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ORIGINAL PAPER

Location is everything: Explorative and exploitative learning, non-scale free resources, and firm performance of German companies

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Abstract
A firm's aptitude to acquire new knowledge and simultaneously exploit existing capabilities is suggested to improve firm performance. Although resource endowment is important to achieve a balance between exploration and exploitation, the role of a firm's non-scale free resources on the exploration−exploitation and performance linkage has gained little attention. We transfer and apply the first longitudinal test of the exploration–exploitation and firm performance linkage in a German sample. We argue and replicate an inverted U-shaped relationship between relative exploration and firm performance. Further, we hypothesize the competition for and the access to non-scale free resources to moderate this relationship. While we do not find support for the latter, we reveal that the competition for non-scale free resources weakens the relationship between relative exploration and firm performance. We contribute to the exploration–exploitation literature by testing the proposed relationship between exploration–exploitation and firm performance in a different geographical setting, advancing the generalizability of this relationship. In order to do so, we make the commonly accepted measurement approach of Uotila et al. (Strateg Manag J 30:221–231. 10.1002/smj.738, 2009) applicable to German-speaking countries by translating, refining, and extending the dictionary proposed by March (1991) with more contemporary words. Moreover, we contribute by investigating the competition for non-scale free resources between companies in the context of exploration–exploitation. We thereby reveal lower competition for non-scale free resources as a success factor for improving the relationship between a firm's relative exploration orientation and its performance. This seems particularly important since Germany's economy has been confronted with a decline in its innovative strength and an eminent lack of skilled workforce in recent years.

Keywords Exploration–exploitation · Firm performance · Non-scale free resources · Geographical context

JEL Classification L26 · M10 · M54 · O32

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1 Introduction

The argumentation that organizations need to balance exploration and exploitation learning modes to prevent firms' failure, as proposed by March (1991), is commonly accepted in literature (e.g., Fourné et al. 2019; Úbeda-García et al. 2020). Exploitative learning is necessary to monetize current products, technologies, or business models, whereas explorative learning is crucial to react to environmental changes (March 1991; Tushman and O'Reilly 1996; Markides 2013). Pursuing both activities simultaneously is referred to as ambidexterity and proposed to support short-term success, while ensuring long-term survival (March 1991; Tushman and O'Reilly 1996; O'Reilly and Tushman 2013; Hill and Birkinshaw 2014).

Over the last two decades the topic of exploration–exploitation caught the interest of many scholars, which led to an increasing number of studies in this research stream (O'Reilly and Tushman 2013; Ozer and Zhang 2015; Yang et al. 2021). At the forefront, research empirically tests the theoretically proposed relationship between exploration–exploitation and performance (O'Reilly and Tushman 2013). For instance, ambidexterity, which is the ability to balance both activities, is revealed to have a positive influence on firm performance (e.g., Uotila et al. 2009; Hsu et al. 2013; Stettner and Lavie 2014; Vagnani 2015), firm survival (e.g., Hill and Birkinshaw 2014), and sales growth (e.g., Fernhaber and Patel 2012). In their review, O'Reilly and Tushman (2013) summarize that "organizational ambidexterity […] typically has a positive effect on firm performance." Organizational ambidexterity can be seen as "a topic of both immense practical importance and great theoretical opportunity" (O'Reilly and Tushman 2013). Especially the practical benefits became apparent in recent years when firms needed to adapt abruptly to changing environmental conditions, e.g., Covid19 pandemic or Russian attack on Ukraine (see, e.g., Osiyevskyy et al. 2020; Sheng and Saide 2021; Doblinger et al. 2022). While exploitation is crucial to monetize and to generate cash flow from today's business model, technologies, and innovations, exploration is essential to find the right answers to the problems arising from the crises, like changing customer behaviors, supply chain difficulties and inflation, to ensure long-term performance and survival (Luger et al. 2018; Osiyevskyy et al. 2020).

Many studies stress inherent trade-offs between the two learning modes (Kang and Kim 2020; Lavie et al. 2010; Levinthal and March 1993; March 1991). They highlight that both learning modes compete for the limited resources of the firm (Kang and Kim 2020; Lavie et al. 2010). Firms need to decide to what extent they allocate resources to exploration or exploitation activities, and consequently, focus on short-term productivity or long-term performance (March 1991; Geerts et al. 2018). In this allocation decision, firms also need to take into consideration the different resource types and their availability, as the resources required for the two learning modes differ. Exploration, which focuses on a firm's long-term viability, requires, for instance, greater financial resources for investments in new technologies or for skilled employees in research and development. Exploitation,

which concentrates rather on a firm's short term perspective, requires, for instance, sufficient operational resources to efficiently conduct production or follow routines (Osiyevskyy et al. 2020).

In the competition for resources, especially non-scale free resources are of particular interest in recent literature (Kang and Kim 2020). Scale-free resources, for instance patents, include resources that are not limited by the number of firm operations dealing with these resources. In other words, they are not limited by a number of usable quantity (Kang and Kim 2020; Levinthal and Wu 2010). In contrast, non-scale-free resources, such as knowledge by specialized workers, are limited to a subject number of accessible quantity and constrained by opportunity costs (Kang and Kim 2020; Levinthal and Wu 2010). Non-scale free resources are particularly required to promote explorative learning, as they are related to "experimentation, play, flexibility, discovery, innovation" (March 1991, p. 71; Kang and Kim 2020). Hence, non-scale free resources are essential for explorative learning, but limited in their availability, which makes it essential to achieve the balance between exploration–exploitation (Kang and Kim 2020; Levinthal and Wu 2010).

Although literature mostly agrees on the positive relationship between exploration–exploitation and performance (e.g., O'Reilly and Tushman 2013; Uotila et al. 2009), empirical studies supporting this conclusion are predominantly based on U.S. American companies in their samples (e.g., Uotila et al. 2009; Patel et al. 2013). As stated above, explorative learning is closely linked to experimentation or risk taking due to the unpredictable results (García-Granero et al. 2015). Risk taking tendencies highly vary between countries, which challenges prior findings as they might only be applicable to countries and regions with a comparable uncertainty avoidance profile (Hofstede and McCrae 2004; Li et al. 2013). In this vein, the U.S. were found to have higher R&D expenditures than other countries, such as Germany (Li et al. 2013). Hence, to generalize the finding of exploration–exploitation and performance, it is advisable to replicate this relationship across different countries with varying uncertainty avoidance profiles.

Moreover, availability, competition for and access to resources, i.e. of non-scale free resources, also differ among countries (Schandl et al. 2018). In recent years, the innovative strength of the German economy declined and Germany is also confronted with a severe shortage of skilled workers (Naudé and Nagler 2021). German companies currently face an increased competition for non-scale free resources, such as employees. Consequently, it is important to know, first, whether the exploration–exploitation and firm performance relationship also applies for Germany; second, whether this relationship can be promoted with non-scale free resources; and third, whether the location of the company beyond the country level, e.g., regions within Germany, matters.

To address these research questions, we hypothesize and test the curvilinear and inverted U-shaped relationship between a firm's relative exploration orientation and its performance in a German firm sample. Furthermore, we argue non-scale free resources to moderate this inverted U-shaped relationship. More precisely, building on the work of Kang and Kim (2020), we hypothesize that competition for non-scale free resources will weaken the relationship between relative exploration orientation and firm performance, whereas the access to these resources will intensify

this relationship. We test our hypotheses in a longitudinal study of DAX, MDAX, and SDAX firms between 2006 and 2015, with the help of a content analysis (e.g., Uotila et al. 2009; Luger et al. 2018).

We find and confirm an inverted U-shaped relationship between a firm's relative exploration orientation and firm performance in a longitudinal study in Germany. Furthermore, we find lower competition for non-scale free resources to intensify this relationship. With our study we make several contributions: First, we contribute to the exploration–exploitation literature by testing the proposed relationship between exploration–exploitation and firm performance in a different geographical setting, namely Germany. We are able to replicate the formerly proposed inverted U-shaped relationship between relative exploration orientation and performance, and hence, improve the generalizability of this relationship. The results remain robust, even in more risk-averse countries, such as Germany. Second, we contribute to the exploration–exploitation literature by making the predominantly used measurement approach for large scale and longitudinal studies (Uotila et al. 2009) also applicable to German speaking countries by translating, refining, and extending the dictionary proposed by March (1991) with more contemporary words. Third, we contribute to the exploration–exploitation literature by emphasizing the importance of non-scale free resources. We reveal that especially the competition for non-scale free resources hampers the relationship between exploration–exploitation and firm performance. Therefore, the location of the business, beyond a country-level perspective, is an important factor for firm performance.

Furthermore, we also make valuable contributions for practitioners. Our study implies that firms should strive to balance explorative and exploitative activities in order to gain a better performance. It highlights the relevance for firms to explore future opportunities, while improving current business models, innovations, and technologies. When being confronted with location decisions of a new headquarter, for instance, our study suggests companies should consider areas with lower competition for non-scale free resources.

2 Theory and hypotheses

2.1 Exploration−exploitation

March (1991) defines two significantly different learning modes—exploration and exploitation—in his seminal work. Exploitation includes activities, such as "refinement, choice, production, efficiency, selection, implementation, execution" (March 1991, p. 71). Exploration comprises activities, such as "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March 1991, p. 71). March (1991) emphasizes the fundamental differences and incompatibilities between explorative and exploitative learning activities and their competition for scarce resources. These differences require different strategies, cultures, and organizational structures (Raisch and Birkinshaw 2008; O'Reilly and Tushman 2013). However, the broad consensus is that balancing

exploration–exploitation leads to a better firm performance and secures firm survival in the long-term (March 1991; O'Reilly and Tushman 2013).

The framework by March (1991) has rapidly gained attention (see, for instance, reviews by Lavie et al. 2010; Fourné et al. 2019; Stelzl et al. 2020), and subsequently, has been applied in various research streams. Exploration and exploitation have been linked to theories such as absorptive capacity (Jansen et al. 2005; Rothaermel and Alexandre 2009; Swift 2016), dynamic capabilities (O'Reilly and Tushman 2008; Taylor and Helfat 2009; Monferrer et al. 2021), innovation and technology management (Tushman and O'Reilly 1996; He and Wong 2004; Ambos et al. 2008; Yang et al. 2021), and organizational adaptation and learning (Kang and Snell 2009; Levinthal and March 1993; McGrath 2001; Úbeda-García et al. 2020). As proposed by March (1991), exploration–exploitation may be associated with resource constraints, but those have not been reflected comprehensively in research. Therefore, recent scholars draw the connection to scale-free and non-scale free resources (Kang and Kim 2020) to investigate their value for a firm's exploration and exploitation.

Studies deduced and discovered several outcomes of exploration–exploitation, with a predominant focus on firm performance (Simsek 2009; Stelzl et al. 2020). The believe that exploration–exploitation positively influences firm performance is widely spread and accepted among leading publishers (O'Reilly and Tushman 2013; Stelzl et al. 2020; Úbeda-García et al. 2020). However, empirical studies still face some challenges that prevent further application and dissemination of the exploration–exploitation literature, such as the regional focus on U.S. samples, concentration on several industries, different methodological settings with scarce longitudinal designs and different exploration–exploitation measures (Junni et al. 2013; O'Reilly and Tushman 2013). In order to grasp the reasons for this phenomenon and to gain a better understanding, we first review prior empirical findings on the relationship between exploration–exploitation and firm performance. In this vein, we identified 19 articles that investigate the relationship between exploration–exploitation and performance, published in well-known journals. Table 1 lists the results.

We find several different approaches to measure exploration–exploitation. For instance, Herhausen (2016), apply a scale for proactive and reactive market orientation developed by Narver et al. (2004). Jansen et al. (2012) use a six-item scale to grasp the degree to which business units move away from existing knowledge to pursue discontinuous innovations. Similarly, Chang and Hughes (2012) measure exploitative innovation using an adapted four-item scale from Jansen et al. (2006). These studies have in common that they use cross-sectional survey data. Acknowledging their results and insights, using cross-sectional survey data carries some disadvantages, such as subjective assessments and challenges to create panel data that are less susceptible to, for instance, singular effects (van Assen 2020). Besides surveys, only a few studies use a measurement approach applicable for longitudinal designs. Belderbos et al. (2010), for instance, conduct a patent analysis. Lin et al. (2007) investigate alliance data on the formation of explorative or exploitative alliances. Uotila et al. (2009) developed a content analysis approach to measure the relative exploration versus exploitation orientation that Luger et al. (2018) and Gatti et al. (2015) adopt.

Table 1 Literature review on empirical findings of exploration–exploitation and performance

Authors/year	Journal	Sample	Data collection	Measurement of exploration–exploitation	Dependent variable	Measurement of dependent variable	Exploration–exploitation and performance
Belderbos et al. (2010)	*Journal of Product Innovation Management*	168 firms from Japan, the United States and Europe—1996–2003	Patent analysis	Balanced (continuous)	Firm performance	Objective	Positive
Cao et al. (2009)	*Organization Science*	122 firms from China—2006	Surveys	Balanced (subtraction) and combined (multiplication)	Firm performance	Subjective	Positive
Chang and Hughes (2012)	*European Management Journal*	243 firms from Scotland—2009	Surveys	Combined (multiplication)	Business performance	Subjective	Positive
Ebben and Johnson (2005)	*Strategic Management Journal*	144 Firms from the United States—2005	Surveys	Balanced (continuous)	Firm performance	Objective	Negative
Gatti et al. (2015)	*Journal of Business Research*	460 firms from the United States—1989–2008	Content analysis	Only exploration and exploitation counts	Firm performance	Objective	Positive
He and Wong (2004)	*Organization Science*	206 from Singapore and Malaysia—1999–2000	Surveys	Balanced (subtraction) and combined (multiplication)	Firm performance	Subjective	Positive
Herhausen (2016)	*Journal of Business Research*	167 firms from Switzerland	Surveys	Only proactive and responsive market orientation	Market performance	Subjective	Positive
Hsu et al. (2013)	*Journal of World Business*	207 firms from Taiwan—2000–2005	Analysis of firm websites	Balanced (subtraction)	Firm performance	Objective	Positive
Jansen et al. (2012)	*Strategic Management Journal*	285 firms from Europe—2012	Surveys	Combined (multiplication)	Unit performance	Subjective	Positive

Table 1 (continued)

Authors/year	Journal	Sample	Data collection	Measurement of exploration–exploitation	Dependent variable	Measurement of dependent variable	Exploration–exploitation and performance
Junni et al. (2013)	*Academy of Management Perspectives*	Meta-analysis of 17 studies on the exploration–exploitation and performance relationship	Consolidation of datasets of prior studies	Balanced (subtraction and continuous) and combined (sum and multiplication)	Performance	Objective and subjective	Positive
Lin et al. (2007)	*Management Science*	95 firms from the United States—1988–1995	Analysis of SDC database (acquisitions)	Balanced (continuous)	Firm performance	Objective	Positive
Lubatkin et al. (2006)	*Journal of Management*	139 firms from the United States—2005	Surveys	Combined (sum)	Relative firm performance	Subjective	Positive
Luger et al. (2018)	*Organization Science*	57 global insurance firms—1999–2014	Content analysis	Balanced (continuous)	Firm performance	Objective	Positive/negative (depending on context)
Morgan and Berthon (2008)	*Journal of Management Studies*	160 firms from the United Kingdom—2007	Surveys	Combined (multiplication)	Business performance	Subjective	Positive
Partanen et al. (2020)	*International Journal of Production Economics*	204 firms from Sweden—2018	Surveys and database analysis	Combined (multiplication)	Firm performance	Objective	Negative
Patel et al. (2013)	*Academy of Management Journal*	215 firms from the United States—2009	Surveys	Balanced (subtraction) and combined (sum)	Firm growth	Objective	Positive

Table 1 (continued)

Authors/year	Journal	Sample	Data collection	Measurement of exploration–exploitation	Dependent variable	Measurement of dependent variable	Exploration–exploitation and performance
Rothaermel and Alexandre (2009)	*Organization Science*	141 firms from the United States—2000–2003	Surveys	Balanced (continuous)	Firm performance	Objective	Positive
Stettner and Lavie (2014)	*Strategic Management Journal*	190 firms from the United States—1990–2001	Analysis of Thompson's SDC database and analysis of press items	Balanced (continuous)	Firm performance	Subjective	Positive
Uotila et al. (2009)	*Strategic Management Journal*	279 firms from the United States—1989–2004	Content analysis	Balanced (continuous)	Firm performance	Objective	Positive

Overall, 16 of the 19 studies constitute that the simultaneous pursuit of explorative and exploitative activities leads to a higher performance and one other study reveals that it depends on the context, whether the link is positive or negative. Excluding a meta-analysis (Junni et al. 2013) in our sample, seven studies use subjective performance measures, 10 studies apply objective performance measures, and one study uses both, subjective and objective performance measures. Interestingly, from the 11 studies including objective performance measures, seven use a U.S.-American sample and two studies use a global or multi-region sample. The remaining two studies investigate companies from Sweden and Taiwan.

While the results of the studies using an objective performance measure in U.S.-American samples seem mainly robust, we find some contradicting results in different samples. Partanen et al. (2020), for instance, report a negative relationship between exploration–exploitation and firm performance, investigating Swedish companies. In contrast, Hsu et al. (2013) and Morgan and Berthon (2008) find a positive relationship in their samples in Taiwan and the United Kingdom. When investigating insurance companies in a global sample, Luger et al. (2018) find that the context characterized by incremental or discontinuous change determines whether the relationship between exploration–exploitation and firm performance is positive or negative. Besides these contradicting results, it is worth noting that European countries, and especially German companies, seem underrepresented in these studies. We argue that it is worth examining German companies and the relationship between exploration–exploitation and firm performance to gain valuable insights about the transferability of former study results in the German area. Since Germany is a highly developed country and one of the most important industry nations (Sommer 2015), struggling with a lack of highly-qualified human capital (Naudé and Nagler 2021), studies dealing with this context could deliver new and helpful insights regarding the theory and relation of exploration–exploitation and firm performance.

2.2 Exploration–exploitation and firm performance in German companies

Pursuing exploration and exploitation can be theoretically linked to superior performance. Exploitation is associated with increasing efficiency and stability (Uotila et al. 2009; Lavie et al. 2010) that leads to short-term success (Raisch and Birkinshaw 2008; Uotila et al. 2009; O'Reilly and Tushman 2013). Exploration, in contrast, is linked to variance increasing activities, flexibility, new knowledge and capability creation that help a firm to adapt to environmental changes and to survive in the long-term (Uotila et al. 2009; Lavie et al. 2010).

A primary focus on either one of both activities—exploration or exploitation—might lead to negative consequences for the firm. Exploitation generates stability, but at the cost of flexibility (Lavie et al. 2010). The resulting short-term success of exploitation encourages a firm to overexploit current competencies that in turn can end in a competence or success trap, if a firm is not able to react to environmental changes anymore (Levitt and March 1988; Raisch and Birkinshaw 2008; Lavie et al. 2010; Úbeda-García et al. 2020). In contrast, explorative activities require resource spending and time, scope, and returns are hard to estimate a priori (Raisch and

Birkinshaw 2008; Uotila et al. 2009; Stelzl et al. 2020); thus, exploration is linked to uncertainty. An exclusive or predominant focus on exploration (overexploration) may end in a vicious circle of "search, failure, and unrewarding change" (Raisch and Birkinshaw 2008, p. 392). In the so called failure trap, a firm never exploits the returns (Levinthal and March 1993; Raisch and Birkinshaw 2008; Úbeda-García et al. 2020). An exclusive or predominant focus on exploitation (overexploitation) may end in performance distress, as research and development of innovations is neglected and former inventions may become obsolete, as the environment alters over time (Kang and Kim 2020; Uotila et al. 2009).

Balancing exploration–exploitation enables organizations to avoid these performance-impairing risks and increases their performance (He and Wong 2004; Cao et al. 2009). As the cultural imprint of uncertainty avoidance may play a role for explorative activities (García-Granero et al. 2015), we compared the uncertainty avoidance scores of the countries that were investigated in prior studies. As outlined above, prior studies use companies from Taiwan (Hsu et al. 2013) and Switzerland (Herhausen 2016). Both countries show a similar uncertainty avoidance scores like Germany (Li et al. 2013) and the relationship was found to be positive. Thus, we argue that balancing exploration–exploitation increases firm performance also in a German sample (Hsu et al. 2013; Li et al. 2013; Herhausen 2016), which means at medium levels of a firm's relative exploration orientation firm performance is highest. A firm's relative exploration orientation describes the level of exploration compared to the level of exploitation (Uotila et al. 2009). Specifically, a low degree of relative exploration orientation implies a firm's intensified focus on exploitative activities, while a high degree of relative exploration orientation suggests a firm's intensified focus on explorative activities. Therefore, firms must balance exploitation and exploration activities to ensure the short-term success and simultaneously be prepared to react to environmental changes to ensure long-term survival (March 1991). Put formally:

Hypothesis 1 The relationship between a firm's relative exploration orientation and its performance is curvilinear and inverted U-shaped.

2.3 *Moderating effect of the role of non-scale free resources*

Firm resources are a central aspect in strategic management due to their important role for corporate success (Kang and Kim 2020; Makhija 2003). The resource-based view from the mid of past century (Penrose 1959) considers internal firm resources and capabilities as being substantial for profit and value creation (Kraaijenbrink et al. 2010; Makhija 2003; Penrose 1980). Based on the resource-based view, the knowledge-based view of the firm is proposed to highlight the increasing importance of intangible knowledge as a firm's most important strategic resource to gain a competitive advantage (Grant 1996). More recently, management scholars distinguish between scale-free and non-scale-free resources (Levinthal and Wu 2010; Chen et al. 2019; Kang and Kim 2020; Giarratana et al. 2021). Scale-free resources, for instance patents, include resources that are not limited by the number

of firm operations dealing with these resources. In other words, they are not limited by a number of usable quantity (Kang and Kim 2020; Levinthal and Wu 2010). Conversely, non-scale-free resources, such as knowledge by specialized workers, are limited to a subject number of accessible quantity and constrained by opportunity costs (Kang and Kim 2020; Levinthal and Wu 2010). It means, firm resources should be allocated in a way that the use of scale-free resources is not impeded, while the use of non-scale-free resources is optimized (Kang and Kim 2020; Levinthal and Wu 2010).

Resource allocation in this context is particularly relevant, as the access to resources constitutes a substantial restriction in balancing exploration–exploitation (Kang and Kim 2020; March 1991). In Hypothesis 1, we attribute a firm's relative exploration orientation to its performance. We argue that this relation is directly affected by a firm's resource allocation, more precisely that of non-scale free resources. We aim to build on the work of Kang and Kim (2020) and further elaborate on the role of non-scale free resources, i.e., competition between firms for and access to these resources. We suggest that a lower competition and a better access to non-scale free resources improve the relation between relative exploration orientation and firm performance due to the following reasons:

First, to exert exploration and exploitation, firms need both—scale- and non-scale free resources. Using March's (1991) definition of exploitation, we argue that "production, efficiency, selection, implementation, execution" (March 1991, p. 71) need scale-free resources. In contrast, non-scale free resources are required to promote explorative activities, as they are related to "experimentation, play, flexibility, discovery, innovation" (March 1991, p. 71). Non-scale free resources are a crucial determinant to achieve a balance in exploration–exploitation, as these are limited in contrast to scale free resources (Kang and Kim 2020; Levinthal and Wu 2010). Consequently, the availability and accessibility of non-scale free resource are both requirements to being able to use these non-scale free resources.

Second, competition between firms can indeed be a driving force for innovation and progress; but when referring to competition for resources, the competition for non-scale free resources might be at the particular center of interest between firms, since they are limited in their quantity (Kang and Kim 2020; Levinthal and Wu 2010). In close proximity to each other, we suggest that this competition may hamper firms' relation between relative exploration and performance. For instance, excellent universities produce a very skilled workforce with excellent general and specialized knowledge, which represents a non-scale free resource. Prior research already revealed that university research nearby firms creates knowledge spillovers and that proximity to these research institutions and their reputation play a vital role in this regard (Audretsch and Lehmann 2005). Those spillovers are likely to promote explorative activities. In the ongoing so-called war for talents, which is intense in Germany due to the eminent lack of skilled workforce (Naudé and Nagler 2021), firms highly compete around these resources. This not only requires suitable strategies to cope with these resource constraints, but is also linked to higher costs for higher wages, for instance, to attract new skilled employees (Schmid et al. 2014; Naudé and Nagler 2021). Competition for non-scale free resources lowers the possibility to acquire the needed non-scale free resources. A better access to non-scale

free resources, in turn, improves the possibility. Consequently, competition for and access to non-scale free resources influences the link between a firm's relative exploration orientation and firm performance (Kang and Kim 2020).

We argue that high competition between firms lower the possibility to acquire non-scale free resources, and hence, hampers the effects of relative exploration orientation on firm performance, i.e., lowering the inverted U-shape. Vice versa, we argue a better access to non-scale free resources to improve the relationship between relative exploration orientation and firm performance. Put formally:

Hypothesis 2a The curvilinear and inverted U-shaped relationship between a firm's relative exploration orientation and firm performance is weakened by the competition for non-scale free resources.

Hypothesis 2b The curvilinear and inverted U-shaped relationship between a firm's relative exploration orientation and firm performance is intensified by the access to non-scale free resources.

3 Methodology

3.1 Sample

To test our hypotheses, we investigate firms of the DAX, MDAX, and SDAX indices in a longitudinal data set for the years 2006–2015. These indices seem suitable for our study as they represent leading benchmarks of the German economy. To avoid survivorship bias in the sampling, we include all firms that were listed at least once between 2006 and 2015. We exclude all firms mainly active in the finance, insurance, or real estate industry, as in these industries, accounting variables have a limited informative character compared to other industries (Villalonga and McGahan 2005; Uotila et al. 2009; Vaaler and McNamara 2010). The resulting final sample encompasses 106 firms and 685 firm years. Our sampling period contains the financial crisis of 2008/2009. To test the impact of the financial crisis on our results, we performed an additional robustness test (see robustness section).

To measure exploration–exploitation through a content analysis, the required news articles were obtained from Nexis database. Financial data were collected from Capital IQ database and geographical statistical information were received from the German Federal Statistical Office, Eurostat and information on the firms' headquarters from firm websites and Google Maps.

3.2 Dependent variable

In line with previous scholars (Wang and Li 2008; Uotila et al. 2009; Belderbos et al. 2010; Gatti et al. 2015; Kang and Kim 2020), we measured firm performance with Tobin's Q, which is the firm's market-to-book ratio (Wang and Li 2008; Uotila et al. 2009). Tobin's Q as performance measurement was primarily chosen because

of the two subsequent reasons. First, as noted above, the performance effects of explorative and exploitative activities greatly differ in terms of time (Birkinshaw and Gupta 2013). While benefits of exploration are more distant in time (Gatti et al. 2015), exploitative endeavors often result in quick returns (He and Wong 2004). As a multidimensional performance measurement Tobin's Q manages to capture both short-term and long-term performance (Lubatkin and Shrieves 1986; Uotila et al. 2009; Kang and Kim 2020). Second, since this variable is characterized to be forward-looking (Belderbos et al. 2010) it avoids the concern of time lag between search activities and accounting-based performance (Wang and Li 2008). Therefore, potential returns from current endeavors are considered even though they might be capitalized several years later.

3.3 Independent variables

3.3.1 Exploration–exploitation

Prior research (e.g., Uotila et al. 2009) introduced a content analytical approach of publicly available news as an alternative approach to collect data on the exploration–exploitation level of a firm and to overcome the challenges of the existing measurement approaches. Surveys are a common instrument to measure exploration–exploitation (e.g., Jansen et al. 2012; Patel et al. 2013; Herhausen 2016), but they are often limited in their generalizability, applicability, and temporal scope (Balboni et al. 2019). Patent analyses as another data collection method are useful for building a longitudinal research design, but they have their own limitations in terms of the patentability and acceptance of inventions, as well as the varying propensity for patenting across industries and countries (Belderbos et al. 2010; Bendig et al. 2020). The use of content analysis allows for a longitudinal research design across various industries.

Indeed, automated word counting within content analyses was also challenged to neglect important information of semantic or structural word occurrences (Carley and Palmquist 1992). However, previous studies test and reveal that both approaches, automatically and manually coded phrases, deliver highly correlated results (Laver and Garry 2000). In the particular case of content analysis to measure exploration–exploitation, Uotila et al. (2009) additionally manually code the firm actions of a subsample. They also find a high correlation between both approaches (Uotila et al. 2009). Hence, we aim to use an automated content analysis to measure exploration and exploitation.

In line with previous papers, which used an automated content analysis, we operationalize the exploration–exploitation construct on the firm level (Uotila et al. 2009; Gatti et al. 2015; Luger et al. 2018). By selecting publicly available text units for the content analysis, a high degree of transparency and systematization is ensured (Kassarjian 1977). Furthermore, computer-assisted content analyses are less subjected to biases or errors of humans. Following Uotila et al. (2009), we took an outside-in perspective analyzing and interpreting explorative and exploitative activities based on publicly published newspaper articles. In line with prior studies (Rothaermel and

Table 2 Search items used for content analyses (e.g., Uotila et al. 2009; Luger et al. 2018) based on March's (1991) definition

Exploration	Exploitation
Search	Refinement
Variation	Choice
Risk taking	Production
Play	Efficiency
Flexibility	Selection
Discovery	Implementation
Innovation	Execution

Alexandre 2009; Boumgarden et al. 2012; Gatti et al. 2015), we collected textual data in the form of newspaper articles from the Nexis database that provides access to 271 German newspapers. Because the underlining sample solely includes companies listed on the German stock exchange, the content analysis was conducted and evaluated exclusively based on news in German language.

We searched for the firm names in the headlines, in the introduction, and in the keyword tags of the newspaper articles. Furthermore, the name of the firm has to occur at least three times in the article to reduce the degree of irrelevant news documents and therefore ensure a high relevance of collected data. The collection process resulted in 334,036 newspaper articles.

Prior works (e.g., Vagnani 2015; Luger et al. 2018; Uotila et al. 2009) operationalized the definition of March (1991) as search items in their content analyses. Table 2 shows the used search items. However, the definition of March (1991) dates back to the beginning of the nineties and only includes a limited scope of words. Furthermore, relying on the definition of March (1991) creates a language barrier, making this method only applicable to English speaking countries. Hence, we aim to generate a dictionary for German speaking countries and publications with more contemporary words, measuring exploration and exploitation. In line with prior works (e.g., Olsen et al. 2016; Yi et al. 2020; Grimpe et al. 2021) we aim to generate a new dictionary to capture exploration and exploitation.

In our approach we were guided by previous works that applied an open iterative process to conduct a content analysis (Vergne 2012; Olsen et al. 2016; Grimpe et al. 2021): In a first step, we asked we asked three graduate students that have already dealt intensively with the topic of exploration and exploitation to develop a new dictionary to capture new developments. They read recent research publications, company publications (e.g., annual reports), and news articles. After an intense search, they proposed 383 words, which might describe explorative activities and 376 words, which can be associated with exploitative activities.

Second, another two graduate students, who are also acquainted with the topic, were asked to validate the dictionary. By using a keyword in context analysis, they ensured that the words are used in the right context. This means, inappropriate word constellations are excluded, e.g., 'internet explorer', which do not have anything to do with exploration (Uotila et al. 2009). Afterwards, the students screened the context in which the search words occurred and decided whether the search word

is really pointing towards an explorative or exploitative activity. For instance, we found the word flexible to be used to describe materials 'flexibler Kunststoff' ('flexible polymer' in English), which is indeed not describing exploration or exploitation.

Third, to operationalize explorative and exploitative tendencies we included all words with a minimum validation level of 60%, which means that on average in 60% of the cases the search word is useful to capture exploration–exploitation. The resulting final set of words includes 34 key words to measure exploration, and 30 key words to measure exploitation. Collectively, on a validation level of 60%, 21,117 word counts either referring to exploration or exploitation were detected. For instance, to gather data on exploration, our dictionary includes the German word 'experimentell', which stands for the English word 'experimental', at a validation level of 86.49%, 'innovative', which means 'innovative' in English at validation level of 94.74% and 'Durchbruch'—'breakthrough' in English—at a validation level of 76.92%. To extract data for exploitation, our dictionary comprises, for instance the words 'Verfeinerung', 'Zentralisierung', and 'Konsistenz' ('refinement', 'centralization', and 'consistency' in English) at validation levels of 80.00%, 87.50% and 70.00%. The list with the complete applied dictionary is depicted in Table 3.

In line with Uotila et al. (2009) and Vagnani (2015), the explorative orientation of a firm is calculated as the amount of explorative words divided by the sum of explorative and exploitative words per firm and year. In doing so, explorative orientation is defined as continuous variable; hence, exploitative orientation is accordingly derived from one minus explorative orientation. To identify the supposed inverted U-shape this study includes a nonlinear quadratic term of relative exploration orientation, which is the most common specification (Lind and Mehlum 2010).

3.3.2 Non-scale free resources

For our moderating variable *competition for non-scale free resources,* we measured the distance to the other companies within our sample. We operationalized the variable by counting the number of companies within 30-km proximity. As shown in the robustness section, we performed additional models using different kilometer cut-off values.

To measure *access to non-scale free resources,* we identified all universities and universities of applied sciences in Germany. Subsequently, we measured again the distance between our sample firms and the more than 340 universities and universities of applied sciences. We operationalized the variables by counting the number of universities and universities of applied sciences within 30-km proximity to the firms' headquarters. Again, we performed several robustness tests, as discussed later.

3.4 Control variables

We used several control variables that have been previously tested in the exploration–exploitation literature. Firm size and firm age as well as the leverage ratio, long-term asset intensity, and availability of cash are included in the model. Additionally, year dummies are incorporated.

Table 3 Developed German word dictionary on exploration and exploitation

Exploration		Exploitation	
1	Experiment	1	Effizienzen
2	Experimentell	2	Effizienz
3	Experimentator	3	Ausführend
4	Experimentieren	4	Verfeinerung
5	Experimentiert	5	Ausnutzen
6	Experimentierend	6	Zentralisierung
7	Flexibilität	7	Zentralisierend
8	Innovieren	8	Konsistenz
9	Innovation	9	Verbesserung
10	Innovativ	10	Steigernd
11	Innovator	11	Evolutionär
12	Anpassen	12	Exzellenz
13	Angepasst	13	Exzellent
14	Vorausschauend	14	Expertise
15	Durchbruch	15	Feinabstimmen
16	Auf dem neuesten Stand	16	Feinabstimmung
17	Dezentralisierung	17	Inkrementell
18	Dezentralisieren	18	Hebelnd
19	Dezentralisiert	19	Maximierend
20	Dezentralisierend	20	Modernisiert
21	Entwickeln	21	Optimierend
22	Differenzierend	22	Durchdringung
23	Spezialisierung	23	Rationalisieren
24	Differenzierer	24	Rationalisierend
25	Diskontinuität	25	Zuverlässigkeit
26	Diversifikation	26	Sparsam
27	Diversifizieren	27	Vereinfachend
28	Eintreten	28	Stabilisierend
29	Expansionistisch	29	Standardisierend
30	Ideenreichtum	30	Synergien
31	Neuerfindung		
32	Revolutioniert		
33	Revolutionierend		
34	Transformations		

The effects of firm size on performance and on the tendency to explore or to exploit have been discussed controversially in literature (Lavie et al. 2010). On the one hand, structural inertia increases with organizational size and reinforces the focus on optimizing existing trajectories (Hannan and Freeman 1984). This also leads to decreasing flexibility and restricted research activities (Jansen et al. 2006). On the other hand, large organizations have access to more resources resulting in loose resource constraints (Lin et al. 2007) and an increased firm's innovative output

(Stettner and Lavie 2014). Following several other scholars (Cao et al. 2009; Chang and Hughes 2012; Fu et al. 2015), we measure firm size as the natural logarithm of a firm's total number of full-time employees. Moreover, we control for firm age since an organization's cumulated experiences might influence its performance (Hsu et al. 2013). Established firms have a thick accumulation of routines (Suzuki 2015), large learning curve effects (Patel et al. 2013), and overcome liabilities of newness (Aloini et al. 2012). In accordance with previous studies (He and Wong 2004; Ebben and Johnson 2005; Fu et al. 2016), we measure firm age as the years since foundation. We also control for leverage ratio—calculated as the firm's total debt over its total equity—as capital structure influences firm performance (Hsu et al. 2013). Due to the fact that firms in the underlying sample have to apply to similar reporting standards (Lin et al. 2007), long-term asset intensity is included to control for unobserved industry idiosyncrasies (Tan and Liu 2014) and measured as the firm's long-term assets over its total assets. For firm size, firm age, leverage ratio and long-term asset intensity the logarithmic form was deployed to compensate for skewness in the distribution of these variables. Finally, the availability of cash resources may both facilitate and mitigate exploration–exploitation and as a consequence firm performance (Lavie et al. 2010). Thus, following Gatti et al. (2015), we use availability of cash as control variable calculated as the firm's unlevered free cashflow over its total assets. In addition, we include year dummies to control for intertemporal trends and unobserved time effects that may affect a firm's performance (Belderbos et al. 2010).

3.5 Model

We apply a fixed-effect panel analysis to test our hypotheses. The Hausman test clearly rejects the applicability of a random-effect model. Fixed-effect models inherently control for both observed and unobserved time-constant variables. Following numerous prior studies (Han and Celly 2008; Rothaermel and Alexandre 2009; Patel et al. 2013; Luger et al. 2018), the variance inflation factors (hereafter: VIF) were used to examine the effects of multicollinearity. The resulting values for the models including relative exploration orientation ranged from 1.02 to 2.10 with an average of 1.65. Therefore, all results are well below the recommended threshold of 10 (Cohen et al. 2003). This suggests that there is no need for concern with regard to multicollinearity.

4 Results

Table 4 reports means, standard deviations, minima, maxima, and pairwise correlations of all variables. The correlation between relative exploration orientation and squared relative exploration orientation is expected to be very high due to the relatedness in calculation. Apart from that, there are no critically high correlations ($\beta > 0.65$) (Cao et al. 2009).

Table 5 shows the results of the fixed-effect regression analysis. Model 1 contains the control variables. Leverage ratio and long-term asset intensity show a

Table 4 Descriptive statistics and correlations

Variables		Mean	*SD*	Min	Max	1	2	3	4	5	6	7	8	9
1	Tobin's Q	1.93	1.47	0.49	14.64									
2	Exploration orientation	0.88	0.19	0.00	1.00	− 0.069								
3	(Exploration orientation)^2	0.81	0.25	0.00	1.00	− 0.059	0.966*							
4	Competition for non-scale free resources	6.53	5.69	0.00	18.00	− 0.186*	− 0.077*	− 0.104*						
5	Access to non-scale free resources	11.58	8.59	0.00	46.00	− 0.027	− 0.015	− 0.045	0.577*					
6	Firm size (log)	4.19	0.67	1.66	5.67	− 0.220*	0.004	− 0.058	0.263*	0.123*				
7	Firm age (log)	1.97	0.31	0.78	2.65	− 0.231*	− 0.002	− 0.009	.060*	− 0.076*	0.148*			
8	Leverage (log)	− 0.58	0.65	− 2.91	2.29	0.376*	0.042	0.065	− 0.210*	− 0.067	− 0.252*	− 0.010		
9	Long-term asset intensity (log)	− 0.72	0.37	− 2.50	− 0.11	− 0.361*	0.004	− 0.018	0.207*	0.167*	0.338*	0.011	− 0.175*	
10	Cash ratio	0.04	0.07	− 0.40	0.38	0.415*	0.030	0.032	− 0.111*	− 0.077*	− 0.098*	− 0.114*	0.195*	− 0.046

n = 685; *p < 0.05

Table 5 Panel analysis of the effects on firm performance

Predictor variable	Tobin's Q				
	Model 1	Model 2	Model 3	Model 4	Model 5
Firm size (log)	− 0.196 (0.428)	− 0.227 (0.428)	− 0.197 (0.426)	− 0.136 (0.424)	− 0.166 (0.427)
Firm age (log)	2.506 (1.319)	2.536 (1.318)	2.478 (1.311)	2.423 (1.305)	2.414 (1.311)
Leverage ratio (log)	0.186* (0.0908)	0.195* (0.0910)	0.190* (0.0905)	0.185* (0.0902)	0.188* (0.0904)
Long-term asset intensity (log)	− 1.364*** (0.227)	− 1.363*** (0.227)	− 1.338*** (0.226)	− 1.312*** (0.225)	− 1.323*** (0.226)
Cash ratio	1.087* (0.513)	1.109* (0.513)	1.050* (0.511)	1.074* (0.509)	1.068* (0.511)
Relative exploration orientation		− 0.208 (0.157)	1.450* (0.614)	3.089*** (0.876)	2.549** (0.947)
(Relative exploration orientation)^2			− 1.307** (0.469)	− 2.602*** (0.676)	− 2.109** (0.763)
Relative exploration orientation x competition for non-scale free resources				− 0.251** (0.0958)	
(Relative exploration orientation)^2 x competition for non-scale free resources				0.199** (0.0756)	
Relative exploration orientation x access to non-scale free resources					− 0.123 (0.0776)
(Relative exploration orientation)^2 x access to non-scale free resources					0.0869 (0.0604)
Constant	− 2.976 (3.018)	− 2.710 (3.023)	− 3.101 (3.008)	− 3.234 (2.997)	− 2.970 (3.011)
Year dummies	Included				
R^2 within	0.216	0.218	0.229	0.238	0.232
F	11.09***	10.48***	10.43***	9.75***	9.43***

[a]Standard errors in parentheses; n = 685; *p < 0.05; **p < 0.01; ***p < 0.001

Table 6 Required test for curvilinear inverted U-shaped relationships

U-test Model 3	Lower bound	Upper bound	U-test Model 4	Lower bound	Upper bound
Interval	0	1	Interval	0	1
Slope	1.543**	− 1.173**	Slope	3.089***	− 2.115***
Turning point	0.568		Turning point	0.594	
Fieller interval (95%)	[0.296; 0.695]		Fieller interval (95%)	[0.481; 0.683]	

**p < 0.01; ***p < 0.001

significant influence on firm performance. The included calendar year dummies are significant in the years 2006, 2008, 2009, 2011, and 2012. Model 2 tests the linear relationship between relative exploration orientation and firm performance, which is negative and not significant. Model 3 tests Hypothesis 1, which predicts a curvilinear and inverted U-shaped relationship between relative exploration orientation and firm performance. The relative exploration orientation positively and significantly influences firm performance ($\beta = 1.450$; $p < 0.05$). The squared relative exploration orientation negatively and significantly ($\beta = -1.307$; $p < 0.01$) influences firm performance, which is a first indication for a curvilinear relationship (Lind and Mehlum 2010). To further validate a curvilinear inverted U-shaped relationship, three requirements need to be fulfilled: First, the squared independent variable needs to be negatively correlated and significant (Haans et al. 2016). Second, the slope at the lower end of relative exploration orientation needs to be positive and significant, while the slope at the higher end needs to be negative and significant (Lind and Mehlum 2010). Third, the turning point of the curvilinear inverted U-shape needs to be located within the data range of relative exploration orientation (Haans et al. 2016). Since the first requirement is already fulfilled, Table 6 specifies the second and third requirement.

As illustrated for Model 3 in Table 6, the lower bound is positive ($\beta = 1.543$) and significant ($p < 0.01$), while the upper bound is negative ($\beta = -1.173$) and significant ($p < 0.01$). Additionally, the slope at the lower and at the upper bound are of similar size. Moreover, the turning point of the curve is well located within the 95% Fieller confidence interval. This supports the existence of an inverted U-shaped curve, and therefore Hypothesis 1.

Hypothesis 2a predicts that competition for non-scale free resources weakens the relationship between the relative exploration orientation and a firm's performance, which we test in Model 4. The relationship between squared relative exploration orientation and firm performance remains negative and significant ($\beta = -2.602$; $p < 0.001$). The moderating effect positively and significantly ($\beta = 0.199$; $p < 0.01$) influences firm performance, hence, supporting Hypothesis 2a. This means a lower competition will improve the link between relative exploration orientation and performance. Figure 1 illustrates our baseline relationship and the moderating effect and shows that firms in a highly competitive environment will benefit less from their explorative orientation when it comes

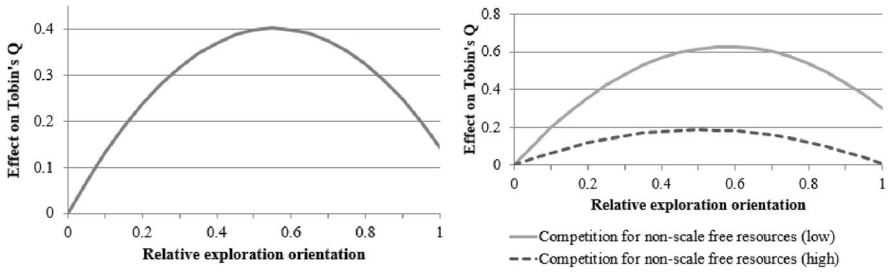

Fig. 1 Illustration of the baseline hypothesis and the moderating effect

to firm performance. Furthermore, as shown in Table 6, we also performed the required and above discussed tests for the curvilinear inverted U-shaped relationship for Model 4. Model 5 tests our Hypothesis 2b, which predicts an intensified relationship between explorative orientation and firm performance, when the access to non-scale free resources is higher. We find a positive ($\beta = 0.0869$; $p > 0.05$), but not significant effect, and hence, no support for our Hypothesis 2b.

5 Robustness checks

We conducted a series of robustness tests. First, instead of using 60% of acceptance in the dictionary, we also performed the regression analysis with 70% acceptance level. The results were qualitatively similar.

Second, in line with prior studies (e.g., Uotila et al. 2009), we limited our sample to manufacturing firms (SIC codes 2000 until 3999). Model 1 in Table 7 shows that the linear relationship between the relative explorative orientation and firm performance remains positive ($\beta = 1.712$; $p < 0.05$) and the squared relationship remains negative ($\beta = -1.460$; $p < 0.05$) and significant. Model 2, which includes our moderating variable competition for non-scale free resources, shows results that are well aligned with our main models.

Third, we changed the operationalization of our moderating variable competition for non-scale free resources. In Model 3 and Model 4, we count the number of companies within a 20- and 40-km proximity to the focal firm's headquarter. The results are in line with our main models.

Fourth, we followed Haans et al. (2016) conducting further robustness checks by adding a cubic term (cubic relative exploration orientation). This test indicates whether the relationship between relative exploration orientation and firm performance is rather S-shaped than U-shaped (Haans et al. 2016). As shown in Model 5, the addition of the cubic term did not improve the underlying models, which provides further support for the existence of an inverted U-shape.

Fifth, our sampling period includes the financial crisis of 2008 and 2009. In Model 6, we inserted a crisis dummy instead of our calendar year dummies. Again, we find results that are in line with our main models.

Table 7 Robustness checks

Predictor variable	Tobin's Q					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Firm size (log)	− 0.040 (0.567)	0.070 (0.565)	− 0.192 (0.425)	− 0.127 (0.423)	− 0.189 (0.426)	− 0.300 (0.427)
Firm age (log)	5.852** (1.859)	5.705** (1.845)	2.476 (1.307)	2.416 (1.302)	2.457 (1.312)	− 0.124 (1.119)
Leverage ratio (log)	0.307** (0.118)	0.288* (0.117)	0.185* (0.090)	0.196* (0.090)	0.195* (0.0909)	0.170 (0.094)
Long-term asset intensity (log)	− 0.553 (0.310)	− 0.500 (0.309)	− 1.326*** (0.225)	− 1.322*** (0.224)	− 1.345*** (0.226)	− 1.410*** (0.231)
Cash ratio	2.361** (0.715)	2.315** (0.710)	1.099* (0.510)	1.058* (0.507)	1.039* (0.511)	1.296* (0.519)
Relative exploration orientation	1.712* (0.815)	3.709*** (1.087)	2.741** (0.837)	3.428*** (0.911)	2.408 (1.651)	1.513* (0.637)
(Relative exploration orientation)^2	− 1.460* (0.629)	− 2.941*** (0.847)	− 2.251*** (0.644)	− 2.959*** (0.706)	− 3.581 (3.667)	− 1.350** (0.485)
(Relative exploration orientation)^3					1.359 (2.173)	
Relative exploration orientation x Competition for non-scale free resources		− 0.397** (0.144)				
(Relative exploration orientation)^2 Competition for non-scale free resources		0.295* (0.114)				
Relative exploration orientation x Competition for non-scale free resources [20/40 KM]			− 0.337* (0.148)	− 0.235** (0.080)		
(Relative exploration orientation)^2 Competition for non-scale free resources [20/40 KM]			0.240* (0.109)	0.199** (0.064)		
Constant	− 10.420* (4.363)	− 10.500* (4.333)	− 2.992 (3.005)	− 3.279 (2.988)	− 3.126 (3.010)	2.302 (2.424)
Year dummies	Included					
Crisis dummy						Included
R^2 within	0.250	0.266	0.236	0.242	0.229	0.152
N	435	435	685	685	685	685
F	7.33***	7.05	9.62***	9.95***	9.832***	12.83***

[a]Standard errors in parentheses; *p < 0.05; **p < 0.01; ***p < 0.001

6 Discussion and contributions

This study contributes to the exploration–exploitation literature by taking the perspective of a German context and bringing non-scale free resources into the field of exploration–exploitation. We investigated the competition for and access to these non-scale free resources as moderators. We hypothesized and confirmed the inverted U-shaped relationship between the relative amount of exploration and firm performance in a German sample. The results suggest that increasing explorative activities to a certain point will improve firm performance. Beyond, when there is too much focus on explorative activities performance decreases as exploitative efforts are neglected. To enhance firm performance and secure long-term firm survival it highlights the relevance for firms to balance both activities. This finding is particularly important for the German area, since the German economy has been confronted with a decline in its innovative strength in recent years and German companies miss disruptive innovation compared to other countries like China or the U.S. (Naudé and Nagler 2021). It points out the relevance to overcome this hurdle and leads us to our first two contributions:

First, we contribute to the exploration–exploitation literature by replicating the formerly proposed relationship between exploration–exploitation and firm performance in a German sample. Most studies investigated this relationship in U.S.-American samples (e.g., Uotila et al. 2009; Gatti et al. 2015). Given different contextual factors and uncertainty avoidance profiles of countries (Hofstede and McCrae 2004; Li et al. 2013), prior findings cannot be generalized with replicating the findings in different countries. Germany shows a higher uncertainty avoidance compared to the U.S. (Li et al. 2013). Finding similar results in our investigation indicates that the relationship between explorative orientation and firm performance is robust, although the uncertainty avoidance is higher. This finding improves the overall generalizability.

Second, by transferring and applying the first longitudinal test of the exploration–exploitation and firm performance relationship in a German sample, we not only methodologically further validate this procedure; we also lay the foundation of further applying the commonly accepted measurement approach to a German context. The content analysis approach by Uotila et al (2009) has only been applicable to English speaking contexts (e.g., Gatti et al. 2015; Uotila et al. 2009). We make this only measurement approach that allows for large scale and longitudinal data, and that does not succumb the mentioned limitations of patent analyses and surveys, applicable to German speaking countries. More precisely, compared to previous studies (see, e.g., Uotila et al. 2009; Gatti et al. 2015; Luger et al. 2018) we translate, validate, and refine the dictionary, used in content analyses and derived from March's (1991) initial work. Since the language and therefore the words used to describe exploration and exploitation changed since that time, we thoroughly revised and extended the dictionary by applying a keyword in context analysis that left us with 34 words appropriate for exploration and 30 words for exploitation. Using the updated and translated dictionary in the content analysis in the context of German firms and applying it to news articles of German

firms, we extend existing research (Gatti et al. 2015; Luger et al. 2018) by providing further validity for the usage of content analytical approaches to detect the exploration–exploitation level. This enables enhancing the knowledge about exploration–exploitation in another country context in a more profound way than by regarding one point in time like in cross-sectional studies (see, e.g., Kammerlander et al. 2020 for the German region) and paves the way for future studies in this linguistic area.

Further, we strive to shed light on the so far neglected importance of a firm's non-scale free resources in terms of a geographical context. Previous literature has rather focused on the (non-) scale free resource endowments within a firm (Giarratana et al. 2018; Kang and Kim 2020). Kang and Kim (2020), for instance, focused on the role of firms' non-scale free resources for the temporal transition between exploration and exploitation. We suggest to also consider surrounding factors. We take an outside perspective on non-scale free resources by considering the competition for these resources on the one hand, and the access to these resources on the other hand. We reveal the negative impact of high competition between companies for non-scale free resources on the exploration–exploitation and performance linkage. *Third,* we contribute to resource scalability literature by highlighting the importance not merely to consider different types of (non-) scale free resources themselves, but rather consider the competition for and access to non-scale free resources. We therewith follow calls by previous scholars to better understand the markets around resources (Asmussen 2015). Although we find good arguments of a better access to non-scale free resources operationalized by the proximity to universities to positively moderate this relationship, the effect is positive yet not significant. One explanation might be that the sole proximity to universities might not guarantee a better access to their non-scale free resources, such as skilled labor or collaboration with these institutions. While we still believe that a better access to non-scale free resources might be beneficial, the proximity to universities might not be an ideal proxy for access to non-scale free resources. We advance the debate on enhancing performance under exploration–exploitation activities and building on the work of Kang and Kim (2020), we believe examining the role of non-scale free resources will profoundly enrich future research on exploration–exploitation. Since not only Germany's lack in the innovative strength is an ongoing debate, but also is Germany confronted with an immense shortage of skilled workers (Naudé and Nagler 2021), this study may provide guidance on how to overcome these problems. We assume that this study only has begun to scratch the surface of the moderating role of different non-scale free resources, especially since the population and area size of Germany are comparably small.

6.1 Practical implications

Our study implies that firms should strive to balance explorative and exploitative activities in order to gain a better performance. This indicates for practitioners to develop firm strategies that are able to balance both learning modes, such as focusing on R&D, while efficiently exploiting existing resources. Furthermore, our

findings suggest that the access to non-scale free resources may be impeded by a high competition around these resources, since it has a negative influence on the relationship between relative exploration orientation and firm performance. It highlights the relevance for firms to properly consider the role of competition for non-scale free resources, such as skilled labor, when being confronted with business location decisions. Faced with location decisions of a new headquarter, for instance, they should consider areas with lower competition for non-scale free resources. When already being in place, it highlights the relevance of employer branding and appropriate recruiting strategies, for instance, to overcome the hurdles of high competition—especially in countries with a shortage of skilled workers, such as Germany (Naudé and Nagler 2021). Of course, the trade-offs for firms in location decisions must be weighed, as competition is often higher in metropole regions, where additionally location costs are higher, but the availability of different types of non-scale free resources may be more diverse and the infrastructure better. Areas outside metropole regions may have lower competition for non-scale free resources, but may also comprise a lower variety of different types of resources and worse traffic connections.

6.2 Limitations and further research

Despite the aforementioned contributions, we acknowledge that this study has limitations, which might pave the way for future research. First, the research design may raise some concerns. We are indeed first testing longitudinal data of exploration–exploitation and firm performance relationship in a German sample. Although, we admit that due to the limited number of included organizations, this study may be constrained in its generalization of findings. Extending the sample on companies outside the indices of DAX, MDAX and SDAX would help to further analyze the effects of the spatial distribution of firms within Germany.

Second, by focusing on publicly traded firms we include larger German firms. Future research needs to study whether the results are also applicable to smaller German firms, since it remains unclear, whether they are able to balance exploration and exploitation despite having lower financial resources, for instance. In this vein, due to their limited resources, it would be interesting to see, whether Hypothesis 2b regarding the access to non-scale free via having universities or universities of applied sciences in close proximity could be supported for smaller firms. They might work closely together with universities of applied sciences, and thereby, compensate their limited resources for R&D, for instance.

Third, following most other studies on exploration–exploitation research, the findings are limited to structural aspects on a firm level, which explain the investment behavior towards explorative and exploitative activities (Cao et al. 2009). Consequently, different levels of analysis like industry, inter-organizational, business-unit, or individual level are rather neglected. Future research can expand the examination of exploration–exploitation to include multiple dimensions, possibly by utilizing mixed method approaches, for instance. Further, since we find the curvilinear inverted U-shaped relationship between relative exploration orientation and

performance to be applicable to a German context despite having a lower cultural risk preference compared to studies from former regions, like the U.S. (Hofstede and McCrae 2004; Li et al. 2013), future scholars may investigate underlying factors that still drive companies in these regions to foster risky investments, such as firm liquidity or governmental subsidies.

Fourth, this study shows the impact of a firm's non-scale free resources in a geographical context on the relationship between exploration–exploitation and firm performance. However, only the firm's headquarter was included as a firm's location. Research centers of firms that affect the level of exploration, are not necessarily located next to the firm's headquarter.[1] Since most of the firms listed on the German stock exchange operate globally, future research needs to take the spatial distribution of individual firms and multi-country operations into account (Fu et al. 2016). In addition, further aspects of the uniqueness and characteristics of Germany should be analyzed in this context. This, for example, includes cultural-specific aspects and other non-scale free resources, such as technological resources (Chang and Hughes 2012; Kang and Kim 2020), regional contexts and testing other varying ranges to universities and other companies. Our findings open up a debate on further investigating important aspects for firms to consider regarding their resource access. Since we showed high competition for non-scale free resources to lower firm performance, but proximity to universities and universities of applied sciences have not been significant, we encourage future scholars to study, which resources exactly are at the center of competition.

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Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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[1] *For example: The research center of Daimler was located in Ulm and not in Stuttgart. Siemens also shifted many research activities to the city of Erlangen next to an excellent research university.*

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