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# How does firm diversification impact innovation?

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**ABSTRACT**

This study sheds light on the relationship between business diversification and innovation. A diversification strategy is both a driver of sunk costs and strategic slack. Strategic slack is a valuable reserve of knowledge, usable to foster innovation. Using linear models, we explore the interplay between research and development (R&D) and organisational slack in large and diversified companies listed on the Euronext 100 Index. We consider the diversification pattern over time, and its interactions with the following three categories: sunk costs, slack resources, and R&D. The results show an antithetic effect of diversification and slack on R&D expenditures. In contrast to unabsorbed and potential slack, diversification and sunk costs hinder innovation. However, diversification is a huge source of strategic slack and, thus, has a positive effect on innovation, indirectly.

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## Introduction

'A company's choice of corporate strategy is partly a legacy of its past' (Porter 1989, 8). Based on this premise, studies have searched for the impact of diversification on innovation, considering the path dependency of investment at diversified companies. For a firm, an investment commitment takes into consideration more than just the ultimate benefits. There are also both positive and negative consequences to consider. Sunk costs can be considered the negative side of the investment. In contrast, the acquisition of excess resources, which are called slack because of their characteristic of being largely without an actual allocation in the business plan, as a positive consequence can offer a future reward to the firm. Specifically, a stock of strategic slack resources is eventually exploitable for innovation and growth. Thus, an investment decision engenders the question, what is the fair trade-off between irreversibility and flexibility? Stated differently, what is a bearable amount of sunk costs and an acceptable level of excess resources to maintain over time?

On the one hand, a firm's advantage and its value depend on its capability to create competitive entry barriers (Tirole 1988). On the other hand, this commitment may reduce the availability of resources to pursue future alternatives. As a consequence, path dependency can present an ambiguous effect on growth and innovation. Sunk costs often mire a firm in the status quo. However, such costs are unavoidable in the process of creating and defending a corporate advantage. Diversification strategy is a huge source of both sunk costs and slack resources.

Scholars have struggled to understand the dynamics of the relationship between diversification and performance. A wide stream of study argues that diversification engenders a discount, which means that this strategy is value destroying, compared to specialised firms (Wernerfelt and Montgomery 1988; Lang and Stulz 1994; Berger and Ofek 1995). Other scholars underscore that diversification creates benefits from the excess resources and capabilities acquired; however, this excess can also engender a value discount due to market imperfections (Teece 1980; Rumelt 1982).

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The main reason to diversify is to maximise the value of jointly owned businesses; sometimes, even at the detriment of the competitive advantage of each business unit. In contrast to sunk costs, some slack resources can have a positive impact on innovation if they are discretionarily available for alternative use. For the corporate parent, this component of slack is strategic when it can be employed for corporate advantage and for creating operational synergies in joint businesses. For example, considering the research and development (R&D) activities of two different business units, synergies can be exploited when one unit is more effective than the other thanks to its resources. Those resources can now be shared between units, with valuable results (Puranam and Vanneste 2016). To some extent, in the merging of businesses, the sharing implicitly implies an excess of resources. In addition, previous literature seems to lack consistent findings on the dynamics between diversification and innovation. Moreover, the simultaneous study of sunk costs and slack resources in diversification appears as a considerable gap in the literature, even though sunk costs and slack resources can be considered two sides of the same coin.

Our study tackles this gap: from a managerial standpoint, it notably connects the dots among relevant strategic topics previously investigated mostly in an over simplified way. At a practical level, the implications from our analysis are useful for coordinating diversification decisions and for setting corporate strategic goals; namely, when the aim is to gather more strategic resources valuable for R&D and innovation, managers might opt for inorganic growth. Inorganic diversification increases the inflow of external heterogeneous resources, which can be usefully recombined to seek and exploit opportunities within the value chain.

Specifically, this study investigates how slack resources and sunk costs interplay in diversified firms, impacting innovative performance. We take into account sunk costs as means to investigate the negative side of path dependency and to examine their role as inhibitor of innovation. We adopt an entropy measure for diversification and examine a sample of diversified companies listed on the Euronext 100 Index. This metric allows us to distinguish the type of diversification (mode), grouping it by organic or inorganic contribution to growth, and to identify cross-commonalities of resources.

The paper is structured as follows: the next section reviews the main literature on diversification, sunk costs and slack resources in relationship to innovation. In the section 'Research model', we introduce our novel conceptual framework. In the section 'Exploratory analysis', we offer an explorative analysis to test the likelihood of our hypotheses. We further discuss results, limits of the analysis, and managerial as well as practical implications. The last section presents concluding remarks and indications for future research.

## Literature review

### *Sunk costs and slack resources*

Studies on sunk costs can be categorised according to their epistemological orientation. In particular, there are two main streams on sunk costs, one looks at their intrinsic value, and one adopts a psychological approach. Studies adopt an intrinsic value perspective of sunk costs where managers rationally avoid new investments when there are previous unrecoverable expenses.

In the intrinsic value perspective, sunk costs represent investment that cannot be recovered through resale or repurposed within the firm (Tirole 1988). There is also a wealth of research in the field of psychology and the neurosciences on sunk costs fallacy, or the judgment error that causes individuals to pursue investments in failing previous endeavours (Arkes and Blumer 1985; Arkes 1991; Kahneman, Knetsch, and Thaler 1991; Arkes 1996); the sunk cost fallacy is seen as 'throwing good money after bad' (Parayre 1995, 418). Their negative influence on new investments, as well as on innovation, is widely stated in antecedent literature (Arkes and Blumer 1985; Stiglitz, McFadden, and Peltzman 1987; Conlon and Garland 1993; O'Brien and Folta 2009).

In contrast with evolutionary theory and sunk cost bias in judgment errors, some extant research argues that the evaluation of sunk costs is rather rational (Friedman et al. 2007; O'Brien and Folta 2009). O'Brien and Folta (2009) shed light on sunk costs, innovation intensity at an industry level, and relatedness in diversification. In the real options literature, scholars consider sunk costs as the shadow cost of incomplete information (Bellalah 2001).

More recent investigations make a further attempt to explore the relationship between sunk costs and R&D (Kaplan, Luski, and Wettstein 2003; Mànez et al. 2009). All of these studies largely agree on the negative role of sunk costs in innovation.

Beyond incurring sunk costs, the idiosyncrasy of investment and diversification can produce an excess of resources. Specifically, organisational slack is the extra resources eventually available for managerial discretionary use (Bourgeois 1981; March 1981; Moses 1992) and their quality of knowledge inventory (Levinthal and March 1993). Discretionary slack refers to excess flexible resources, which are usable in alternative ways (Bourgeois and Singh 1983). In contrast to sunk costs, slack can play a positive role in innovation (Bourgeois 1981; Singh 1986; Nohria and Gulati 1995, 1996; O'Brien 2003).

Nohria and Gulati (1997) suggest an inverse u-shaped relationship between slack and innovation, where small increasing quantities of slack are associated with positive innovative performance. Other scholars see slack resources as a source of strategic options (Renzi and Simone 2011).

### *Diversification and its interplay with innovation*

Diversification occurs when an existing firm enters into a new area of business (either through acquisition or internal growth) (Puranam and Vanneste 2016). As the authors indicate, in general, this decision implicitly implies that the corporation already owns part of the resources in the value chain of the new business. Thus, diversification has two main drivers: exploiting existing synergies through the employment of resources already in the firm's value chain; or gaining access to external, ready-made resources (Puranam and Vanneste 2016). The diversification mode can be related and unrelated: it is said to be related when the value chain of the joint businesses has a relevant strategic fit and exhibits cross-commonalities in terms of specialised resources and capabilities; it is said to be unrelated in the absence of such commonalities and strategic fit (Thompson, Strickland, and Gamble 2007).

Although diversification and performance have drawn the attention of many scholars over time (Ansoff 1957; Bettis 1981; Michel and Shaked 1984; Rajagopalan and Harrigan 1986; Varadarajan 1986; Lubatkin and Rogers 1989; Chatterjee and Wernerfelt 1991), the empirical evidence has been rather ambiguous, probably because the research domain is still evolving (Palich, Cardinal, and Miller 2000). Porter (1989) calls diversification the 'darling' and stepchild of management studies. After extensively reviewing 30 years of research in diversification and performance, Palich, Cardinal, and Miller (2000) hypothesise an inverted u-shaped dynamic between the two areas: 'diversification is positively related to performance across the low to moderate range of diversification and is negatively related to performance across the moderate to high range of diversification' (161).

One way to address the ambiguity of results is an explanation in terms of differences in resource cross-commonalities, distinguishing between related and unrelated diversification. Previously, Penrose (1959) argued that the diversification pattern is linked to the heterogeneity of resources. Similarly, Chatterjee and Wernerfelt (1991) propose a resource-related interpretation: knowledge-based resources and external financing can lead to related diversification, whereas internal equity is mostly utilised in association with the unrelated mode. Inherent flexibility of resources can lead to different evolutionary paths. In fact, several scholars reference knowledge relatedness in technology diversity and diversification strategy (Scherer 1965; Teece 1980; Miller 2006). Tanriverdi and Venkatraman (2005) propose a measure of cross-business knowledge synergy, which synthesises both the resource-based view of diversification and the economic theory of complementarities. At a firm level: this metric allows the capture of resource relatedness in product, customer, and managerial knowledge or their interplay.

Another locus in previous literature is the negative relationship between diversification and R&D (Hoskisson et al. 1993; Hitt, Hoskisson, and Kim 1997). Some scholars even argue that diversification and innovation are almost in opposition (Palepu 1986; Baysinger and Hoskisson 1989; Hoskisson, Hit, and Hill 1993). Others propose a contingent approach to firm diversification impact on innovation performance, where performance depends on the extent of the diversification in products and international markets (Chan Kim, Hwang, and Burgers 1989). The negative relationship between innovation and diversification might lead corporations to prefer innovation acquisition over in-house development (Hoskisson, Hit, and Hill 1993). There are also some exceptions: inter-dependency, at an industry level, of exploration and long-run performance can have positive implications (Vagnani 2015); thus, the relationship between type of diversification and innovation can be positive, depending on the strategic fit (Kim et al. 2013).

Even though diversification is negatively related to innovation performance, sometimes the discount can become a premium after refocusing on selected businesses (Campa and Kedia 2002), and in related diversification (Villalonga 2004).

However, we argue that a clear understanding of the relationship between diversification and innovation cannot disregard the diversification mode and its characteristics, as well as the relatedness of the resources.

### *Entropy metrics for diversification and resource relatedness*

Diversification can be measured in different ways. For instance, looking at sales and concentration is one way (Gort 1962). One of the most admired metrics is the entropy measure of industrial concentration initially proposed by Jacquemin and Berry (1979): it has been said that entropy is an additive measure, able to capture the relationship between the mode of diversification and corporate growth, as has been largely verified by later studies (Baysinger and Hoskisson 1989; Hoskisson et al. 1993). The entropy diversification metric has, thus far, been successfully adopted by scholars (Palepu 1985; Hoskisson et al. 1993; Tanriverdi and Venkatraman 2005; Kim et al. 2013).

## Research model

The degree and mode of diversification of the corporate parent can be expressed in terms of entropy: the more diversified inorganically, the greater the entropy. In contrast, organic growth and related diversification are linked to moderate levels of entropy. Entropy is a sign of the variety of resources in the value chain and offers a metric for cross-commonalities among joint businesses. When a firm can rely on some degree of resource variety, it is supposed to have more alternatives for exploiting internal opportunities. However, the reserve of resources acts as a cost. With regard to the nature of the resource reserves, which are internally differentiated, we argue they are slack resources. The breadth of the reserve depends on the heterogeneity of the portfolio of businesses owned by the parent. Some of the slack can be successfully recovered and employed for growth, when it is suitable to being recombined in original ways. Despite the benefits of resource variety, diversification is also a source of sunk costs. Based on past history, managers may be less willing to invest in R&D. They may prefer to opt for external acquisition of innovation to avoid further costs, uncertainty, and risk. In sum, there is a trade-off between diversification and R&D. We hypothesise a negative correlation between diversification and R&D, at least in the short-run. However, unrelated diversification can also offer long-run rewards in terms of innovative performance in view of the stock of strategic slack the firm has gathered over time. Hence, we further hypothesise that in companies that pursue unrelated diversification, there are positive long-run effects of strategic slack on innovative performance. Positive effects occur indirectly. In contrast, we argue that related diversification is associated with less slack resources than unrelated diversification. A smaller stock of slack resources could depend on stronger synergies among joint businesses: for the most part, resources are already in place, allocated

through the value chain. Though, sometimes more synergies can also mean more duplication and thus more available slack.

We also suppose there is a negative relationship between diversification and sunk costs: the more a firm can exploit synergies, the lower its sunk costs. The effect of slack resources can be further differentiated, distinguishing between strategic slack, valuable for innovation and growth, and unrecoverable slack, which is, de facto, a sunk cost. Strategic slack is prominent: it is available or easily recoverable, as happens for unabsorbed and potential slack. Therefore, we assume a positive correlation between strategic slack and innovation. Absorbed slack refers instead to already allocated or unrecoverable resources. Thus, we formulate the following list of hypotheses:

Hypothesis 1: R&D expenditures are negatively related to diversification and to sunk costs.

Hypothesis 2: R&D expenditures are positively related to strategic slack (unabsorbed and potential slack) and negatively related to absorbed slack.

Hypothesis 3: Unrelated diversification is positively related to strategic slack and negatively related to absorbed slack. (The reserve can be exploited for innovation in the long run, with such diversification gaining a premium reward.)

Hypothesis 4: Related diversification has a positive relationship with all types of slack resources. (The positive relationship with absorbed slack can explain the diversification discount.)

Hypothesis 5: The effect of strategic slack is greater in unrelated diversification than in related diversification.

The positive impact of some slack resources on R&D is rather clear, and so is the negative effect of sunk costs. On the other hand, diversification has an ambiguous effect on R&D and innovation. Previous findings generally underscore the negative dynamic between diversification and innovation. Our work addresses the issue of innovative performance at diversified firms. In general, we confirm a direct negative relationship between diversification and innovative performance.

However, distinguishing diversification mode and considering long-run effects, we hypothesise that unrelated diversification can have a positive impact on R&D and innovation due to a reserve of strategic slack. In fact, unrelated diversification encompasses more heterogeneity in slack resources and the corporate parent can use them to leverage future innovation. Thus, over time, unrelated diversification can be value creating and the reward can be a diversification premium.

In contrast, innovative performance and related diversification have a negative association. The positive relationship between related diversification and absorbed slack can explain the diversification discount, in the long run. Specifically: in the short-run, related diversification is more efficient than unrelated diversification. This situation can turn into a diversification premium for related diversified companies because relatedness of resources allows for synergy exploitation and a diversification discount for unrelated companies. However, in the long run, the situation is switched: related diversification can be value destroying. Related diversification is characterised by efficiency and managers can rely on less strategic slack for innovation. In this case, they might prefer to acquire innovation externally, adopting a myopic behaviour. At one point in time, there may be no more synergies to exploit; there is an excess of absorbed resources, which are useless for growth; and the corporation failed to grow innovation in time. On the other hand, unrelated diversification appears more effective in the long run for innovative performance goals.

## Exploratory analysis

### *Sample*

The sample includes companies listed on the Euronext 100 Index, the Index of highly capitalised European firms. They are all large companies, operating in heterogeneous sectors of industry, and mostly diversified. Data were gathered from the Osiris database for a period of five years, from 2006 to 2010. This database offers the overview on segment data per year.

The sample excludes financial companies as their diversification strategy largely follows a financial approach. Additionally, the sample excludes companies with most data missing. Other missing values were filled randomly with the proper Excel function. Zero values in the sample means there is marginal or almost no diversification. Some companies declare zero R&D expenditures for one or more years. In total, the manually cleaned data set includes 83 companies.

## Methodology

The model is tested through a longitudinal study. Extracted data are manipulated in order to correctly measure the set of variables over time. The first tests consist of descriptive statistics, correlation, and covariance among variables. Subsequently, we measured the mean value for each company in the five-year period. We use this data set for the summarised tables. This data set is also used to test for linear regression, either between R&D and the other single variables; or between single types of diversification and sunk costs and unabsorbed slack, respectively. Longitudinal observations were used similarly.

## Independent and control variables

We adopt the following entropy measure as a proxy for diversification and resource relatedness:

$$E = \sum_{i=1}^{n} \pi_i \ln (1/\pi_i), \tag{1}$$

where $\pi_i$ are the revenues for each firm's segment.

We distinguish among sectors of activity, grouping them by segment data provided in the Osiris database. Then, we compute two different entropy measures for each company: one for related and one for unrelated diversification.

For slack resources, we refer to the popular ease-of-recovery taxonomy (Bourgeois 1981; Singh 1986), distinguishing three types of slack: absorbed, unabsorbed, and potential slack. Thus, slack is measured as

Absorbed slack: general and administrative expenses to sales (Hambrick and D'Aveni 1988);
Unabsorbed slack: current ratio (current assets to current liabilities) (Palepu 1985; Singh 1986; Hambrick and D'Aveni 1988);
Potential slack: equity to debt ratio (Cheng and Kesner 1997).

We consider net investments to sales as a proxy for sunk costs. We also use different control variables such as size indicators: sales, revenues, and number of employees. These indicators are useful when characterising firm growth (Delmar, Davidsson, and Gartner 2003). We further control for sector activity for each business in the value chain.

## Dependent variables

In the linear regressions, we use two different dependent variables in subsequent tests. First, we test the dependence of R&D in terms of diversification; sunk costs, and organisational slack. We use the ratio of R&D investment to sales, following prior literature (Lecraw 1984; Bettis 1981; Chatterjee and Wernerfelt 1991). Second, we consider the relationship between unabsorbed slack and the two different types of diversification, respectively.

**Table 1.** Mean value for 2006–2010 of EuroNext 100 selected companies.

| Company name | Related diversification | Non-related diversification | Sunk costs | Absorbed slack | Unabsorbed slack | Potential slack | R&D to sales |
|---|---|---|---|---|---|---|---|
| ACCOR SA | 0.63 | 0.39 | 1.64 | 0.48 | 0.79 | 3.52 | 0.00 |
| AEROPORT DE PARIS SA | 0.69 | 0.35 | 2.67 | 0.37 | 1.00 | 1.13 | 0.00 |
| AIR FRANCE | 0.55 | 0.22 | 1.15 | 0.35 | 0.91 | 0.78 | 0.00 |
| AKZO NOBEL NV | 0.87 | 0.30 | 0.97 | 0.30 | 2.02 | 2.18 | 3.40 |
| ALCATEL LUCENT SA | 0.83 | 0.13 | 2.70 | 0.27 | 1.42 | 1.43 | 15.62 |
| ALSTOM SA | 0.69 | 0.63 | 1.14 | 0.25 | 0.85 | 1.30 | 3.16 |
| ANHEUSER-BUSCH INBEV | 0.40 | 0.38 | 1.37 | 0.22 | 0.73 | 1.13 | 0.31 |
| ARCELORMITTAL SA | 1.36 | 0.48 | 0.77 | 0.03 | 1.49 | 2.19 | 0.40 |
| ASML HOLDING N.V. | 0.71 | 0.70 | 1.40 | 0.20 | 2.60 | 4.02 | 12.86 |
| BEKAERT SANV | 0.47 | 0.28 | 0.90 | 0.31 | 1.64 | 1.73 | 2.54 |
| BELGACOM SA | 1.07 | 0.00 | 1.17 | 0.31 | 1.01 | 1.19 | 0.00 |
| BOUYGUES SA | 0.94 | 0.75 | 0.97 | 0.19 | 0.99 | 0.95 | 0.26 |
| BUREAU VERITAS SA | 2.02 | 0.00 | 0.60 | 0.42 | 1.25 | 0.42 | 0.00 |
| CAP GEMINI | 1.23 | 0.00 | 1.03 | 0.54 | 1.59 | 3.21 | 0.00 |
| CARREFOUR SA | 0.70 | 0.32 | 0.56 | 0.11 | 1.64 | 1.73 | 0.00 |
| CASINO GUICHARD PERRACHON | 1.06 | 0.50 | 0.75 | 0.12 | 0.86 | 0.88 | 0.00 |
| CHRISTIAN DIO SA | 0.88 | 1.02 | 1.81 | 0.22 | 1.45 | 0.86 | 0.20 |
| COMPAGNIE DE SAINT GOBAIN | 1.41 | 0.13 | 1.01 | 0.19 | 1.21 | 1.51 | 0.93 |
| COMPAGNIE GENERALE DES ETABLISSEMENTS MICHELIN (C.G.E.M.) SA | 0.66 | 0.39 | 1.03 | 0.33 | 1.66 | 1.31 | 3.30 |
| CORIO N.V. | 0.41 | 0.00 | 14.13 | 0.11 | 0.82 | 1.47 | 0.00 |
| DANONE | 1.06 | 0.00 | 1.15 | 0.15 | 0.33 | 0.96 | 1.09 |
| DASSAULT SYSTEMES SA | 0.50 | 0.00 | 1.34 | 0.44 | 2.44 | 1.01 | 23.65 |
| DELHAIZE GROUP SA | 0.38 | 0.49 | 0.47 | 0.16 | 1.06 | 1.47 | 0.00 |
| EDP – ENERGIAS DE PORTUGAL, S.A. | 0.49 | 0.00 | 2.04 | 0.16 | 0.17 | 0.47 | 0.00 |
| EIFFAGE | 0.64 | 1.17 | 1.85 | 0.25 | 0.92 | 0.19 | 0.00 |
| ELECTRICITÈ DE FRANCE SA | 0.72 | 0.24 | 2.80 | 0.23 | 1.04 | 0.61 | 0.56 |
| ESSILOR INTERNATIONAL SA | 0.24 | 0.00 | 1.00 | 0.33 | 1.81 | 4.84 | 4.54 |
| ETABLISSEMENTEN FRANZ COLRUYT N.V | 0.72 | 0.23 | 0.30 | 0.11 | 1.66 | 1.31 | 0.00 |
| EUROPEAN AEREONAUTIC DEFENCE | 1.12 | 0.11 | 1.71 | 0.24 | 0.84 | 2.30 | 6.64 |
| EUTELSAT COMMUNICATION SA | 0.68 | 0.32 | 10.92 | 0.87 | 1.66 | 0.52 | 0.00 |
| FRANCE TÈLECOM SA | 1.22 | 0.27 | 2.16 | 0.42 | 0.58 | 0.68 | 1.85 |
| FUGRO NV | 0.88 | 0.00 | 0.74 | 0.27 | 1.26 | 1.52 | 0.00 |
| GALP ENERGIA | 0.43 | 0.72 | 0.40 | 0.04 | 1.14 | 1.49 | 0.00 |
| GDF SUEZ | 1.08 | 0.15 | 0.95 | 0.11 | 1.18 | 2.04 | 0.23 |
| GECINA SA | 1.02 | 0.00 | 16.92 | 0.06 | 1.28 | 1.34 | 0.00 |
| GROUPE ERAMET SA | 1.05 | 0.00 | 1.22 | 0.19 | 2.62 | 9.57 | 1.23 |
| HEINEKEN NV | 0.62 | 0.48 | 0.97 | 0.23 | 0.89 | 1.20 | 0.42 |
| HERMES INTERNATIONAL SA | 0.89 | 0.76 | 1.08 | 0.24 | 2.47 | 26.26 | 0.00 |
| ICADE | 0.88 | 0.19 | 3.05 | 0.20 | 1.41 | 0.76 | 0.00 |
| ILIAD | 0.18 | 0.00 | 0.72 | 0.13 | 1.48 | 0.96 | 0.00 |
| IMERYS SA | 1.31 | 0.00 | 1.22 | 0.26 | 1.49 | 0.86 | 0.00 |
| JCDECAUX SA | 1.04 | 0.00 | 1.75 | 0.27 | 1.11 | 2.21 | 0.19 |
| JERONIMO MARTINS SGPS SA | 0.36 | 0.52 | 0.41 | 0.07 | 0.47 | 0.77 | 0.00 |
| KLEPIERRE SA | 0.95 | 0.00 | 8.85 | 0.26 | 0.57 | 0.36 | 0.31 |
| KONINKLIJKE AHOLD NV | 1.16 | 0.38 | 0.58 | 0.03 | 1.08 | 0.94 | 0.00 |
| KONINKLIJKE DSM N.V. | 1.46 | 0.17 | 1.14 | 0.20 | 1.91 | 2.75 | 0.75 |
| KONINKLIJKE KPN NV | 0.65 | 0.02 | 1.62 | 0.31 | 0.70 | 0.34 | 0.00 |
| KONINKLIJKE PHILIPS ELECTRONICS NV | 0.20 | 1.06 | 1.43 | 0.26 | 1.52 | 4.34 | 6.40 |
| KONINKLIJKE VOPAK N.V. | 0.02 | 0.11 | 1.95 | 0.36 | 0.86 | 1.04 | 0.00 |
| LAFARGE SA | 0.90 | 0.01 | 1.74 | 0.24 | 1.15 | 0.92 | 0.00 |
| LAGARDERE SCA | 1.04 | 0.36 | 1.47 | 0.22 | 0.92 | 1.36 | 0.00 |
| L'AIR LIQUIDE | 0.33 | 0.21 | 1.32 | 0.23 | 1.26 | 1.23 | 1.21 |
| LEGRAND | 0.39 | 0.55 | 1.52 | 0.49 | 1.07 | 1.32 | 3.01 |
| L'OREAL SA | 1.38 | 0.00 | 1.41 | 0.21 | 0.99 | 4.71 | 3.39 |
| LVMH MOET HENNESSY | 0.68 | 1.05 | 1.66 | 0.28 | 1.56 | 2.41 | 0.00 |

(*Continued*)

**Table 1.** Continued.

| Company name | Related diversification | Non-related diversification | Sunk costs | Absorbed slack | Unabsorbed slack | Potential slack | R&D to sales |
|---|---|---|---|---|---|---|---|
| PERNOD RICARD SA | 0.51 | 0.54 | 2.97 | 0.02 | 1.73 | 2.25 | 0.00 |
| PEUGEOT SA | 0.71 | 0.04 | 1.26 | 0.22 | 1.06 | 0.43 | 3.69 |
| PORTUGAL TELECOM SGPS SA | 0.47 | 0.39 | 2.50 | 0.33 | 1.40 | 0.29 | 0.00 |
| POSTNL N.V. | 0.76 | 0.04 | 0.94 | 2.09 | 0.73 | 0.85 | 0.00 |
| PPR S.A. | 1.49 | 0.11 | 1.38 | 0.16 | 0.90 | 1.58 | 0.00 |
| PUBLICIS GROUPE SA | 0.00 | 0.00 | 2.46 | 0.59 | 0.96 | 1.31 | 0.18 |
| RANDSTAD HOLDING NV | 0.77 | 0.00 | 0.23 | 0.65 | 0.23 | 3.09 | 0.00 |
| RENAULT | 0.00 | 0.00 | 1.01 | 0.19 | 0.95 | 0.66 | 4.87 |
| REXEL S.A. | 0.32 | 0.36 | 0.71 | 0.11 | 1.64 | 1.06 | 0.00 |
| ROYAL DUTCH SHELL PLC | 0.23 | 0.20 | 0.68 | 0.07 | 1.16 | 5.25 | 0.32 |
| SAFRAN | 1.07 | 0.13 | 1.50 | 0.35 | 1.03 | 2.01 | 7.85 |
| SANOFI | 0.34 | 0.00 | 2.55 | 0.43 | 1.54 | 6.69 | 15.70 |
| SCHNEIDER ELECTRIC SA | 0.47 | 0.85 | 1.70 | 0.26 | 1.49 | 1.94 | 2.37 |
| SES S.A. | 0.56 | 0.00 | 4.91 | 0.40 | 0.51 | 0.54 | 0.00 |
| SODEXO | 0.00 | 0.16 | 0.60 | 0.45 | 0.39 | 0.57 | 0.00 |
| SOLVAY SA | 0.00 | 1.04 | 1.28 | 0.06 | 2.08 | 2.11 | 5.37 |
| STMICROELECTRONICS N.V. | 1.06 | 0.04 | 1.45 | 0.17 | 2.81 | 4.13 | 19.25 |
| SUEZ ENVIRONNEMENT COMPANY SA | 1.07 | 0.03 | 1.46 | 0.30 | 0.82 | 0.49 | 0.00 |
| TECHNIP | 0.98 | 0.00 | 1.16 | 0.16 | 0.98 | 0.43 | 0.68 |
| THALES SA | 0.53 | 0.80 | 1.24 | 0.02 | 0.97 | 1.75 | 4.21 |
| TOTAL SA | 0.60 | 0.36 | 0.78 | 0.08 | 1.37 | 2.07 | 0.47 |
| UCB NV | 0.34 | 0.56 | 3.16 | 0.19 | 0.99 | 1.69 | 24.38 |
| UNIBAIL | 0.00 | 0.79 | 12.08 | 0.01 | 0.57 | 1.58 | 0.68 |
| VALLOUREC S.A. | 0.30 | 0.00 | 0.85 | 0.17 | 2.15 | 3.94 | 0.46 |
| VEOLIA ENVIRONMENT | 1.08 | 0.45 | 1.22 | 0.31 | 1.03 | 0.35 | 0.34 |
| VINCI | 0.73 | 0.59 | 1.56 | 0.26 | 0.91 | 0.45 | 0.00 |
| VIVENDI | 0.74 | 0.98 | 1.78 | 0.16 | 0.72 | 2.22 | 1.84 |
| WOLTERS KLUWER NV | 1.16 | 0.00 | 1.62 | 0.42 | 0.56 | 0.62 | 0.00 |

## *Analysis results*

Table 1 reports the mean values over the time range for each corporate parent.

According to our results, unabsorbed slack and potential slack are positively related to R&D; whereas the remaining other variables have a negative correlation with R&D.

Related diversification is positively associated with all three kinds of slack. Unrelated diversification is negatively associated with absorbed slack. The correlation and covariance results are presented in Tables 2 and 3, respectively.

Regression analysis largely confirms the model hypotheses. However, not all relationships are statistically significant. Table 4 synthesises the main relevant results of the one-way analysis of variance test.

Reported relationships are those of statistical significance, whereas all other relationships are omitted because of their scarce influence. The different regression tests confirm the following hypotheses at a significant statistical level:

R&D expenditures are a negative function of related diversification, and a positive function of unabsorbed and potential slack;
Sunk costs are a negative function of related diversification;
Unabsorbed slack is a positive function of unrelated diversification.
Absorbed slack is a negative function of unrelated diversification.

In sum, the results are largely consistent with the model hypotheses.

**Table 2.** Correlation of R&D, diversification, organisational slack, and sunk costs.

| Correlation among variables for EuroNext 100 companies | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Related diversification | Non-related diversification | Sunk costs | Absorbed slack | Unabsorbed slack | Potential slack | R&D to sales |
| Related diversification | 1 | | | | | | |
| Non-related diversification | −0.24734367 | 1 | | | | | |
| Sunk costs | −0.090252295 | −0.071165692 | 1 | | | | |
| Absorbed slack | 0.019375624 | −0.222339173 | −0.022743728 | 1 | | | |
| Unabsorbed slack | 0.030480983 | 0.101149433 | −0.116104631 | −0.127194404 | 1 | | |
| Potential slack | 0.023970834 | 0.111369093 | −0.08874438 | −0.050461406 | 0.462115047 | 1 | |
| R&D to sales | −0.120575993 | −0.00689929 | −0.038686964 | −0.004123419 | 0.381184241 | 0.092137709 | 1 |

**Table 3.** Covariance of R&D, diversification, organisational slack, and sunk costs.

| Covariance among variables for EuroNext 100 companies | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Related diversification | Non-related diversification | Sunk costs | Absorbed slack | Unabsorbed slack | Potential slack | R&D to sales |
| Related diversification | 0.159957513 | | | | | | |
| Non-related diversification | −0.031683609 | 0.102580083 | | | | | |
| Sunk costs | −0.102627081 | −0.064804267 | 8.083562528 | | | | |
| Absorbed slack | 0.001936707 | −0.017797267 | −0.016161023 | 0.062461384 | | | |
| Unabsorbed slack | 0.006621991 | 0.017597552 | −0.179311536 | −0.017267565 | 0.29506288 | | |
| Potential slack | 0.029524099 | 0.109846793 | −0.77702222 | −0.038837952 | 0.773033965 | 9.483799283 | |
| R&D to sales | −0.240910368 | −0.011038963 | −0.549488197 | −0.005148202 | 1.034390558 | 1.417492957 | 24.95655544 |

**Table 4.** Main results of ANOVA test for hypotheses.

| Summary of results: ANOVA test | | | | | | |
|---|---|---|---|---|---|---|
| | | gdl | SQ | MQ | *F* | *F* crit |
| R&D and related diversification | Regression | 1 | 30.11510833 | 30.11510833 | 1.194997736 | 0.277564238 |
| | Residual | 81 | 2041.278993 | 25.20097522 | | |
| | Total | 82 | 2071.394101 | | | |
| R&D and unabsorbed slack | Regression | 1 | 300.9765159 | 300.9765159 | 13.77025284 | 0.000377522 |
| | Residual | 81 | 1770.417585 | 21.85700723 | | |
| | Total | 82 | 2071.394101 | | | |
| R&D and potential slack | Regression | 1 | 17.58480505 | 17.58480505 | 0.693525544 | 0.407416572 |
| | Residual | 81 | 2053.809296 | 25.35567032 | | |
| | Total | 82 | 2071.394101 | | | |
| Unabsorbed and non-related diversification | Regression | 1 | 0.250564522 | 0.250564522 | 0.837294369 | 0.362887762 |
| | Residual | 81 | 24.23965453 | 0.299254994 | | |
| | Total | 82 | 24.49021905 | | | |
| Sunk costs and related diversification | Regression | 1 | 5.465091048 | 5.465091048 | 0.665202002 | 0.417121307 |
| | Residual | 81 | 665.4705988 | 8.215686405 | | |
| | Total | 82 | 670.9356898 | | | |

## Discussion

Our results shed light on the ambiguous effect of diversification on innovation, clarifying its impact on R&D and future growth with the simultaneous introduction of the two categories of slack resources and sunk costs.

The managerial relevance of our findings appears extremely notable since it contrasts with some antecedent results while filling a different literature gap. Previous studies have found a negative relationship between diversification and innovation (Baysinger and Hoskisson 1989; Hoskisson, Hit, and Hill 1991; Hoskisson et al. 1993).

We upend the previous results by distinguishing by diversification mode, sunk costs, and the nature of the underlying slack resources. Our main finding is that unrelated diversification does indeed have a positive influence on innovation. This effect occurs in an indirect manner due to strategic slack inventories. In fact, R&D is positively associated with unabsorbed slack, as is unrelated diversification. Strategic slack is used by the corporate parent in its R&D and innovation investment. We also find that related diversification is indeed linked to weak R&D expenditure. However, it is also negatively related to sunk costs: the more managers search for related business investments, the greater the synergies they can extract. Thus, related diversification can be chosen when the corporate goal is rationalisation as a means to reduce redundancies (Puranam and Vanneste 2006) through the exploitation of slack resources. Even potential slack has a positive influence on R&D: it can be deployed to leverage innovation as means to attract external financing and other types of resources. In brief, organic growth allows either the exploitation of synergies, such as consolidation or combination, or the utilisation of slack resources. In contrast, inorganic growth can lead both to customisation or the connection of synergies and the accumulation of more slack resources, which are useful for innovation. Considering the trade-off between efficiency and effectiveness; it can be said the first diversification mode (organic growth) is more efficient; the second (inorganic growth) is more effective. Unrelated diversified corporations gather knowledge inventories over time, thereby indirectly stimulating innovation. From a resource-based perspective, heterogeneity of resources fosters innovation (Chen 1996; Miller, Fern, and Cardinal 2007), which is driven by plastic resources such as unabsorbed and potential slack (O'Brian, 2003). The model also offers insights that explain the diversification discount and premium over time, distinguished by diversification mode. Maximising shareholder value with related diversification can lead to a diversification premium in the short-run; but it is value destroying in the long run. Unrelated diversification can lead to a diversification premium in the long run because it can maximise corporate goals and performance due to the role played by the heterogeneity of resources.

Our results also offer a practical guide for diversification decision-making according to corporate goals: when the aim is to rationalise and re-organise firm structure, then, related diversification is a better choice. In the case the aim is corporate growth through innovation, managers might prefer to invest in unrelated diversification. This longitudinal study allows the detection of changes over time in a more accurate manner than cross-sectional studies, along with an understanding of the temporal order of events.

We observed a reduction in the diversification degree over time as well. In particular, many companies seem to re-focus on related diversification. However, this strategic decision engenders a myopic approach to firm wealth in the long run, which is supposed to be mostly based on a firm's exploration capabilities.

## Conclusions

Despite the copious literature on the relationship between diversification and performance, we can state, with some dismay, that scholars have not presented clear evidence of its dynamics. Porter (1989) noted the large scale restructuring in diversified companies. Markides (1995) presented a similar observation, after examining 50% of the Fortune 500 in 1980. Strategists believe that 'refocusing efforts improve financial outcome' (Palich, Cardinal, and Miller 2000, 156). Rumelt (1982) underscores positive interactions between unrelated diversification and long-run performance in view of the heterogeneity of resources such diversification inherently encompasses. These examples of opposite viewpoints are emblematic of managerial issues in diversification studies.

In this study, we make an attempt to gain a clearer and less-obstructed understanding of the interplay between diversification and innovative performance, tackling different antecedent gaps. We distinguish the innovative performance of diversified firms basing on diversification mode, presence of sunk costs, and slack resources. We further explain the dilemma of the diversification discount and premium, considering the short- and long-run performance in the two different diversification modes.

According to our findings, related diversification is more likely to deplete slack resources over time, while unrelated diversification is more likely to be replete with slack resources. Thus, related diversification can be value destroying because of a poor dynamic with future growth through innovation. One reason for this may be that managers desperately seek synergies (Goold and Campbell 1998). Even if this behaviour appears rational, it actually endangers the corporate advantage. In the long run, unrelated diversification appears to be more effective for growth. Although our findings are relevant, the sample of analysis is relatively small. Replication studies on varied, larger scale samples with alternative and more robust testing techniques can offer more insights.

Future scholars can prove the positive impact of unrelated diversification on innovative performance. Another point deserving future attention is the dynamic between the diversification mode and the discount, taking into consideration the relatedness of slack resources. This could be further confirmed through future analysis, although other variables might explain the diversification discount and premium.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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