we test the relationships between resource plasticity and related/unrelated diversification on performance, using the Generalized Method of Moments (GMM) procedure, to estimate a panel data set of 15,054 European Union (EU) diversified firms, over the 2011-2019 sampling period, in a total of 135,486 testable firm-years.

The contribution of this paper to the literature on diversification and performance is threefold. Firstly, our empirical focus is on EU evidence, while mainstream literature has focused predominantly on U.S. and Asia. Secondly, we predominantly test data of unlisted firms (93.98 percent), whereas extant literature uses data drawn from larger listed firms (e.g., Morris et al., 2017; Almeida et al., 2015; Chakrabarti et al., 2007; Villalonga, 2004a). And thirdly, we examine the role that resource plasticity plays on the link between diversification relatedness and performance, which has been relatively neglected.

The main findings, document positive and statistically significant effects of diversification relatedness, through the resource plasticity channel, on performance, with the unrelated / related diversification exhibiting a 1.80 percent and 1.39 percent impact, respectively.

Findings suggest that unrelatedly diversified firms endowed with more plastic resources, exhibit higher economic performance. Perhaps, induced by improvements associated with diversification benefits. Additionally, our findings on the link between resource plasticity, diversification relatedness, and performance, also contribute to mitigate a potential misspecification problem.

Our empirical findings contribute to the diversification literature by: (i) Enlightening the linkage of the resource plasticity between diversification and economic performance; (ii) documenting the nature and the magnitude of the joint effect of resource plasticity and unrelated / related diversification on performance; and (iii) suggesting the potential presence of financial synergies, for example, in the form of the coinsurance effect.

The remainder of the paper is structured as follows: Section I discusses the relevant theoretical and empirical literature and formulates the research questions. Section II describes the data and the empirical implementation. Section III presents and analyzes univariate statistics and the results of econometric estimations. Section IV documents robustness check results. Section V summarizes and provides concluding remarks.

I. Background and Research Questions

Prior theoretical work, anchored on the seminal contributions of Coase (1937) and Williamson (1975), explains that organizational forms of economic activity are a continuum of coordination technologies, spanning from markets to hierarchies.[4]

Under this framework, firms emerge as a trade-off between the allocative efficiency of using the price system or the hierarchical management system. Therefore, the economic performance of a diversified firm is, arguably, linked to where its boundaries are set (e.g., Gertner & Scharfstein, 2013; Maksimovic & Phillips, 2007; Gonenc et al., 2007; Demsetz, 1997).

As insightfully pointed out by Williamson (1975), the answer to the question of whether diversification matters for firm valuation seems to be intimately linked to where firm boundaries are set and to the type and extent of the undertaken diversification.[5]

From this theoretical perspective, diversification may be beneficial whenever the costs of carrying out transactions under an organizational arrangement of a group of coordinated 'hierarchies' (an M-form firm) is lower than carrying them out in a set of independent hierarchies. Therefore, diversification may be a source of value creation (e.g., Liebeskind, 2000; Williamson, 1975; Rumelt, 1974; Chandler, 1962).

Since the early 1920s, the U.S. witnessed the establishment of diversified business organizations – the 'M-Form' – pioneered by the DuPont Company and General Motors, which have gathered a geographically widespread and significant economic role (e.g., Montgomery, 1994; Williamson, 1975).

A crucial question when studying diversification is naturally, why do firms diversify? According to extant literature, firms diversify to improve the economic performance of the resources they have under control (e.g., Giachetti, 2012; Chatterjee & Wernerfelt, 1991).

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

Nonetheless, theoretical and empirically based arguments suggest that diversification may affect value ambivalently (e.g., Campa & Kedia, 2002), findings from prior research document that firms involved in either diversification or refocusing strategies exhibit improvements in economic performance (e.g., Hoskisson et al., 2005; Matsusaka & Nanda, 2002; Steiner, 1997).[6]

[4] A seminal contribution by Ronald Coase (1937) related firm boundaries to resource allocative efficiency, as a result of the balance between the costs of market and hierarchical productive activity coordination. For more details on firm boundaries, see, e.g., Hart & Holmström (2010), Mullainathan & Scharfstein (2001), Demsetz (1997), and Williamson (1975) and references cited therein.

[5] According to Leland (2007, p.765) "[p]ositive or negative operational synergies are often cited as a prime motivation for decisions that change the scope of the firm".

[6] In this paper, we use 'refocusing', 'reverse diversification', and downscoping interchangeably.

The most ubiquitous diversification strategies observed in the real corporate world include: (i) related versus unrelated diversification (e.g., La Rocca et al., 2018; Chatterjee & Wernerfelt, 1991; Bettis, 1981); (ii) domestic versus international diversification (e.g., Borda et al., 2017; Freund et al., 2007; Lu & Beamish, 2004; Denis et al., 2002); (iii) diversification versus refocusing (e.g., Çolak, 2010; Matsusaka & Nanda, 2002; Markides, 1995); and (iv) organic versus external diversification (e.g., Custódio, 2014; Leland, 2007; Amihud & Lev, 1981).

The proposition that diversification and performance are positively linked is anchored in the following arguments: (i) operating and financial synergies associated with resource sharing across business units and with the mitigation of suboptimal financing and investing policies (e.g., Maksimovic & Phillips, 2013; Fang et al., 2007; Gomes & Livdan, 2004); (ii) the coinsurance effect associated with the imperfectly correlated operating cash flows generated across conglomerate business units (e.g., Hann et al., 2013; Jia et al., 2013; Tong, 2012); (iii) increased monitoring benefits associated with the exercise of control rights by headquarters (e.g., Khanna & Tice, 2001; Scharfstein & Stein, 2000; Lamont, 1997; Stein, 1997); (iv) active winner-picking by headquarters (Stein, 1997; Gertner et al., 1994; Williamson, 1975); (v) effectiveness and efficiency in redeploying resources (e.g., Feldman & Sakhartov, 2021; Kim & Kung, 2017; Lieberman et al., 2017).

The hypothesis that diversification and performance are inversely related is supported in the following arguments: (i) allocative inefficiencies associated with conflicts of interest, informational and incentive problems in the agency relationships of subsidiary-headquarters (Cline et al., 2014; Ozbas & Scharfstein, 2010; Wulf, 2009; Scharfstein and Stein, 2000); (ii) suboptimal resource (re)deployment (e.g., Billett & Mauer, 2003, 2000; Shin & Stulz, 1998; Berger & Ofek, 1995); (iii) governance problems associated with centralized capital budgeting systems (e.g., Sautner & Villalonga, 2010); and (iv) subsidiary managerial rent-seeking behavior (Seru, 2014; Glaser et al., 2013; Scharfstein & Stein, 2000).

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

Prior research documents that the levels of related and unrelated diversification are associated with different levels of firm profitability (e.g., Wernerfelt & Montgomery, 1988; Varadarajan & Ramanujam, 1987; Palepu, 1985; Rumelt, 1974).

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).

In the presence of mature or declining markets, the single-industry segments of M-form firms may experience suboptimal economic performance of their resources. In those circumstances, the real option to reallocate, divest, or liquidate the resources of the underperforming business emerges (e.g., Feldman & Sakhartov, 2021; Lieberman et al., 2017; Anand & Singh, 1997).

The exercise of the real option of reallocating those resources to other business opportunities with higher growth prospects and/or lower expected business risk, arguably, improves the performance of organizational, functional, and technological resources.

As resource redeployability is contingent on the level of their plasticity, we should expect that the higher the degree of plasticity, the larger the set of opportunities for reallocating those resources to other business opportunities with higher value creation prospects. (e.g., Kim & Kung, 2017; Sakhartov, 2017; Teece et al., 1997; Kensinger, 1980).[7]

Diversification is a commonly used strategy for firms redeploying their resources so that they are in place to achieve their best usages. Conventional wisdom suggests that firms exercise diversification options on assets-in-place, or growth-opportunities aiming at optimizing their performance in terms of value creation. For example, by enlarging their boundaries into other related or unrelated industries and/or markets, capturing operating and financial synergies, benefiting from market power, and/or reaping economies of scale or scope (e.g., Hann et al., 2013; Devos et al., 2008; Gomes & Livdan, 2004).

Asset redeployment, however, is contingent, among other factors, on the degree of resources 'plasticity'.[8] Thus, the higher the degree of plasticity, the larger the opportunity set for redeploying those resources to other business opportunities with higher growth prospects and/or lower expected business risk (e.g., Kim & Kung, 2017; Sakhartov & Folta, 2014).

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

Theoretically, diversification actions are expected to be performance-enhancing, namely, when based on redeploying 'plastic' resources. As M-form firms progress along their life cycles, their growth-opportunity sets are expected to shrink (Mueller, 1972). Therefore, if they are endowed with flexible resources, they may be able to redeploy them to implement their growth opportunities and

[7] Williamson (1996, p.105) postulates that "asset specificity has reference to the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value". In the same vein, Alchian & Woodward (1988, p.69) "call resources or investment "plastic" to indicate that there is a wide range of discretionary, legitimate decisions within which the user may choose". According to Kensinger (1980, p.9), "more flexible assets would have a wider variety of uses and so by their adaptability be less sensitive to systematic forces".

[8] In this paper, we use interchangeably 'resource plasticity', 'asset specificity', 'asset flexibility', and 'resource redeployability'. For more details on resource plasticity refer to, e.g., De Vita et al. (2011), Gossy (2008), and Franke (1987).

therefore to optimize their performance through extending the duration of the maturity stage of their life cycles.

A branch of the accounting-based performance metrics literature reports that related may dominate unrelated diversification (e.g., Wade & Gravill, 2003; Wernerfelt & Montgomery, 1988; Varadarajan & Ramanujam, 1987; Palepu, 1985). 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; Michel & Shaked, 1984).

Summarizing, potential synergies associated with unrelated and related diversification may arguably have an important and positive effect on firms' performance level (e.g., La Rocca et al., 2018; Chakrabarti et al., 2007; Bettis, 1981). Assuming that firms diversify their business units' portfolio to optimize economic performance related diversification tends to be more influenced by operating synergies, and unrelated diversification more related with financial synergies, we examine whether diversification relatedness matters for performance (see also, Giachetti, 2012; George & Kabir, 2012).

II. Data Description and Empirical Specification

For our empirical testing, we build a sample of diversified firms from EU countries, drawn from the Orbis Europe database, spanning the 2011-2019 period.[9]

During this research, we adopted 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 & Rivkin, 2001).[10]

To be included in the sample, firms had to comply with the following criteria: (i) to be a non-financial diversified firm (that is a Global Ultimate Owner (GUO) or not) holding directly and/or indirectly, a minimum 50.01 percent ownership in any subsidiary, and owning two or more subsidiaries;[11] (ii) to be established in the EU; (iii) to be active for the full sampling period, with at least 7 to 9 years of data for all the variables, to ensure a balanced panel; and (iv) to report annual sales higher than 20 million euros.[12] All financial service firms, education, and regulated utilities were excluded from the sample.

[9] As the Orbis Europe database does not include financial data for subsidiaries outside European countries, our sample excludes non-EU subsidiaries.

[10] Like other papers with a similar focus that used Bureau van Dijk's databases, data from subsidiaries 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.

[11] 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.

[12] We exclude very small firms from our estimation sample, whose ownership and financial data are usually missing and may cause bias.

Using the above-described criteria, we end up with a sample of 15,054 diversified firms with 135,486 firm-year observations.

This empirical research was designed to test the relationships between resource plasticity, related/unrelated diversification, and performance.

To that end, we estimated two panel data regression models using the Generalized Method of Moments (GMM) procedure, in line with prior research (e.g., La Rocca et al., 2018; George & Kabir, 2012; Chakrabarti et al., 2007), under the following specifications:

$$Perf_{\text{it}} = \beta_1 Perf_{\text{it-1}} + \beta_2 UD \quad ResourcePlasticity_{it} + \beta_x ControlVariables_{it} + \varepsilon_{it} \qquad (1)$$

$$Perf_{it} = \beta_1 Perf_{it-1} + \beta_2 RD \quad ResourcePlasticity_{it} + \beta_x ControlVariables_{it} + \varepsilon_{it} \qquad (2)$$

where $Perf_{it}$ denotes firm performance, measured by the ratio of earnings before interest, tax, depreciation, and amortization (EBITDA) to total net assets; UD_{it} and RD_{it}, the levels of unrelated and related diversification, respectively, measured by Jacquemin & Berry's (1979) entropy index;[13] $ResourcePlasticity_{it}$, the degree of resource plasticity, proxied by Tobin's q ratio, as specified in Lang & Stulz (1994); UD Í $ResourcePlasticity_{it}$ and RD Í $ResourcePlasticity_{it}$, interaction terms between unrelated and related diversification and resource plasticity, respectively; $ControlVariables_{it}$, a vector of i firm-level control variables, including, leverage and age; $Leverage_{it}$, measured as the ratio of long-term debt plus short-term debt, to total net assets; positioning in the business life cycle (Age_{it}), proxied by the natural logarithm of number of years since the incorporation of the firm; subscripts refer to firm i at time t; and ε_{it} is the error term with zero mean and constant variance.

Given that assessment of performance at the firm level, regardless of the specification of its measurement, should be anchored in a risk-return framework, we scaled all regressed variables by equity betas, surrogating accounting-based risk measures.

Regression models also included year and industry dummies. Industry dummies were specified based on the NACE Rev. 2's main section. All variable distributions were winsorized at the top and bottom 5$^{\text{th}}$ percentile.

Prior empirical research identified endogenous relationships when testing diversification and performance (e.g., La Rocca et al., 2018; George & Kabir, 2012; Graham et al., 2002). Therefore, to mitigate potential endogeneity problems between resource plasticity, diversification relatedness and performance, we conduct panel data estimation using the Generalized Method of Moments (GMM) procedure (e.g., Kahn & Whited, 2018).[14]

[13] As argued by Pomfret & Shapiro (1980, p.145), "[o]ther measures of diversification could be calculated, but the reward is small because the measures tend to be correlated". According to, e.g., La Rocca et al. (2018, p.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).

[14] In line with extant empirical literature, we use instrumental variables (IV) applied in GMM estimators to mitigate endogeneity problems. We also lag all of the right-hand-side variables, and

III. Results

Table 1 presents the data distribution in the sample, by industry and country. Panel A shows that all major non-financial industries are represented in the sample, with an emphasis on manufacturing and trade. It is worth noting the concentration in the wholesale and retail trade and manufacturing industries, which represent 53.60 percent of the firms in the sample (63.19 percent of the universe of firms in Bureau van Dijk's databases).

Table 1
Industry and Country Distribution

The industry classification was based on the NACE Rev. 2's main section.

Panel A: Industry distribution		
Industry	**Number of firms in sample**	*%*
Agriculture, forestry, and fishing	187	1.24
Information and communication	785	5.21
Construction	1038	6.9
Manufacturing	4273	28.38
Mining and Natural Resources	89	0.59
Electricity, gas, steam, and air conditioning supply	523	3.47
Real State	786	5.22
Wholesale and retail trade	3797	25.22
Professional, scientific, and technical activities	1220	8.1
Water supply; sewerage, waste management and remediation activities	323	2.15
Accommodation and food service activities	224	1.49
Transportation and storage	991	6.58
Administrative and support service activities	744	4.94
Others (Arts, entertainment, and recreation; Other service activities)	74	0.49
	15,054	

their first differences, as instruments in our SYS-GMM estimations (e.g., Roberts & Whited, 2013; Blundell & Bond, 1998).

Panel B: Country composition		
Country	**Number of firms in sample**	**%**
Austria	377	2.5
Belgium	712	4.73
Bulgaria	120	0.8
Czech Republic	259	1.72
Germany	1065	7.07
Denmark	247	1.64
Estonia	74	0.49
Spain	2008	13.34
Finland	596	3.96
France	2431	16.15
Greece	104	0.69
Croatia	106	0.7
Hungary	168	1.12
Italy	4299	28.56
Lithuania	64	0.43
Luxembourg	26	0.17
Latvia	43	0.29
Malta	18	0.12
Netherlands	246	1.63
Poland	504	3.35
Portugal	312	2.07
Romania	123	0.82
Sweden	986	6.55
Slovenia	122	0.81
Slovakia	44	0.29

Panel B documents Italy, Spain, and France as having the highest representations in the sample (58.05 percent), while Malta, Luxembourg, Latvia, Slovakia, Lithuania, Estonia, Greece, Croatia, Bulgaria, Slovenia, and Romania all exhibit representations lower than 1 percent.[15]

Table 2 provides a univariate analysis of the sample's data (Panel A). Pairwise comparisons (Panel B) indicate statistically significant differences at the 1 to 5 percent levels, between Resource Plasticity, Leverage, Age and MtoB variables, for both UD and RD firms. On the other hand, mean and median Performance for UD are not statistically significantly different from those of RD firms, at the usual significance levels.

[15] To have a strictly balanced panel dataset, we require that sample firms must have been active for the full sampling period. Therefore, we excluded firms with incomplete historical financial data.

Table 2
Summary Statistics

This table reports the summary statistics of the variables considered in the empirical implementation. The Panel A columns present summary statistics for the full sample: mean; median; coefficient of variation (cv); minimum (Min); and maximum (Max). Panel B columns report parametric tests for equality of means and Wilcoxon-Mann-Whitney tests for equality of medians between unrelated diversified vs related diversified firms. Variables are defined in section II. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Panel A

Variables	Full Sample (135,486 firm-year obs.)				
	Mean	**Median**	**CV**	**Min**	**Max**
$Perf_{it}$	0.08646	0.07665	0.74437	-0.02303	0.24233
UD_{it}	0.41286	0.36605	0.93910	0.00000	1.51831
RD_{it}	0.36065	0.12950	1.29852	0.00000	2.09820
$AssetPlasticity_{it}$	3.22244	2.41692	0.84710	0.20074	12.65456
$UD\ X\ ResourcePlasticity_{it}$	1.33195	0.55918	1.47573	0.00000	11.44891
$RD\ X\ ResourcePlasticity_{it}$	1.15909	0.14019	1.84955	0.00000	13.66904
Age_{it}	3.25931	3.33221	0.22839	0.00000	4.73620
$Leverage_{it}$	0.60979	0.63065	0.36492	0.06988	1.118129
$MtoB_{it}$	7.03725	5.73131	0.72443	0.05175	15.00000
$N\_euro\_area\_subsidiaries_{i}$	5.37465	3.0000	1.85298	2.0000	557.0000
$N\_foreign\_subsidiaries_{i}$	9.62369	3.0000	3.80263	0.0000	1295.000

Panel B

Variables	Unrelated diversified (79,139 firm-year obs.) vs related diversified (56,347 firm-year obs.)					
	Unrelated diversified	**Related diversified**	**Two-sided t-test**	**Unrelated diversified**	**Related diversified**	**Wilcoxon-Mann-Whitney test**
	Mean			**Median**		
$Perf_{it}$	0.0866	0.0862	-1.0365	0.0767	0.0766	-1.80
UD_{it}						
RD_{it}						
$AssetPlasticity_{it}$	3.2721	3.1879	-5.1290***	2.4508	2.3936	-2.56**
$UD\ X\ ResourcePlasticity_{it}$	1.33195	1.15909	-20.243***	0.55918	0.14019	-190.993***
$UD\ X\ ResourcePlasticity_{it}$						
Age_{it}	3.28236	3.22685	-13.3928***	3.33221	3.29584	-14.274***
$Leverage_{it}$	0.6063	0.6148	6.7214***	0.6275	0.6352	6.678***
$MtoB_{it}$	7.2122	6.9402	-8.3486***	5.8985	5.6263	-7.94***
$N\_euro\_area\_subsidiaries_{i}$						
$N\_foreign\_subsidiaries_{i}$						

Evidence supports the assumption that the degree of Resource Plasticity is significantly higher for UD than for RD firms, with the former potentially presenting

a wide range of options in its reallocation to business opportunities with potentially higher profitable growth.

Correlation coefficients between the variables used in our tests range from -0.2072 to 0.3367 (Table 3). Results indicate that the correlations between resource plasticity, unrelated and related diversification levels, and performance are positive and statistically significant at the 1 percent level, with coefficients of 0.3367 for UD Í Resource Plasticity / Performance and 0.2571 for RD Í Resource Plasticity / Performance, respectively. These findings are in line with our research a priori.

Scaling all the regressed variables by a risk index and using several explanatory variables simultaneously may raise multicollinearity problems, potentially yielding less accurate estimators. To test for the existence of multicollinearity, we performed the variance inflation factor (VIF) test. The joint VIFs for our empirical models are 3.47, 4.23 for model 1 and 4.21 for model 2, which are below the critical value of 10, showing no potential multicollinearity problems (see Table 3).

Table 3
Correlations and VIF

This table reports the Pearson correlation coefficients between the variables used in the empirical implementation to answer the research objective and the variance inflation factor (VIF) to test for possible multicollinearity problems. Variables are defined in section II. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

	1	2	3	4	5
	$Performance_{it}$	UD X $ResourcePlasticity_{it}$	RD X $ResourcePlasticity_{it}$	$Leverage_{it}$	Age_{it}
1	1.0000				
2	0.3367***	1.0000			
3	0.2571***	0.1591***	1.0000		
4	-0.2072***	-0.0499***	-0.0197***	1.0000	
5	0.0142***	0.0207***	-0.0010	-0.0886***	1.0000
VIF	-	1.11	1.10	5.90	5.79
1/VIF	-	0.8990	0.9097	0.1696	0.1728
Mean VIF	3.47				

Table 4 presents the results of estimating Equations (1) and (2), using GMM estimators. Difference-in-Hansen test for the validity of the specified set of instruments and the AR(2) test for the null hypothesis of no second-order serial correlation, also exhibited in Table 4, indicate that the set of instruments specified for the empirical models tested is valid.

Regression coefficient results document both positive and statistically significant at the 1 percent level relationships, between unrelated (1.80 percent) and related (1.39 percent) diversification levels, through the resource plasticity channel, and diversified firms' performance. Results also indicate that resource plasticity plays

a significant role in the relationship between, both, unrelated and related diversification, and performance, exhibiting a higher impact on the former relationship.

Findings also document that a higher degree of resource plasticity may offer larger opportunity sets for redeploying resources to other business opportunities with higher value creation prospects, as the impact is higher for unrelated diversified firms. We conjecture that this finding may reflect the impact of financial synergies, in the form of the coinsurance effect (e.g., Maksimovic & Phillips, 2013; Lewellen, 1971).

Table 4
Resource Plasticity, Diversification, and Performance – Equations (1) and (2)

This table summarizes the estimations on the effect of unrelated and related diversification levels, through the resource plasticity channel, on diversified firms' performance generated by Blundell & Bond's (1998) system GMM. Variables are defined in section II. The AR(2) and Difference-in-Hansen tests are also reported. *, ** and *** indicate significance at the 10, 5 and 1 percent level, 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	**system GMM (1)** UD **X** ResourcePlasticity → Performance	**system GMM (2)** RD **X** ResourcePlasticity → Performance
$Performance_{it-1}$	0.3162***	0.3298***
	(10.47)	(10.65)
UD X $ResourcePlasticity_{it}$	0.0180***	
	(21.63)	
RD X $ResourcePlasticity_{it}$		0.0139***
		(17.51)
$Leverage_{it}$	0.2178***	0.2210***
	(6.32)	(5.97)
Age_{it}	-0.0603***	-0.0605***
	(-5.98)	(-5.58)
Observations	101,558	101,558
F-Statistic	691.47	630.89
	[0.000]	[0.000]
AR(2) test	2.16	2.29
	[0.030]	[0.022]
Difference-in-Hansen test	7.83	6.71
	[0.645]	[0.752]
Year dummies	Yes	Yes
Industry dummies	Yes	Yes

Evidence presented in Table 4 indicates that the estimates on the control variables document: (i) a positive and statistically significant relationship between financial leverage and performance, at the 1 percent level, suggesting that diversified firms may make use of leveraging with positive effects on performance, as suggested by the trade-off theory, e.g., Bradley et al. (1984); and (ii) a negative and statistically significant relationship between firm age and profitability, at the 1 percent level. The result suggests that the expected inverse relationship between the positioning in the life cycle and the growth opportunities set may be affected by the ability of diversified firms endowed with more flexible resources to redeploy them extending the duration of their maturity life cycle stages.[16]

IV. Robustness Checks

To check for the robustness of the regression results, we firstly used the market-to-book as a surrogate for firm performance, according to, e.g., La Rocca et al. (2018), Lu & Beamish (2004), Ferris et al. (2002). Secondly, we used a higher number of lags (two) of the right-hand-side variables unrelated and related diversification levels and resource plasticity as instruments in our SYS-GMM estimations to perform an additional test in mitigating potential endogeneity issues. Thirdly, we used the asset beta, specified as the operating cash flow coefficient of variation (Kale et al., 1991) scaled by the natural logarithm of the net total assets, as a proxy for resource plasticity.

The main results of the robustness checks, presented in Table 5, document, after considering all the alternative variables and models specifications used: a positive relationship between both unrelated and related diversification levels, through the resource plasticity channel, on diversified firms' profitability, even when using an increased number of lags of the right-hand-side variables as instruments in our estimations. Overall, these findings are consistent with those previously reported and discussed, in terms of coefficient signs, magnitude, and statistical significance level. Withal, some additional comments are applicable.

The relationship between firm's leverage and performance is statistically significant, at the 1 to 5 percent levels, exhibiting positive coefficients when using both accounting-based and market-based performance measures.

Firm's Age, used as a proxy for business life cycle stages, exhibits a negative and statistically significant relationship, at the 1 percent level, with performance. This finding is consistent for the alternative measures used to proxy for growth opportunities, which may help to strengthen our results against potential collinearity problems.

[16] Table 3 reports a Pearson correlation coefficient between *Leverage* and *Age*. Even though VIF is lower than 10, we examined whether results were robust when excluding *Age* variable from regression models to mitigate potential multicollinearity problems. Results document consistency with those previously reported, in terms of coefficient signs, magnitude, and statistical significance level. A table with these estimation results is available from the authors upon request.

Table 5

Robustness Tests – Resource Plasticity, Unrelated and Related Diversification Levels, and Performance

This table summarizes the estimations on the effect of resource plasticity and unrelated and related diversification levels on diversified firms performance, generated by Blundell & Bond's (1998) system GMM estimation method, conducting the following robustness checks: (i) using the market-to-book to surrogate performance – columns 1 and 4; (ii) using two lags on independent variables unrelated and related diversification levels, and resource plasticity, as instruments in SYS-GMM estimations – columns 2 and 5; (iii) using asset beta scaled by the natural logarithm of total assets, as proxy for resource plasticity – columns 3 and 6. Variable definitions are listed in section 3. The AR(2) and Difference-in-Hansen tests are also reported. *, ** and *** indicate significance at 10, 5 and 1 percent level, 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)** **[ROA → MtoB]**	**(2)** [Higher_N_Lags]	**(3)** *Independent Var* **[Tobin's Q → CV_OpCF]**	**(4)** **[ROA → MtoB]**	**(5)** [Higher_N_Lags]	**(6)** *Independent Var* **[Tobin's Q → CV_OpCF]**
$Performance_{it-1}$	0.3028***	0.3641***	0.4750***	0.3310***	0.3900***	0.4753***
	(8.38)	(15.86)	(25.15)	(8.44)	(16.97)	(25.21)
	1.2203***	0.0117***	0.0097***			
	(24.45)	(10.45)	(6.04)			
				0.8911***	0.0065***	0.0065***
				(19.54)	(7.55)	(3.76)
	14.9253***	0.0133***	0.0428***	15.6725***	0.0118**	0.0428***
	(9.51)	(2.56)	(13.43)	(9.27)	(2.09)	(13.44)
	-3.0236***	0.0093***	-0.0098***	-3.1447***	0.0106***	-0.0098***
	(-8.04)	(6.15)	(-10.15)	(-7.87)	(6.50)	(-10.16)
Observations	80,758	83,172	109,991	80,758	83,172	109,991
AR(2) test	1.60	1.59	2.70	1.86	1.93	2.70
	[0.108]	[0.111]	[0.007]	[0.063]	[0.053]	[0.007]
Diff-in-Hansen test	8.75	6.74	59.07	9.76	6.59	59.61
	[0.556]	[0.565]	[0.000]	[0.462]	[0.582]	[0.000]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes

Using the operating cash flow coefficient of variation scaled by the natural logarithm of total assets, as a proxy for resource plasticity, results were consistent, both in terms of coefficient signs and magnitude, with those of previous estimations at the usual significance levels.

V. Conclusions

In this paper, we examine whether the redeployment of plastic resources on an M-Firm influence the relationship between diversification relatedness and firm performance.

This paper investigates the generic research question of whether the effect of resource plasticity on diversification relatedness matters for economic performance. Specifically, we test the relationships between resource plasticity and related/unrelated diversification on performance.

Regression results document that EU diversified firms exhibit positive and statistically significant relationships, between unrelated and related diversification levels and diversified firms' performance, through the resource plasticity channel. 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.

Findings document that the degree of resource plasticity associated with the level of diversification relatedness influences diversified firms' performance, thus suggesting that firms may reallocate assets to other business opportunities with higher value creation prospects. The unrelated diversified firms seem to be the ones exploiting this effect to a greater degree.

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