Exploration and exploitation in crisis environment: Implications for level and variability of firm performance

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Abstract

Exploration and exploitation are two generic strategies of firm adaptation to their environment. However, the effectiveness and reliability of these approaches are not fully understood when the business environment is undergoing a major crisis. Building on organizational adaptation, strategicfit, and organizational decline streams of literature, we develop a framework that examines exploration and exploitation in crisis contexts. We argue that the severity of crisis a firm is exposed to acts as a positive contingency for the impact of exploration on firm performance level and variability, and as a negative contingency for exploitation's level and variability effects. Employing the multiplicative heteroscedasticity regression model on the data from 500 Russian SMEs, we test the proposed theoretical framework linking exploration and exploitation activities to the distribution of firm performance under different conditions of the firm-specific crisis severity. The results provide an improved understanding of strategic management approaches under economic crises and related turbulence.

1. Introduction

There is a broad consensus that firms today face environments characterized by high levels of uncertainty, instability, and turbulence (Schilke, 2014; Wright et al., 2005). It is also well established that firm performance depends largely on the fit between the strategies it employs and the environment under which these strategies are employed (e.g., Zajac, Kraatz, & Bresser, 2000). When the environment changes abruptly, firms need to adapt their behavior to the new circumstances. A country-wide or global economic crisis is a good example of a sudden environmental jolt that makes firms reconsider their strategic behavior to cope with the economic downturn (Archibugi, Filippetti, & Frenz, 2013; Battisti et al., 2019; Doern, Williams, & Volery, 2019; Kunc & Bhandari, 2011; Pollard & Hotho, 2006; Smallbone et al., 2012). Responding to an economic crisis, firms may employ two distinct approaches to organizational adaptation: exploration and exploitation (Gupta, Smith, & Shalley, 2006; March, 1991; Ngo et al., 2019). In a seminal study, March (1991) broadly defined exploration as "search, variation, risk-taking,

experimentation, play, flexibility, discovery, and innovation," contrasting it with exploitation, which involves "refinement, choice, production, efficiency, selection, implementation and execution" (p. 71).

Economic crisis presents substantial challenges and opportunities for SMEs attempting to weather the economic downturn and grow their businesses (Davidsson & Gordon, 2016). Industries and markets during times of crisis experience rapid changes and increased environmental uncertainty. These dynamics inevitably shape firms' decision-making processes, including decisions regarding how to balance exploration and exploitation to manage the firm-level consequences of the economic downturn. In fact, the literature on organizational decline (McKinley, Latham, & Braun, 2014; Trahms, Ndofor, & Sirmon, 2013; Weitzel & Johnston, 1989) has suggested that firms employ a variety of responses to organizational crisis situations, including increasing rigidity as a response to threats (see also Staw, Sandelands, & Dutton, 1981), as well as increasing adaptability (Sarkar & Osiyevskyy, 2018). Corresponding to these types of alternative strategic behavior, exploration and exploitation have the potential to play particularly important roles when firms face the consequences of economic crisis to different degrees. Whereas exploration generates new opportunities, knowledge, and competencies, exploitation leverages existing opportunities, knowledge, and competencies (Abebe & Angriawan, 2014; Lavie, Kang, & Rosenkorf, 2011; Sariol & Abebe, 2017; Uotila, 2017). Both types of activities are essential for firm performance but have inherent contradictions that need to be managed (Lavie, Stettner, & Tushman, 2010; Tushman & O'Reilly, 1996).

Exploration and exploitation have been shown to provide distinct strategic paths to improved firm performance in stable environments (Gonzalez & de Melo, 2018). During times of stability, firm outcomes associated with exploration are more variable and remote in time, while the outcomes associated with exploitation are more certain and closer in time (He & Wong, 2004). Furthermore, prior studies have recognized the "tension between the need to explore to be different and the need to exploit to be more effective" (Parida, Lahti, & Wincent, 2016, p. 1148), providing different performance outcomes in terms of level and variability of performance. Most studies suggest that firms should consider both exploration and exploitation, establishing ambidexterity, which is central to enhancing performance (He & Wong, 2004). However, some studies report that firms that pursue either exploration or exploitation outperform those that combine these activities (Ebben & Johnson, 2005), or that the expected exploration-exploitation complementarity is not

materializing (e.g., Ngo et al., 2019). As such, the investigation of whether the established performance consequences of exploration and exploitation hold during periods of economic crisis and severe market conditions is warranted, as environmental conditions may dramatically shape their role in firm performance (Auh & Menguc, 2005; Marino et al., 2015).

In this research, we build on the classic notion of *strategic fit* (Fainshmidt et al., 2019; Miller & Friesen, 1983; Venkatraman & Prescott, 1990; Zajac et al., 2000) to examine and compare the distinct effects of exploration and exploitation on the level and variability of firm performance during an economic crisis. We expect this perspective to provide important understanding; in fact, the organizational decline literature emphasizes that the strategic fit of firms' responses to the decline driven by "environmental jolts" is decisive to economic performance, e.g., in the context of acquisitions (see Trahms et al., 2013, p. 1295; Wan & Yiu, 2009). By focusing on exploration and exploitation strategies adopted by firms, we aim to provide new insight into how firms may position themselves better to fit volatile and hostile conditions such as economic crises. This research provides insights into several important research questions within strategic management: (1) how do exploration and exploitation relate to the level of firm performance and performance variability during an economic crisis; and (2) how does the firm-specific crisis severity (the impact of the economic crisis on a particular firm) shape these relationships? To address our research questions, we use the comprehensive national random sample of 500 Russian SMEs collected during the period of economic crisis and political sanctions (spanning the time interval of 2014-2016), supplementing the survey-based measures of the exploration and exploitation constructs with the objective financial data.

Our study provides two main contributions to the strategic management literature, which bear practical relevance since firms need to deal with increasing levels of volatility in their economic environments. First, we supplement the current knowledge of how exploration and exploitation affect the *overall level* of firm performance with a nuanced understanding of the impact of these approaches on the *variability* of firm performance. This step represents a substantial departure from the existing approaches that concentrate on the "mean" impacts only [with the only exception being the simulation study of Uotila (2017) and the variance-focusing article by Parida et al. (2016)]. Understanding both the level (conditional mean) and variability (residual deviation from the conditional mean) provides a better understanding of what outcomes can be expected from exploration and exploitation strategies. For this, we demonstrate the

effectiveness of the relatively rarely used yet crucially informative multiplicative heteroscedasticity regression method (Harvey, 1976), which provides useful applications in the future studies of entrepreneurial actions and strategies regarding their effects on firm performance outcomes and related variability.

Second, our study enriches the understanding of the role of exploration and exploitation under volatile and hostile environments, such as during economic downturns. While much research has been focused on the performance outcomes of exploration and exploitation under various environmental contingencies (e.g., Jansen, Van Den Bosch, & Volberda, 2006; Marino et al., 2015; Posen & Levinthal, 2012), as well as on simultaneous exploration and exploitation (i.e., ambidexterity; see Junni et al., 2013), our study provides useful evidence of firm-specific effects of these external conditions. In particular, our examination of *firm-specific crisis severity* provides a valuable view of how firms might seek a better strategic fit with their environment with exploration and exploitation strategies that take into account the firm's own situation within the broader crisis. We find that exploration strategies improve firms' performance under high crisis severity, but on the other hand, the variability of the performance also rises. Further, we find that exploitation strategies decline in their performance under high crisis severity, while the variability of performance goes down. Thus, exploration strategies seem to be beneficial under crisis, but come with a cost of higher volatility, while exploitation leads to "reliable decline of performance." With these results, our study provides more insights into the established literature of organizational decline, which has shown that the strategic fit of firms' actions under challenging business environments has important performance implications (Moulton, Thomas, & Pruett, 1996; Wan & Yiu, 2009). Our results complement these views by providing evidence of the firm-specific crisis severity within a broader economic crisis context, providing more understanding of the strategic fit of firms' actions in under challenging environments.

2. Theory and hypotheses

2.1. Economic downturn, organizational decline, and SMEs strategic responses

Changes in organizational performance, especially performance decline (Cameron, Sutton, & Whetten, 1988; Weitzel & Jonsson, 1989; Zammuto & Cameron, 1985), have an impact on managerial behaviors, particularly in the situation of economic adversity or external threat (Chattopadhyay, Glick, & Huber, 2001; Battisti et al., 2019; Shirokova, Ivvonen, & Gafforova,

2019; Shirokova, Osiyevskyy, Laskovaia, & MahdaviMazdeh, 2020). A well-developed literature on strategic adaptation suggests threat perception can be considered as a catalyst for a strategic response (e.g., Gilbert, 2005; Laskovaia et al., 2019). Furthermore, threat rigidity theory predicts the reactions top managers have when they are faced with external threat (Osiyevskyy & Dewald, 2018; Staw et al., 1981) and suggests that decision-makers tend to employ existing schemas under threat, thereby exhibiting rigidity—inability to recognize innovative responses (Barnett & Pratt, 2000). The performance implications of such strategic behaviors depend on the firm's operating environment and in crisis contexts, defensive strategies can protect firm survival (Håkonsson, Klaas, & Carroll, 2013). However, a number of studies have observed that threat can also be an antecedent of the more proactive strategic behaviors that enable firms to overcome inertia (Beliaeva et al., 2020; Laskovaia et al., 2019; McKinley et al., 2014; Shirokova et al., 2019; 2020).

Based on the prior literature, we define economic crisis as an extreme, unexpected or unpredictable change in the external macroeconomic environment that requires an urgent response from firms and creates challenges and new threats for them (Doern et al., 2019; Vaaler & McNamara, 2004). In such environments, organizations have to readjust their strategies and behaviors with new realities in order to prevent performance declines and ensure business survival (McKinley et al., 2014; Trahms et al., 2013). Or in other words, they have to improve their strategic fit to the environment (Fainshmidt et al., 2019) if they wish to survive in the new situation. The existing studies in SMEs' responses to economic recession are scant and tend to focus on either vulnerability or the resilience of such firms (Battisti et al., 2019; Cowling et al., 2015; Doern et al., 2019; Smallbone et al., 2012). According to the vulnerability view, SMEs are highly sensitive to external threats because of the "liability of smallness" (Aldrich & Auster, 1986). Therefore, the probability of failure among such firms is typically much higher, in comparison with larger, well-established firms (Davidsson & Gordon, 2016). On the other hand, in the resilience view, SMEs are more flexible, closer to the market and their customers, and, therefore, less negatively affected by an economic downturn (Beliaeva et al., 2020; Latham, 2009; Shirokova et al., 2019; Smallbone et al., 2012). These two views correspond with the views in the organizational decline literature, which have contrasted between organizational decline as a catalyst or inhibitor for adaptation and innovation (McKinley et al., 2014; Sarkar & Osiyevskyy, 2018).

Collectively, the findings illustrate that appropriate strategies can protect even small firms against a declining environment. Nevertheless, an economic crisis presents small firms with a

major dilemma: cut costs and/or rely on existing resources in order to maintain survival in the short term or invest in innovative activities in order to create capabilities for long-term viability (Sariol & Abebe, 2017; Smallbone et al., 2012). While we already know a lot about the determinants and the process that lead to different types of firm behavior under crisis and decline (see, e.g., McKinley et al., 2014; Trahms et al., 2013), the important question we want to address relates to the consequences of firms' strategic actions once they are selected, and under varying crisis severity on those firms while those strategies are deployed. Thus, in our study, we focus on two types of strategies SMEs may employ to achieve a better fit with the changing environment under conditions of a major economic downturn that illustrate this dilemma—*exploration* and *exploitation* (March, 1991). Below, we provide a brief literature review on exploration/exploitation–firm performance relationship in order to introduce the research gap in the existing literature related to the performance implications of these strategies in the context of an economic crisis.

2.2. Exploration, exploitation, and firm performance

Exploration and exploitation are viewed as the two key forms of organizational adaptation to their environments to achieve a strategic fit (Lavie et al., 2010; March, 1991). Exploration allows the firm to create completely new opportunities, knowledge, and competencies, whereas exploitation focuses on the utilization of its existing opportunities, knowledge, and competencies (Abebe & Angriawan, 2014; Uotila, 2017). A fundamental question in the exploration-exploitation literature concerns the impact of these strategies on organizational performance. Since March's (1991) seminal work, scholars have long been arguing that exploration and exploitation produce differential performance outcomes. However, until recently, empirical research on the performance implications of exploration and exploitation has been scarce. Few studies demonstrate divergent effects of exploration and exploitation on firm performance. For instance, based on a survey of 206 manufacturing firms, Auh and Menguc (2005) report that exploration contributes to long-term performance, whereas exploitation is associated with short-term performance. Another example is the case study of a large European financial services firm, demonstrating that the impact of exploratory and exploitative innovations on firm performance is moderated by environmental dynamism and competitiveness (Jansen et al., 2006). However, Posen and Levinthal (2012) have warned that environmental turbulence "is not a self-evident call for strategies of greater exploration" (p. 587). Indeed, several simulation studies suggest that

environmental change undermines exploration efforts because it can devaluate existing knowledge while disregarding new knowledge developed through exploration (Kim & Rhee, 2009; Posen & Levinthal, 2012). Moreover, under some circumstances, the most appropriate response to environmental turbulence is a focus on the exploitation of existing knowledge rather than the exploration of new opportunities. In addition, a recent study by Marino et al. (2015) shows that environmental change—considered as radical industry regulatory changes—negatively moderates the exploration-performance relationship.

In sum, most studies reflect a long tradition of interest in the external environment and the ability of organizations to adapt. Several recent studies suggest that while firms, in general, tend to reduce innovative strategies under economic crises, adopting innovative and proactive behavior can help firms to overcome the crisis and improve their innovation performance as well as turnover recovery (Ahn, Mortara, & Minshall, 2018; Archibugi et al., 2013; Beliaeva et al., 2020; Laskovaia et al., 2019; Shirokova et al., 2019). However, we did not find any studies that would investigate the exploration/exploitation–firm performance relationship particularly under conditions of major exogenous shocks. Thus, we attempt to fill this gap by focusing on the role of economic crisis in the exploration/exploitation–firm performance relationship.

2.3. Firm performance: both level and variability matter

The vibrant available literature on exploration and exploitation hitherto concentrated on investigating the impact of exploration and exploitation on firm performance under different conditions, answering a broad question of how "*a unit increase in exploration/exploitation increases the expected performance by X*" (see, e.g., Auh & Menguc, 2005; Swift, 2016). However, this emphasis on explaining the *level of performance* (i.e., mean of resulting performance distribution) neglects the substantial simultaneous impact of these strategies on the *variance* of performance. While the conventional, mean-centered approach has partially helped to explain the outcomes of exploration and exploitation, we argue that understanding the variability of firms' performance is as crucial as explaining its level for several important reasons.

First, high variability implies highly uncertain outcomes; this risk is undesirable from the perspective of the management team (Parida et al., 2016). For example, resource-constrained small and medium enterprises cannot sustain getting to the left-hand tail of the wide performance distribution, and as such, their managers predictably shy away from engaging in activities with high variability of outcomes. However, high variability also enables the possibility of getting

abnormally high returns (e.g., "blockbuster" products), and thus it is a sought-after property leading to increase of returns at the levels of aggregation above a particular firm (e.g., a portfolio of an investor, corporate-level performance, or economy as a whole). In other words, performance variability at the level of particular firms creates the variation of performance in their population, which allows employment of the proper selection and retention mechanisms at the higher levels, leading to the overall system's development thanks to filtering out the unsuccessful firms (Aldrich & Reuf, 2006; Levinthal & Marino, 2015).

Despite the recent progress in studying performance implications of exploration and exploitation, to the best of our knowledge, only two studies focused on the firm performance variability. The study by Parida et al. (2016) suggests that ventures should have a clear preference for either exploration or exploitation and shows the evidence for the effects of lower performance variability in dynamic environments. They claim that the performance variance is very problematic for entrepreneurial firms in the conditions of highly dynamic environments and suggest that firms "should carefully consider how much they explore to be as different as possible and how much they exploit to be as effective as possible" (p. 1147). The second study, based on the three canonical simulation modeling approaches (Uotila, 2017), finds that although exploration provides more variability in terms of its immediate performance effects within the organization, exploitation is generally associated with an increase in performance variability between different organizations.

In sum, exploration and exploitation both affect firm performance. However, the likelihood and nature of the performance outcomes vary across activities and depend on the organizational and environmental contingencies. Moreover, we argue that the relevant performance implications of exploration and exploitation should include both performance level and performance variability. We base our theoretical development presented in the following sections on these core intuitions.

2.4. Baseline hypotheses: the impact of exploration and exploitation on firm performance level and variability

As a starting point of theoretical development, we consider the situation of "business as usual," i.e., normal, non-crisis conditions of the firm's activities. The broad consensus in the literature suggests that during stable times, an exploration strategy requires incurring major costs (e.g., for research and development or looking for new markets) and results in occasional losses due to negative feedback from potential customers (Clark & Fujimoto, 1991; Mudambi & Swift, 2014). Moreover, exploration diverts resources from leveraging current capabilities to the slow processes

of learning and developing the new ones, resulting in the opportunity cost of de-emphasizing exploitation. Of course, exploration sometimes leads to positive performance outcomes thanks to discovering new opportunities, gaining important market or technological knowledge, developing new unique competencies and expanding the customer base (Brown & Eisenhardt, 1997; Lubatkin et al., 2006). However, the results of this strategy are highly uncertain, hard to estimate in advance, and distant in time (He & Wong, 2004; Lavie et al., 2010).

This leads to the conjecture that—at least in the short-term—pursuing the exploration strategy is likely to affect the level (mean) of firm performance negatively. Moreover, the inherently uncertain nature of exploration activity should increase the variability of firm performance (Uotila, 2017). This insight dates to the study of March (1991) that sparked the exploration/exploitation literature, where the former strategy was explicitly linked to "variation" (along with risk-taking, experimentation, and discovery—all leading to an increase in variance, yet unlikely to result in short-term performance improvements). This leads to the baseline hypotheses:

H1a: *Exploration is negatively associated with firm performance level.*

H1b: *Exploration is positively associated with firm performance variability.*

The opposite is true of exploitation strategy, which is generally associated with leveraging the current capabilities of a firm through minor refinements, improving efficiency, and better execution (March, 1991). Under the conditions of environmental stability, these actions are likely to result in short-term performance improvements (He & Wong, 2004; Lavie et al., 2010; March, 1991). Moreover, exploitation of current capabilities is likely to yield highly reliable outcomes (i.e., reducing the variability by concentrating on sure bets), because of the low chances of noticing either major new opportunities or incurring unpredictable losses (Mudambi & Swift, 2014). As such, we hypothesize that:

H2a: *Exploitation is positively associated with firm performance level.*

H2b: *Exploitation is negatively associated with firm performance variability.*

The theoretical framework for the baseline scenario (Hypotheses 1a,b and 2a,b) is graphically depicted in Figure 1.

---> INSERT FIGURE 1 HERE <---

2.5. Performance implications of exploration and exploitation during an economic crisis: The moderating role of firm-specific crisis severity

A macro-level crisis (be it an economic downturn or industry-wide disruption) is a period of unexpected and unpredictable changes in the external environment requiring urgent responses from incumbent firms to maintain the strategic fit (Doern et al., 2019; Vaaler & McNamara, 2004). However, the impact of the crisis in the external environment on particular firms is not homogenous, with firm-level peculiarities determining the degree of impact and threat (Paunov, 2012). The studies of SMEs in crisis contexts corroborate this general view about the differential effect of macro-level adversity on incumbent firms (Osiyevskyy & Dewald, 2018; Peric & Vitezic, 2016; Smallbone et al., 2012). While some SMEs find themselves in major misfit with the environment and suffer major revenue decline and losses, the other part of firms thrive amidst the adversity. As such, although the economy- or industry-wide downturn serves as a general, exogenous shock for all players, its effect is heterogonous between them, and hence must be assessed at the level of a particular SME. Considering this nuance, we explicitly argue that within the context of a broader economic crisis, firms will encounter different levels of *firm-specific crisis severity*—that is, there are differences between firms of how severely the available financial and other resources are constrained due to the crisis. More formally, in this study, we operationalize firm-specific crisis severity as a drop in revenues of the firm during the crisis, which creates important contingency implications for how well the potential strategies the firms employ fit the context of the economic crisis. Moreover, while an economic downturn presents dangers to firm performance and survival, it also may create opportunities to capitalize on (Archibugi et al., 2013; Ahn et al., 2018; Beliaeva et al., 2020; Shirokova et al., 2019). Firms may respond to an economic crisis by either proactively addressing the environmental changes through bold, radical initiatives (employing explorative actions) or initiating internal adjustment actions aimed at incremental and reliable adaptation to the environmental pressures (adopting exploitative actions).

When a firm is severely affected by an exogenous shock (such as an economic crisis), it must find a way of effective adaptation to new conditions (Ahn et al., 2018) through shifting the resources from supporting the old capabilities that are becoming obsolete. In such contexts, the allocation of scarce resources towards an explorative search for new technological knowledge or markets becomes a preferred strategy, allowing building and leveraging new valuable capabilities that might improve the fit with the environment. Not surprisingly, the vast literature on exploration

argues for and demonstrates the superiority of an exploration strategy in dynamic and hostile environments (e.g., Brown & Eisenhardt, 1997; Jansen et al., 2006; Posen & Levinthal, 2012). In fact, several studies have shown that while firms, in general, tend to reduce explorative strategies under economic crises, adopting explorative alignment can help firms to overcome the crisis and improve their innovation performance as well as turnover recovery (Ahn et al., 2018; Archibugi et al., 2013; Paunov, 2012). However, the uncertainty and ambiguity inherent in crisis situations (Sarkar & Osiyevskyy, 2018) are also likely to amplify the inherent uncertainty of the exploration activities; hence, strengthening their variance-boosting property. As such, we predict that:

H3a: *Firm-specific crisis severity positively moderates the association between exploration and firm performance level, weakening (and possibly changing the sign) of the negative main-effect association.*

H3b: *Firm-specific crisis severity positively moderates the association between exploration and firm performance variability, strengthening the exploration's positive impact on variance.*

With respect to exploitation, it is reasonable to expect the opposite moderation effect for the performance level variable. The turbulence created by the crisis is likely to make the firm's established competencies obsolete. Consequently, exploitative leveraging of the existing capabilities (knowledge, products, markets, or technology) is unlikely to pay off in such situations (see, e.g., Ritala, Heiman, & Hurmelinna-Laukkanen, 2006; Voss, Sirdeshmukh, & Voss, 2008), leading to decreasing average returns with the rising crisis severity. Here, the strategic fit of firms' actions under a crisis environment is reduced, leading to performance decline (Trahms et al., 2013; Zajac et al., 2000).

With respect to variability, in a crisis context, an exploitation strategy's variance-reducing property is likely to be augmented, in that the crisis-induced resource scarcity (Sarkar & Osiyevskyy, 2018) is likely to prevent anything beyond minor deviations from established routines. Instead, all efforts of the organizational actions will concentrate on resource conservation (Staw et al., 1981) to get the maximal output of the shrinking resource base, without any experimentation or flexibility to adjust to the changing conditions. In organizational decline literature, this phenomenon has been discussed as a "downward spiral through rigidity" (McKinley et al., 2014), where the episodes of organizational decline further strengthen the retention mechanisms and lock managers into existing routines, leaving little room or motivation for

variation. Therefore, we expect that under the condition of firm-level crisis, the exploitation strategy will lead to performance outcomes that are "reliably decreasing":

H4a: *Firm-specific crisis severity negatively moderates the association between exploitation and firm performance level, weakening (and possibly changing the sign) of the positive main-effect association.*

H4b: *Firm-specific crisis severity negatively moderates the association between exploitation and firm performance variability, reinforcing the exploitation's negative impact on variance.*

The theoretical model of the study is summarized in Figure 2.

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3. Method

3.1. Context and data collection

The data for this study were collected from a survey of Russian small and medium firms (Beliaeva et al., 2020; Laskovaia et al., 2019; Shirokova et al., 2019, 2020) in late 2015 and early 2016 (September to February), amidst a period of major economic downturn and instability in the country. The Russian economy in this period (2014-2016) was in a crisis state for several reasons. First, foreign countries (most notably, the U.S. and E.U. members) introduced economic and political sanctions against Russia, leading to a sudden decrease in the number of contracts, economic interactions, and business activities of Russian firms with foreign counterparts. Second, the global price of oil rapidly decreased by more than 60%, and this major negative change in the price of the main export commodity substantively affected the country's federal budget. Not surprisingly, the growth of the Russian gross domestic product (GDP) stalled, the national currency devaluated in half, and the unemployment and inflation rates ballooned.

To approach a random sample of Russian SMEs, we created a random list of private firms using the Main State Registration Number (OGRN). The list of randomly generated OGRN codes was loaded into the SPARK Interfax database (containing the information about all legal firms registered in Russia and constantly-updated data from official government databases) to ensure the validity of the created codes, to select firms meeting the requirement of the current study, and to download the available financial and general firm information. We excluded from the study firms with over 500 employees (according to the Chamber of Commerce and Industry of the Russian

Federation), firms from the agricultural sector, governmental and public organizations, and liquidated firms. In total, 10,359 companies were selected for the survey.

As the first step intended to validate the focal sample, we contacted the selected random companies by telephone. In total, 2,583 SMEs were invited to take part in the study. The survey questionnaire was then distributed to each company's CEO and/or founder, in that these respondents have profound knowledge and understanding of their firm's strategy and environment (Deutscher et al., 2016). The survey was administered online, as an online survey can control for the risk of unrepresentative samples. Overall, we obtained 656 questionnaires for an effective response rate of 25.4% (656/2583). After excluding the observations with missing financial data for 2012-2016 (-142 observations) and firms that reported over 250 employees (-14 observations), the resulting final sample used for further analyses includes data on 500 small and medium-sized firms.

3.2. Measures

We relied on survey instruments from prior literature to capture the study's constructs. The survey items were measured on a 7-point Likert scale with a neutral central point. Composite survey constructs were assessed by averaging the values of their respective indicators, resulting in the scales from 1 (lowest) to 7 (highest). The survey-based measures were supplemented with objective firm-level financial data for 2012-2016.

Dependent variables. Taking into account the peculiarities of our empirical context, we selected *firm revenue growth* as the most appropriate, conventionally used indicator of performance and success of SMEs (Chandler, McKelvie, & Davidsson, 2009; Hmieleski & Corbett, 2008; Wales, Patel, & Lumpkin, 2013). The reason for this decision is that the other performance measures (e.g., profitability measures such as ROE or ROA, or growth in total assets, net assets, or profit) might be subject to major biases related to accounting practices, particularly in a sample of private firms in a developing economy. As will be discussed in the following section (Estimation approach), we assess the firm performance level using Gibrat's growth model (Sorenson & Sørensen, 2001), with logarithm of firm revenue in 2016 as the outcome variable, and logarithm of firm revenue in 2015 (i.e., lagged dependent variable) as the crucial predictor accounting for all firm-specific time-invariant characteristics. The presence of the lagged dependent variable in the regression specification implies the existence of a firm-level growth trend and that all other predictors will determine the deviation from this trend (i.e., acceleration or

deceleration of firm revenue growth). Alternatively, we could have measured revenue growth as the absolute or relative difference in sales between 2015 and 2016. Yet, this is not a recommended practice (e.g., Sapienza, Parhankangas, & Autio, 2004), as the relative measures yield inflated growth figures for smaller firms, while absolute measures yield inflated results for larger firms (Young, Smith, & Grimm, 1996). Therefore, in line with Sorenson and Sørensen (2001), the firm revenue growth was measured by including the lagged dependent variable to the regression equation.

Following Sørensen (2002), we operationalize the *firm revenue variability* as the level of residual variance (degree of deviation of actual dependent variable values from conditional (predicted) mean for each observation). The advantage of this method over alternatives (e.g., assessing standard deviation of sales: Parida et al. (2016), Wales et al. (2013), which is, in essence, the residual variance over the sample or group mean) is that it is based on assessing the variability as deviations from conditional mean that cannot be well approximated by the sample mean or some group mean. For example, if a particular predictor strongly positively affects the firm performance, observations high on this predictor will have predictably high values of the dependent variable (conditional means and actual values), but also predictably large positive deviations from the sample mean. The latter should not indicate a lack of reliability but would still get a high score on variability if it is measured as deviation from the sample mean rather than from the conditional (predicted) mean (see detailed discussion of this issue in Sørensen (2002)). In other words, the approach embraced in this study of assessing variability as residual deviation from conditional mean is the most accurate way of capturing this construct (Sorenson & Sørensen, 2001; Sørensen, 2002).

Predictors. The primary predictors of our study, exploration and exploitation, were captured using the 6-item scales of exploratory and exploitative orientation within small and medium-sized firms proposed in Lubatkin et al., (2006). The common title of the 12-item question block requested: "In the period from 2013 to 2015, our firm can be described as one that: (1- strongly disagree; 7- strongly agree)." The *exploration* scale included the following items (Cronbach Alpha=0.901): "looks for novel technological ideas by thinking "outside the box"/"bases its success on its ability to explore new technologies"/"creates products or services that are innovative to the firm"/"looks for creative ways to satisfy its customers' needs"/"aggressively ventures into new market segments"/"actively targets new customer groups." The *exploitation* scale comprised

the following items (Alpha = 0.817): "commits to improve quality and lower cost"/"continuously improves the reliability of its products and services"/"increases the levels of automation in its operations"/"constantly surveys existing customers' satisfaction"/"fine-tunes what it offers to keep its current customers satisfied"/"penetrates more deeply into its existing customer base."

Moderators. The hypothesized moderator, *firm-specific crisis severity*, was assessed using the firm financial data. To assess the misfit between the firm and its environment (i.e., firm-specific crisis severity measure effectuated by the economy-wide crisis), we estimated this variable as the drop in two-year revenue between the crisis years (2014 and 2015) and the pre-crisis years (2012 and 2013). To make sure that larger values on this variable correspond to a severe firm-level crisis, we subtracted the discussed above fraction from one:

$$\textit{Firm-specific crisis severity} = 1 - \frac{Revenue_{2014}+Revenue_{2015}}{Revenue_{2012}+Revenue_{2013}} \quad (1)$$

The positive values on this variable suggest that during the crisis years, the firm suffered a drop in revenue (i.e., $\frac{Revenue_{2014}+Revenue_{2015}}{Revenue_{2012}+Revenue_{2013}} < 1$). The crisis severity variable equals zero if there is no change in revenue ($\frac{Revenue_{2014}+Revenue_{2015}}{Revenue_{2012}+Revenue_{2013}} = 1$), while negative values of this variable suggest that the firm was growing despite the overall economic downturn ($\frac{Revenue_{2014}+Revenue_{2015}}{Revenue_{2012}+Revenue_{2013}} > 1$). In our sample, the mean value of crisis severity is -0.56, implying that, on average, the SMEs were experiencing revenue growth. Overall, 187 firms (37.4% of the sample) had positive values on this variable, suggesting that the general economic downturn negatively affected less than 40% of the sampled firms, while over 60% experienced some growth.

Control variables. To account for the possible factors that might confound our results by simultaneously affecting the predictors and the outcome variable (i.e., omitted variable bias), we added a wide set of relevant control variables measured in 2015. In particular, it is well established that firm context has a non-trivial impact on the pursuit of exploration and/or exploitation (e.g., Gonzalez & de Melo, 2018), while possibly simultaneously affecting the resulting performance in different environments.

First, we controlled for the firm size factor (through *total assets* and *number of employees* covariates) and *firm age.* We also controlled for the firm's *international sales* (dummy variable assuming the value of 1 if it had any export sales).

Second, we controlled for the internal organization of the firm, which might affect the salience of exploration/exploitation and firm performance: *Formalization* (4 items from Cardinal (2001); Alpha= 0.858, sample item "There is strict enforcement of written rules and procedures") and *centralization* (5 items from Ferrell and Skinner (1988); Alpha= 0.786, sample item "In my dealings with this company, even quite small matters have to be referred to someone higher up for a final answer").

Third, we controlled for the level of resources available to the firm (namely, social and financial capital). Social capital was assessed using the instrument for the *social ties* with managers at other firms and government officials (6 items from Peng and Luo (2000); Alpha= 0.870, sample item "Please circle the number best describing the extent to which top managers at your firm have utilized personal ties, networks, and connections during the past three years with: … officials in regulatory and supporting organizations such as tax bureaus, state banks, commercial administration bureaus, and the like"). *Financial resource availability* was captured using a 4-item scale from Wiklund and Shepherd (2005) and Story, Boso, and Cadogan (2015) (Alpha = 0.911, sample item "If we need more financial assistance for our business operations, we could easily get it").

Fourth, we controlled for the industry characteristics that might simultaneously affect the exploration/exploitation and firm performance: *environmental dynamism* (5 items from Miller and Friesen (1982); Alpha= 0.809, sample item "The production/service technology change often and in a major way") and *environmental hostility* (6 items from Mitchell, Shepherd, and Sharfman (2011); Alpha= 0.766, sample item "My industry is very risky, such that one bad decision could easily threaten the viability of my business unit").

Finally, all our regression specifications included the *industry fixed effects* (dummy-coded) and *federal region fixed effects* (dummy-coded) to account for the possible between-industries and between-regions heterogeneity in firm growth.

4. Results

4.1. Descriptives

The descriptive statistics and correlations between the study's constructs are presented in Table 1.

---> INSERT TABLE 1 HERE <---

The examination of the correlations table does not raise multicollinearity concerns, in that none of the pairs of predictors with a correlation over 0.80 enters the regression models. The predictably high correlation is observed between the logarithm of revenue in 2016 and 2015 (r=0.898), justifying the lagged dependent variable model employed in our study (Gibrat's law of proportionate growth) but not creating a collinearity concern, in that these are dependent and independent variables, respectively. All other correlation coefficients (Table 1) are relatively low, with only the exception of the correlation between revenue in 2015 and total assets in 2015 (r=0.742). The latter correlation did not create collinearity problems when assessed through VIF statistics (reaching a maximum of 3.17 in the fully specified regression model with all interactions added, see Table 2); furthermore, omitting the logarithm of total assets variable did not change the hypotheses testing results.

4.2. Estimation approach

For assessing the impact of the predictors (exploration, exploitation, crisis severity, interaction terms, and control variables) on the level (conditional mean) of a firm's revenue growth rate and degree of variation from the predicted mean, we follow the multiplicative heteroscedasticity estimation methodology (Harvey, 1976). This approach is widely used in economic studies addressing research questions about the effect of predictors on both conditional mean and the variability of values around conditional mean in the dependent variable, yet it is relatively rare in management studies (with the notable exceptions of Sorenson and Sørensen, 2001; Sørensen, 2002).

Following the approach of Sorenson and Sørensen (2001), we assess the impact of the characteristics of a firm and its environment on commercial success through modeling the firm growth rate according to the conventional Gibrat's law of proportionate growth (Samuels, 1965; Sutton, 1997):

$$\ln(S_{i,t+1}) = \alpha \ln(S_{i,t}) + X_{i,t}B + \varepsilon_{i,t+1} \qquad (2)$$

where $S_{i,t}$ represents the size of a firm i in period t; $X_{i,t}$ is a vector of firm and environmental characteristics (predictors), B is the vector of regression weights, α is the factor determining the average firm growth rate (independence of α from firm size explains the Gibrat's law's "proportional growth" label), and $\varepsilon_{i,t+1}$ is the error term.

We assess the impact of predictors measured in 2015 on firm revenue in 2016, with *S* representing the total annual sales (revenue) of a particular firm (Sorenson & Sørensen, 2001). As such, in our study, the general equation (2) assumes the following form:

$$\ln(S_{i,2016}) = \alpha \ln(S_{i,2015}) + X_{i,2015}B + \varepsilon_i \quad (3)$$

Estimating the parameters of equation (3) would allow assessing the impact of predictors on expected value (conditional mean) of the dependent variable, $\ln(S_{i,2016})$. In particular, the regression coefficients (β_j from vector B) would reveal how particular predictors x_j affect the deviation of a firm's growth rate from the default trend (determined by parameter α, representing the regression coefficient for lagged dependent variable). Since each firm enters equation (3) only once, we are not encountering the empirical challenges of autocorrelated within-firm residuals, and as such, equation (3) is suitable for conventional regression estimation (e.g., OLS).

However, in addition to assessing the impact of predictors on the conditional mean of $\ln(S_{i,2016})$, we also are interested in assessing the reliability of the resulting variable, or the variability (deviation) from the conditional mean. For this, we employ Harvey's (1976) multiplicative heteroscedasticity regression model, allowing estimating the impact of covariates on both conditional mean and between-firm variability of the dependent variable around the conditional mean. In this model, the error term ε_i from equation (3) is presented as a function of a vector of independent variables (Z_i) and a random term u_i:

$$\varepsilon_i = e^{Z_i \Gamma} u_i \quad (4)$$

where Γ represents a vector of parameter estimates for the effects of predictors Z_i on variance in the dependent variable. A positive value of a particular parameter (γ_j in Γ) suggests that the corresponding predictor z_j increases the variability in the dependent variable from equation (3), while a negative value of parameters suggests an increase in reliability.

Empirically, the equation (4) implies regressing the log-squared residuals [predicted minus actual values of dependent variable, $\ln(S_{i,2016})$] from equation (3) on the vector of predictors Z_i (e.g., Sørensen, 2002). However, rather than doing the two-step estimation (regression estimation of equation (3), then calculating log-squared residuals, then regression estimation of equation (4)), we follow the more efficient simultaneous estimation approach (e.g., Greene, 1997). For this, we performed the simultaneous estimation of equations (3) and (4) [i.e., the assessment of the impact of vector or predictors X_i on the conditional mean, and vector Z_i on variance in firm growth rate] using the maximum likelihood method for multiplicative heteroscedasticity models. In line with

the conventional practice, we made the list of predictors the same for both equations (i.e., $X_i = Z_i$), with the exception of the lagged dependent variable $\ln(S_{i,2015})$, which was added to the mean-regression only (similarly to Sorenson and Sørensen (2001)).

4.3. Regression Results

The multiplicative heteroscedasticity regression results are presented in Table 2. Each of the models (1-3) presents two results: the mean regression (equation (3) assessing the impacts β_j of predictors on the conditional mean/level of the dependent variable), and variance regression (equation (4) assessing the impacts γ_j of predictors on the variability of residuals about the conditional mean).

---> INSERT TABLE 2 HERE <---

For all models in Table 2, the regression coefficient for the lagged dependent variable, $\ln(\text{revenue}_{2015})$, is positive and statistically significant ($p<0.001$). This suggests that the revenue variable is path-dependent; the coefficient of Gibrat's proportionate growth α falls in the range of 0.936 to 0.990. This finding corroborates the appropriateness of the lagged dependent variable specification of the estimated equation (3): firms demonstrate a similar growth rate, and all other regression coefficients in equation (3) assess the impact of predictors as accelerators or decelerators of this process.

Model 1 includes control variables only. Here, notable is the variance-reducing impact of firm age (γ=-0.699, $p<0.001$) without a significant impact on the conditional mean (β=-0.001, p=0.985). A similar impact is demonstrated by firm size (number of employees, ln: γ=-0.205, p=0.007 while β=0.048, p=0.210) and environmental dynamism (γ=-0.118, p=0.044 while β=0.005, p=0.850). In other words, firm age, number of employees and environmental dynamism characterize a pure variance-reducing property: they make the growth more reliable without affecting the expected value. Whereas the variance-reducing impact of age and size is intuitively obvious (i.e., older and larger companies should be more stable), the variance-reducing impact of dynamism requires further investigation and explanation in future studies.

Their opposite is the pure variance-boosting property, demonstrated by environmental hostility (γ=0.266, $p<0.001$ while β=-0.025, p=0.470). This finding suggests that hostility increases the firm-level risk (variability) in firm growth, without affecting the average.

Model 2 includes the main effects of the hypothesized predictors (exploration, exploitation) and the moderator, firm-specific crisis severity. In this model, exploration demonstrates a pure

variance-boosting property (γ=0.427, p<0.001 while β=-0.031, p=0.225). Exploitation does not have a statistically significant impact on either conditional mean or variability of firm growth, while the impact of crisis demonstrates a negative impact on the mean coupled with a negative impact on variability (β=-0.069, p=0.015; γ=-0.055, p=0.042). However, since the theoretical argument presented in this study and the insights of prior literature suggest the context-dependence of exploration's and exploitation's performance implications (Auh & Menguc, 2005; Jansen et al., 2006; Marino et al., 2015; Posen & Levinthal, 2012;), Model 2 without interactions is likely to be mis-specified, and as such no reliable conclusions about hypotheses testing can be inferred from these results.

Model 3 in Table 2 presents the results of the fully specified model. When the crisis severity variable is at the sample mean, exploration demonstrates a significant negative effect on the conditional mean of firm growth and simultaneously a significant positive effect on the variability of firm growth (β=-0.062, p=0.014; γ=0.342, p<0.001). This provides full support to Hypotheses 1a and 1b.

At the same time, exploitation demonstrates an insignificant effect on the conditional mean of firm growth and a significant positive effect on the variability of firm growth (β=0.035, p=0.154; γ=0.156, p=0.036). As such, Hypotheses 2a and 2b are not supported (insignificant result and opposite sign, respectively).

Of course, the presence of significant interaction effects in the regressions requires a qualifying comment here: the regression coefficients for exploration and exploitation discussed above provide an assessment of the main effects of these variables when the moderator (crisis severity) is at the sample mean (-0.561), reflecting the business-as-usual context. As the firm-level crisis severity variable deviates from the sample mean, the main effects will change according to the moderation logic. As such, we now proceed to analyze the interaction terms.

First, the "exploration by crisis severity" interaction term demonstrates a statistically significant positive impact on both mean and variability of firm growth (β=0.068, p<0.001; γ=0.215, p<0.001). The interaction charts for this moderation effect are presented in Figure 3a (impact on conditional mean of firm growth) and Figure 3b (impact on variability). Thus, Hypotheses 3a and 3b are fully supported: in times of crisis, the exploration activities bring a positive impact on firm growth yet also increase the variance of the resulting distribution.

Finally, in line with Hypotheses 4a and 4b, the "exploitation by crisis severity" interaction term demonstrates a statistically significant negative impact on both mean and variability of firm growth (β=-0.035, p=0.028; γ=-0.136, p=0.005). The interaction charts for this moderation effect are presented in Figure 4a (impact on conditional mean of firm growth) and Figure 4b (impact on variability).

---> INSERT FIGURES 3,4 HERE <---

4.4. Robustness checks and additional analyses

We performed a series of robustness checks, reported in online Appendix A. The results of hypotheses testing were fully replicated when: (1) the large firms were added to the sample (14 companies with over 250 employees), (2) the crisis severity variable was assessed as a drop in firm revenue between 2014 and 2013 (i.e., shorter crisis time lag as compared to the main analysis), (3) the crisis severity variable was estimated as a firm's proximity to bankruptcy (as negative standardized Z score (Altman et al., 2014)).

On the other hand, the hypothesized moderation effects did not hold when the crisis severity was assessed as a firm's lack of financial resource availability, and when the crisis is assessed at the industry level (measured as a drop in USD value of aggregated output in 2015 and 2014 over 2013 and 2012 in a firm's industry).

As an additional analysis, we tested the possibility that exploration and exploitation are mutually dependent and interact with each other. The intuition behind this approach is that ambidexterity, or a combination of exploration-exploitation rather than the individual components (e.g., He & Wong, 2004; Ho et al., 2020), is the primary way through which these two strategies affect performance. For this, we estimated a set of nested models with an "exploration X exploitation" term presented. The reported findings in the online Appendix A reveal that exploration and exploitation are distinct strategies with distinct performance implications (the hypotheses testing results fully collaborated when controlling for ambidexterity), while their hybrid (ambidexterity) does not demonstrate a unique effect above its individual components.

5. Discussion

5.1. Explorative and exploitative adaptation and distribution of firm performance

When faced with changes in their environments, firms can employ two generic strategies for sustaining the strategic fit: trying to leverage the existing assets, knowledge, and competencies (exploitation), or trying to develop the new ones (exploration). Our investigation reveals the distinct implications of these strategies on the level of firm performance (i.e., conditional mean), as well as the variability of performance. We find that exploration, on average, lowers the firm performance but simultaneously increases the performance variability, creating by this means the necessary conditions for both achieving abnormally high returns (right-hand side of performance distribution) and suffering major losses (left-hand side of performance distribution). This finding supports our hypotheses on the role of explorative strategy as providing more alternatives, but also reducing performance, at least in the near term.

Surprisingly and contrary to our predictions, an exploitation strategy is not significantly related to the firm performance level but is also significantly positively related to performance variability. However, the results become more meaningful when we take into account the firm-level severity of the crisis. In our main analyses, we operationalize *firm-specific crisis severity* as a drop of revenue, which we use as a moderator in examining the effects of exploration and exploitation on the level and variability of firm performance. We find that crisis severity has a strong moderating role, changing the utility of exploration and exploitation strategies. In particular, we find that under a high level of crisis severity, exploration strategies are significantly and positively related to the level of firm performance as well as to its variability (see Figures 3a and 3b). Under low levels of crisis severity, the exploration strategies lead to a reduction of performance, as well as a reduction in variability. Furthermore, we find that exploitation strategies under high crisis severity lead to reductions of both firm performance level as well as variability. On the other hand, when crisis severity is low, exploitation strategies lead to increase in performance level coupled with increase in its variability. Overall, these results mean that under difficult conditions, firms that focus on exploitation can expect reliable (i.e., low variance) but declining performance. However, exploring under crisis seems to provide access to major opportunities to achieve high performance, along with a "cost" of increased variability.

Our study involves important implications for firms' strategic choices under severe crises, given the crucial choice to allocate resources and attention to either exploration or exploitation. Organizational decline literature has shown that firms have a variety of ways to approach crisis and decline, including decline as a catalyst or an inhibitor for adaptation (McKinley *et al*., 2014). Following the strategic fit approach (Trahms et al., 2013; Zajac et al., 2000) our findings provide particular evidence not on the antecedents to firm adaptation choices like much of the decline literature, but rather to the consequences of particular strategic choices under different firm-specific crisis severity contexts. As we show that when firms are going through a severe crisis with falling financial performance, our findings suggest that they should explore ways to capitalize on the crisis. This insight is aligned with the dynamic capabilities view, in that more explorative strategic approaches are the preferable way when environmental uncertainty grows (e.g., Ahn et al., 2018; Schilke, 2014), as well with the evidence that firms able to adopt explorative approaches during an economic crisis might end up better off than other firms (Archibugi et al., 2013; Paunov, 2012). An explorative approach implies some risks, however, as the variability of performance rises. Therefore, if the aim of a firm under severe crisis is to secure a reliable, even if slightly falling stream of revenue, then exploitation is the preferred strategy. Therefore, it can be concluded that an exploration strategy allows finding potential ways to escape the falling performance, but this comes with a cost of increased risk. Thus, performance reliability and opportunities can be seen as substitutive strategic alternatives for firms that suffer the consequences of an economic downturn.

On the other hand, even under conditions of an economic downturn, some firms do not suffer from firm-level drops in revenue. Our results suggest that for such firms, the better strategy is to continue exploiting the key strengths since it is likely to generate increasing streams of revenue (see Figure 4a). Interestingly, in those cases, there is also increased variability of performance, suggesting that the broader context of a financial crisis still creates volatility and uncertainty.

Finally, we found via additional analyses that there is no additional effect of ambidexterity beyond individual exploitation and exploration strategies (see online Appendix A). While ambidexterity has been viewed often as a beneficial strategy for firms in a variety of contexts, it is also unclear whether and when it contributes to firm performance directly, or when such effect is due to contextual or research methodological issues (as demonstrated in a meta-analysis by Junni

et al., 2013). Thus, our finding that exploitation and exploration have particular implications under different contingencies, and ambidexterity does not provide additional explanations beyond these, is perhaps not fully surprising. Thus, it remains for future studies to examine this aspect (or its absence) further.

5.2. Contributions

Based on the presented results, we believe our study makes two major theoretical contributions to the strategic management literature. First, we provide a more overarching understanding of the performance impact of exploration and exploitation than in the previous literature. Thus far, the literature has provided a lot of understanding of the individual and joint effects of exploration and exploitation on firm performance (Jansen et al., 2006; Marino et al., 2015; Posen & Levinthal, 2012; Uotila et al., 2009). However, our study also involves the investigation of the variability of firm performance, which is an important but overlooked outcome of exploration and exploitation strategies (for exceptions, see Parida et al., 2016; Uotila, 2017). We argue that understanding both the level and variability of firm performance is very relevant from both scholarly and managerial perspectives. If the benefits to performance come at the cost of higher variability and risk, the assessment of those outcomes can be made from a more informed approach. For various reasons, some firms might prefer lower performance if they can, at the same time, achieve a more reliable performance trajectory. On the other hand, some firms might be tempted to aim for higher performance. Our study thus provides important evidence of a previously overlooked aspect of performance variability (or reliability) in exploration and exploitation research.

Second, our study enriches our understanding of the role of exploration and exploitation under exogenous shocks, such as during economic downturns. Here, our contribution can be viewed through the lenses of strategic fit, where firms' strategies provide better performance when they are well aligned with the external environment (e.g., Fainshmidt et al., 2019; Zajac et at., 2000). Indeed, the organizational decline literature has already demonstrated that firms' actions' strategic fit to crisis environments has notable performance implications (Trahms et al., 2013; Wan & Yiu, 2009). Here, firms' strategic fit is examined in an interesting research setting: a period of major economic crisis, of which we measured the crisis severity at the firm level and focused on particular adaptation strategies of exploration and exploitation. We find that given the right choices to employ explorative or exploitative strategies, firms can enhance their performance, often with

the expense of increased variability. Existing research has already established that exploration-type strategies often better fit the dynamic environments (e.g., Jansen et al., 2006; Schilke, 2014) as well as provided evidence of the merits of innovative activities under economic downturn (Ahn et al., 2018; Archibugi et al., 2013; Shirokova et al., 2019). Furthermore, organizational decline literature has suggested that firms benefit from different types of strategic actions in declining and growing industry conditions (McKinley et al., 2014; Trahms et al., 2013). Our results provide a further enriched picture of firm behavior under crisis context regarding two canonical strategies—exploration and exploitation. Our results show that firms suffer from major crises to different extents, as we measure this firm-specific crisis severity effect in two alternative ways (sales decline as well as closeness to bankruptcy), finding consistent results with both measures. Importantly, we demonstrate how such crisis severity affects the outcomes (and strategic fit) of both of these strategies.

Methodologically, the current study is intended to draw the attention of strategic management and entrepreneurship scholars to the need to analyze performance implications of firm entrepreneurial actions not only from the perspective of their impact on the level (conditional mean of performance, as it is done in absolute majority of studies based on conventional regression methodology) but also from the perspective of the impact of entrepreneurial actions on variance of the resulting performance distribution. For this, we discuss the multiplicative heteroscedasticity regression methodology (Harvey, 1976), which—although not widely used in management—is broadly used in the economics field for assessing the impact of predictors on both level and variability of the outcome variable.

5.3 Managerial Implications

Our findings provide concrete managerial advice for firms' exploration and exploitation strategies under crisis situations. The main implication is that exploration strategies might be beneficial under firm-specific crisis situations, especially for those firms that can stand the risks involved. Exploration will lead to higher variability of performance but provides the chance to grasp new opportunities. On the other hand, if the firm has a situation where it has a serious threat regarding its survival, and extra finances and resources are not likely available, choosing an exploitative strategy might be a better option. Under high crisis severity, exploitation leads to performance decline, but with a lower variation. Thus, if a firm can muddle through a period of declining performance via continuing exploitation, it might find new opportunities as the broader crisis

situation is resolved. While these implications point to sufficiently clear strategic choices, in reality, the crisis situation involves other strategic elements to consider. For instance, it is advisable to also examine the firm's competitive situation as well as the broader economic context before deciding to place the bets on a mostly exploitative or explorative approach. Furthermore, when the economic shock is coupled with other types of disruptions such as the recently witnessed global pandemic (due to COVID-19 virus), the firm-specific implications are likely to be further dispersed based on the industry affiliation, geographical location, or legislative regime in a particular institutional context.

5.4. Limitations and future research directions

A set of limitations of the current paper set the stage for future studies. First, the insights of the studies of organizational ambidexterity (He & Wong, 2004; Ho et al., 2020; Koryak et al., 2018; Lubatkin et al., 2006; Stettner & Lavie, 2014) strongly suggest that the *balance* or *combination* of exploration and exploitation might have a major impact on firm performance, above and beyond the impacts of these strategies individually. Although our additional analyses (see online Appendix A) fail to support this prediction, this non-significant result might be driven by the context-dependence of the ambidexterity-performance relationship. As such, a more nuanced investigation of combined implications of exploration and exploitation on firm performance level and variability is warranted, and here our current paper might serve as the founding step establishing the distinct effects of the strategies.

Second, our empirical investigation focuses on the implications of exploration and exploitation on performance level and variance in the short-term only. However, the long-term performance implications of these strategies might be substantively different, as, for example, exploration requires much more time to pay off as compared to exploitation (Uotila, 2017). Hence, we encourage further longitudinal studies of the same phenomenon.

Finally, as it is usually the case with non-experimental study design, our reported findings are vulnerable to a threat of endogeneity. In particular, the possible unobservable industry- and firm-level characteristics might simultaneously affect the hypothesized predictors (exploration, exploitation, crisis severity) and the outcome variable (revenue growth and revenue variability). To mitigate this threat to internal validity, we performed a series of checks, such as accounting for a time lag between the measures of dependent and independent variables (to establish the temporal

order) and using within-firm lagged dependent variable specification (to account for all time-invariant firm- and industry-level covariates). Moreover, we added a wide list of control variables, the most obvious drivers of both exploration/exploitation and performance, such as the main effect of crisis severity (as probably the main driver of firm's adaptive actions) and other characteristics of the firm's environment. Nevertheless, the causal claims of the paper require verification in experimental, quasi-experimental, or simulation-based settings.

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Declarations of interest

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Table 1. Descriptive statistics and correlations

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)
(1) Revenue in 2015, ln	9.813	2.024	0.000	16.752	1					
(2) Revenue in 2016, ln	9.947	1.885	3.714	16.730	0.898	1				
(3) Exploration	4.143	1.464	1.000	7.000	0.036	0.071	1			
(4) Exploitation	5.235	1.098	1.000	7.000	0.013	0.051	0.576	1		
(5) Crisis severity (firm-specific)	-0.561	2.449	-38.592	1.000	-0.030	-0.049	-0.057	-0.018	1	
(6) Total assets, ln	9.369	1.912	3.850	15.174	0.742	0.796	0.081	0.057	-0.001	1
(7) Firm age, ln	2.328	0.676	0.000	4.771	0.110	0.109	0.021	0.041	0.183	0.155
(8) Number of employees, ln	2.927	1.144	1.099	5.521	0.529	0.550	0.063	0.098	0.034	0.565
(9) International sales (dummy)	0.072	0.259	0.000	1.000	0.121	0.103	0.107	0.118	-0.111	0.137
(10) Formalization	4.444	1.559	1.000	7.000	0.107	0.103	0.186	0.267	-0.013	0.136
(11) Centralization	4.350	1.203	1.000	7.000	0.050	0.038	-0.005	0.140	0.047	0.062
(12) Social ties	2.661	1.331	1.000	7.000	0.104	0.069	0.275	0.239	0.004	0.101
(13) Financial resource availability	3.160	1.231	1.000	7.000	0.114	0.112	0.112	0.101	0.014	0.090
(14) Environmental dynamism	3.201	1.168	1.000	6.600	-0.017	-0.003	0.464	0.144	0.004	-0.005
(15) Environmental hostility	3.886	1.074	1.000	7.000	-0.045	-0.039	0.252	0.209	0.024	-0.007

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(7) Firm age, ln	1								
(8) Number of employees, ln	0.292	1							
(9) International sales (dummy)	0.051	0.066	1						
(10) Formalization	0.133	0.212	0.086	1					
(11) Centralization	0.118	0.168	0.005	0.558	1				
(12) Social ties	-0.008	0.138	0.139	0.069	0.012	1			
(13) Financial resource availability	0.021	0.135	0.036	0.294	0.243	0.093	1		
(14) Environmental dynamism	-0.033	-0.028	-0.177	-0.003	-0.058	0.031	0.085	1	
(15) Environmental hostility	0.022	0.015	0.046	0.013	0.015	0.313	-0.131	0.258	1

Notes: N = 500. All Pearson correlations with absolute values above |r| > 0.088 are significant at the $p < 0.05$ level; all |r| > 0.115 are significant at the $p < 0.01$ level; all |r| > 0.147 are significant at the $p < 0.001$ level.

Table 2. Multiplicative heteroscedasticity models of revenue growth
Dependent variables: mean and log-variance of ln(revenue$_{2016}$)

Predictors (2015):	**Model 1**		**Model 2**		**Model 3**	
	Mean regression (β_j)	**Variance regression (γ_j)**	**Mean regression (β_j)**	**Variance regression (γ_j)**	**Mean regression (β_j)**	**Variance regression (γ_j)**
Exploration ***Hypothesis 1***			-0.031 (0.026) [0.225]	0.427*** (0.064) [0.000]	-0.062* (0.025) [0.014]	0.342*** (0.064) [0.000]
Exploration X Crisis severity ***Hypothesis 3***					0.068*** (0.009) [0.000]	0.215*** (0.026) [0.000]
Exploitation ***Hypothesis 2***			0.008 (0.025) [0.738]	0.098 (0.074) [0.188]	0.035 (0.025) [0.154]	0.156* (0.074) [0.036]
Exploitation X Crisis severity ***Hypothesis 4***					-0.035* (0.016) [0.028]	-0.136** (0.048) [0.005]
Crisis severity (firm-specific)			-0.060* (0.025) [0.015]	-0.055* (0.027) [0.042]	-0.066*** (0.015) [0.000]	0.199*** (0.039) [0.000]
Total assets, ln	-0.005 (0.030) [0.871]	0.005 (0.042) [0.908]	0.028 (0.025) [0.267]	0.001 (0.042) [0.977]	0.046* (0.023) [0.047]	0.049 (0.042) [0.248]
Firm age, ln	-0.001 (0.043) [0.985]	-0.699*** (0.100) [0.000]	0.008 (0.039) [0.844]	-0.842*** (0.101) [0.000]	0.009 (0.037) [0.814]	-0.793*** (0.102) [0.000]
Number of employees, ln	0.048 (0.038) [0.210]	-0.205** (0.076) [0.007]	0.058+ (0.033) [0.081]	-0.193* (0.076) [0.011]	0.059+ (0.032) [0.061]	-0.263*** (0.076) [0.001]
International sales (dummy)	0.184 (0.121) [0.131]	-0.291 (0.259) [0.260]	0.175+ (0.090) [0.052]	-0.766** (0.263) [0.004]	0.189* (0.086) [0.027]	-1.004*** (0.264) [0.000]
Formalization	0.005 (0.025) [0.827]	-0.012 (0.051) [0.817]	0.000 (0.020) [0.992]	-0.084 (0.052) [0.111]	0.002 (0.019) [0.934]	-0.104* (0.053) [0.047]
Centralization	0.006 (0.032) [0.838]	0.000 (0.065) [1.000]	-0.004 (0.027) [0.890]	0.154* (0.066) [0.019]	-0.006 (0.026) [0.820]	0.205** (0.066) [0.002]
Social ties	0.015 (0.025) [0.550]	-0.043 (0.052) [0.409]	0.026 (0.021) [0.222]	-0.087 (0.053) [0.102]	0.027 (0.022) [0.215]	-0.066 (0.053) [0.215]
Financial resource availability	-0.011 (0.026) [0.665]	0.006 (0.057) [0.916]	-0.017 (0.022) [0.433]	-0.043 (0.057) [0.444]	-0.015 (0.021) [0.467]	-0.040 (0.057) [0.483]
Environmental dynamism	0.005 (0.028) [0.850]	-0.118* (0.059) [0.044]	0.018 (0.028) [0.520]	-0.228*** (0.067) [0.001]	0.035 (0.027) [0.198]	-0.288*** (0.067) [0.000]
Environmental hostility	-0.025 (0.034) [0.470]	0.266*** (0.067) [0.000]	-0.024 (0.027) [0.377]	0.140* (0.068) [0.038]	-0.040 (0.027) [0.146]	0.176** (0.068) [0.009]
Industry fixed effects	IN	IN	IN	IN	IN	IN
Region fixed effects	IN	IN	IN	IN	IN	IN

Lagged DV, $\ln(\text{revenue}_{2015})$	0.990*** (0.030) [0.000]	-	0.951*** (0.024) [0.000]	-	0.936*** (0.023) [0.000]	-
Intercept	-0.105 (0.272) [0.700]	1.914*** (0.533) [0.000]	-0.005 (0.252) [0.984]	2.634*** (0.567) [0.000]	-0.051 (0.240) [0.831]	2.174*** (0.568) [0.000]
Model χ^2 (df)	**964.590 (35)**		**1044.876 (41)**		**1092.797 (45)**	

Notes: N=500. Standard errors reported in parentheses, exact p-values (two-tailed) reported in brackets. +p<0.1; * p<0.05; ** p<0.01; *** p<0.001. The variables *exploration*, *exploitation*, and *crisis severity* were mean-centered to facilitate interpretation of the interaction results.

Figure 1. Baseline hypotheses: The impact of exploration and exploitation on resulting performance distribution

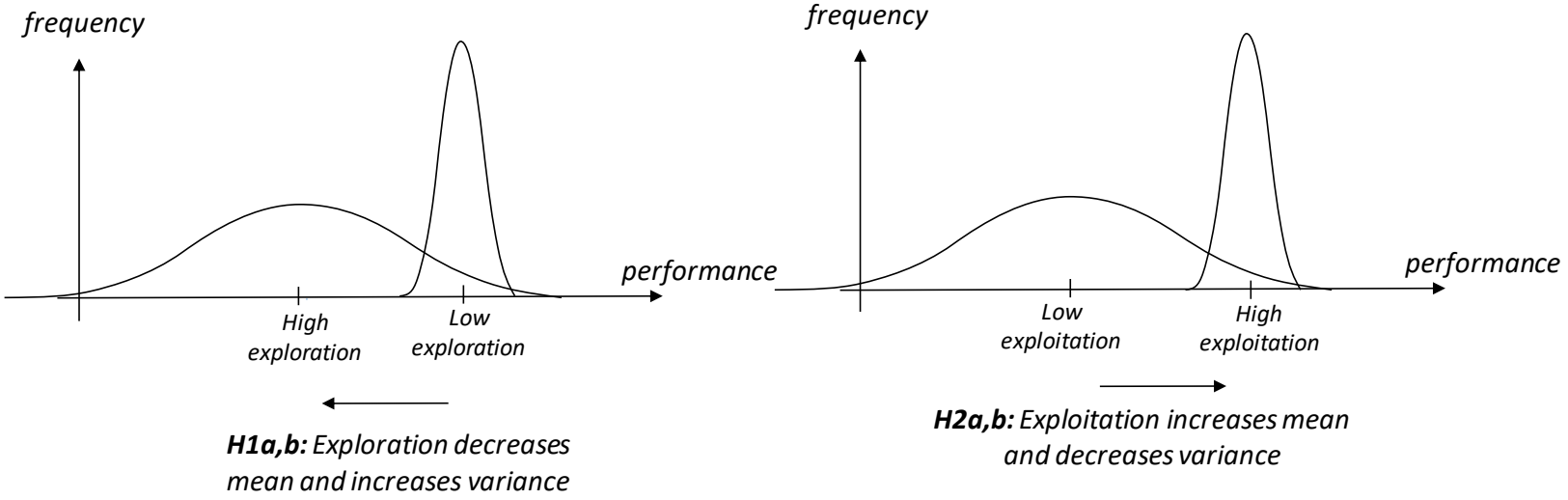


Figure 2. Theoretical framework of the study

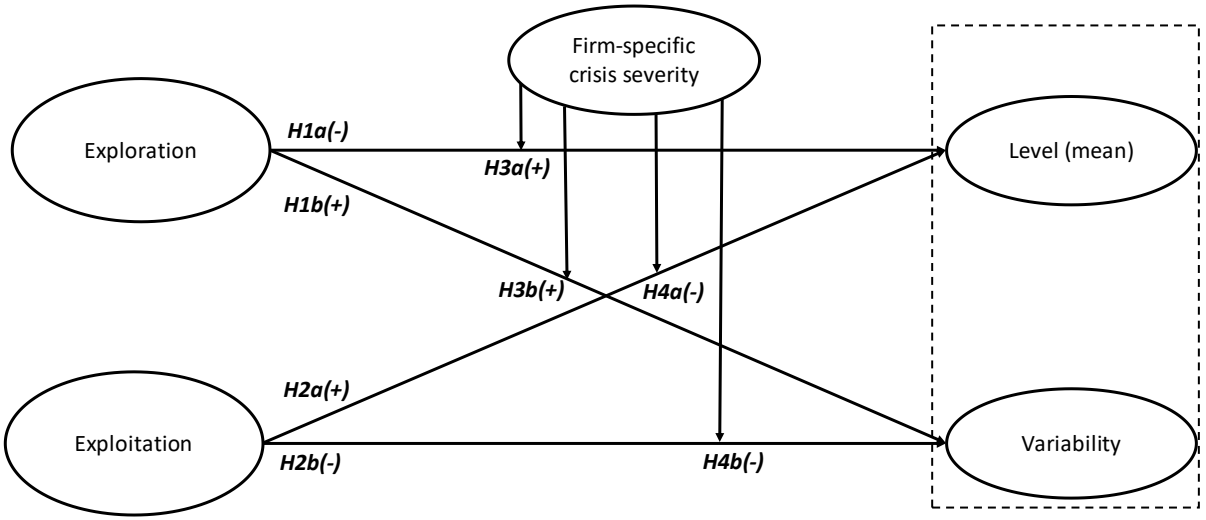
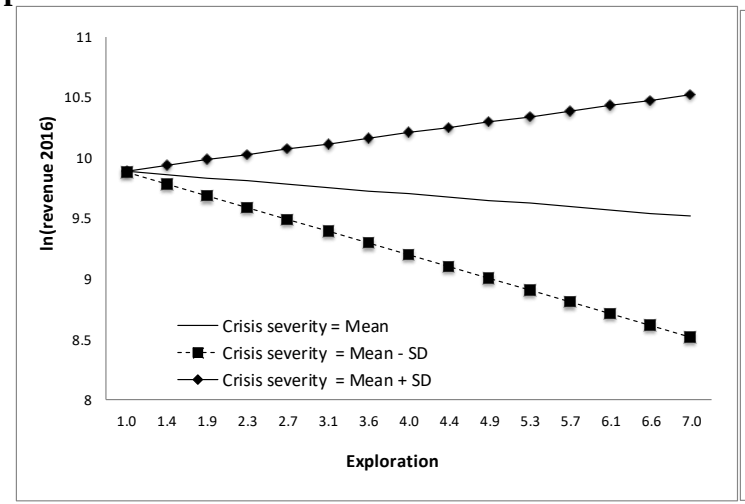


Figure 3. Moderating effect of *crisis severity* on the relationship between exploration and firm growth

3a – Impact on conditional mean



3b – Impact on variability

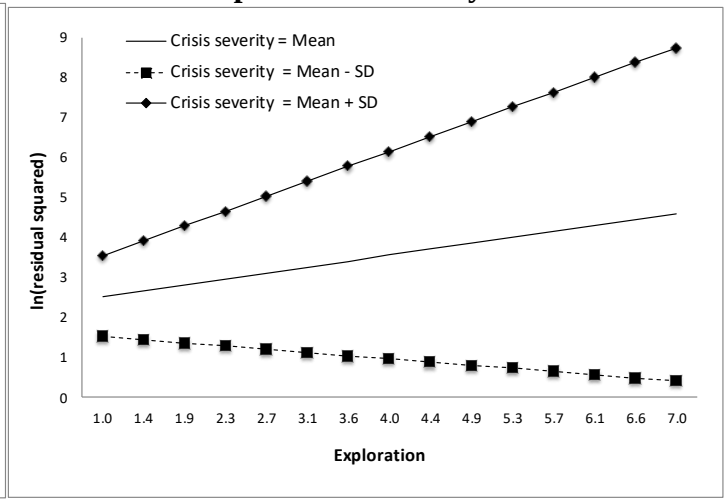
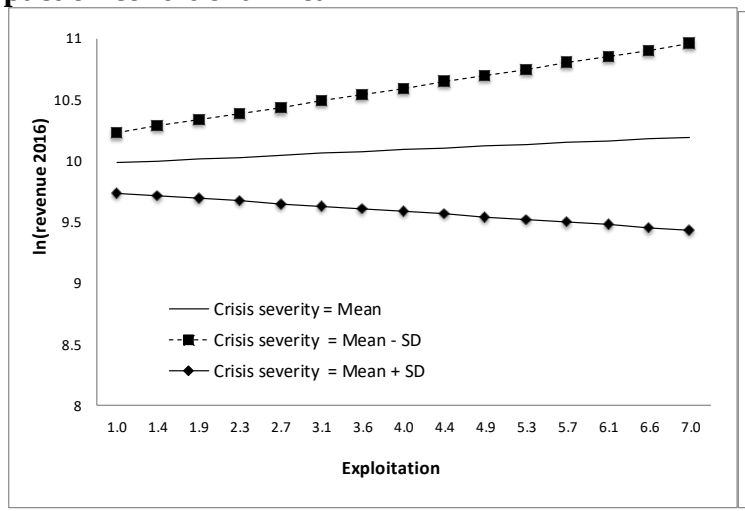


Figure 4. Moderating effect of *crisis severity* on the relationship between exploitation and firm growth

4a – Impact on conditional mean



4b – Impact on variability