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Supply chain resilience and absorptive capacity: crisis mitigation and performance effects during Covid-19

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Abstract

Purpose

The purpose of this paper is to investigate the relationships of supply chain resilience (SCR) and absorptive capacity (ACAP) with firm performance by specifically examining the crisis mitigating effects under an environmental jolt such as Covid-19.

Design/methodology/approach

The paper is based on data from a questionnaire survey among Danish manufacturing and transport and logistics companies with 174 respondents.

Findings

While the adaptive capabilities associated with both SCR and ACAP are well recognized in extant SCM literature, less is known about their boundary conditions. Examining the functioning of SCR and ACAP amid the Covid-19 crisis, this study finds that both SCR and ACAP related positively to firm performance. However, while the positive relationship between SCR and firm performance was partly mediated by better crisis-mitigation, the results did not find that a similar mechanism was present for ACAP. These results suggest notable refinements of current understandings of SCR and ACAP, respectively.

Research limitations/implications (if applicable)

The present study is limited by the cross-sectional design, the focus on Danish companies only, and by examining only two industries. Hence, comparisons to other countries and other industries would be of significant interest.

Practical implications (if applicable)

Investing in SCR and ACAP to different extents provide for a complementary mix of longer-term opportunity-generating dynamic capabilities and more short-term crisis-mitigating dynamic capabilities. Firms will benefit from both types of dynamic capabilities during a crisis, but the latter will be more important for mitigating specific crisis impacts.

Original/value

The paper extends current theorizing on ACAP and SCR by adding the distinction between the long-term opportunity generating dynamic capabilities and short-term crisis mitigating dynamic capabilities. The paper provides novelty by empirically examining this theorizing by investigating the performance- and crisis mitigating effect of SCR and ACAP in the light of the Covid-19 crisis.

Keywords: Covid-19, crisis, supply chain resilience, environmental jolts, performance

1. Introduction

Companies have always been exposed to disruptions and disturbances, not least in their supply chains. Following the globalization of trade, and hence supply chains, this exposure has increased significantly. Disruptions and disturbances impacting the supply chain may be pandemics, natural disasters like earthquakes, volcano eruptions, flooding, tsunamis (Akkermans and van Wassenhove, 2018; Wedawatta and Ingirige, 2012), the drought in central Europe causing shallow waters in the German river Rhine, forcing lesser cargo to be carried on the vessels. It may also be currency fluctuations (Chowdhury and Quaddus, 2016), terror attacks (Sheffi, 2001), trade wars (e.g., China vs. the USA), and regional instability (Akkermans and van Wassenhove, 2018; Pettit et al., 2010; Ponomarov and Holcomb, 2009), cyberattacks (Nguyen et al., 2021), or the recent blockage of the Suez Canal. The increasing incurrence of disruptive events put a high pressure on managers to develop firm-level capabilities to cope with disruptions of different types (Pereira et al., 2014). The devastating impact from the Covid-19 pandemic on supply chains all over the world even further accentuates this challenge (Ivanov, 2020; Paul and Chowdhury, 2020).

At the country level, the impact of Covid-19 on local firms' operating conditions has varied relative to various characteristics of local business eco-system and their international connectedness, and relative to country institutions and differences in fiscal, monetary, public health, and human control policy responses (Ozil and Arun, 2022). Studies further show significantly different industry effects. In Australian food, healthcare, pharmaceutical and telecommunication obtained cumulative abnormal returns after the Covid-19 outbreak while transportation, technology, energy, and real estate experienced negative abnormal returns (Alam et al., 2021). In China, tourism, film and TV-entertainment, catering retail, and transportation was the most badly hit sectors (Shen et al. 2020). Yet, there is also an observance of within-industry differences in how firms have been capable of responding to the disrupted business landscapes. For example, a Danish study (Klyver and Nielsen, 2021) found that within the more challenged industries, some companies were severely negatively impacted (crisis victims), some were not, or only marginally affected by the pandemic (crisis immune), while some companies even faced increasing turnover because of Covid-19 (crisis exploiters). In line with dynamic capability theory (Eisenhardt and Martin, 2000) this suggests that firms have varied in their capabilities to respond to the rapid and unpredictable change ignited by the pandemic. Yet, what exactly constituted such dynamic capabilities in the face of the pandemic is still underexamined.

Two central theoretical constructs have been used to explain variance in firms' capabilities to adapt to changing environmental conditions and respond to environmental jolts - each with a slight difference in their underlying mechanisms. First, absorptive capacity (ACAP) describes firms' dynamic capabilities to acquire, assimilate, transform, and exploit knowledge. Its primary orientation is towards learning and proactively creating and engaging in innovation and the development of new business opportunities (Zahra and George, 2002). Second, supply chain resilience (SCR) describes firms' capabilities to "*prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function*" (Ponomarov and Holcomb, 2009, p. 131). This conceptualization connotes a primary orientation toward operational stability, risk management, foresight, and preparedness.

However, existing knowledge of the contextual functioning of ACAP and SCR is still scarce. This is evident in several recent calls for more empirical studies of SCR (Ali et al., 2017; Ali and Gölgeci, 2019; Hohenstein et al., 2015; Kamalahmadi and Parast, 2016; Kochan and Nowicki, 2018; Shekarian and Parast, 2021), more studies that examine the value of SCR (Ali et al., 2017; Li et al., 2017), research that covers the consequences of SCR and how it impacts performance (Chowdhury and Quaddus, 2017; Shashi et al., 2019), and notably, research that "investigate the roles of various contingent variables in forming resilience capabilities and affecting their contributions to performance outcome" (Li et al., 2017, p. 264). Likewise, the concept of ACAP has, in its own right, gained increased interest in current years, but also in relation to SCR. Cheng and Lu (2017), for example, found a positive relationship between ACAP and SCR, while Roh et al. (2022) find that different dimensions of ACAP relate somewhat differently to low-impact resilience and high-impact resilience, respectively. This finding importantly insinuates that dynamic capabilities associated with ACAP, and SCR may vary in their effects under different environmental circumstances.

Many of the challenges experienced by firms during the pandemic were of a hereto unprecedented kind, which importantly challenges the underlying mechanisms of ACAP and SCR. Previous studies have argued for a positive crisis-mitigation effect from ACAP (Ambulkar et al., 2016; Gölgeci and Kuivalainen, 2020). Yet, other studies have emphasized that the development of ACAP builds on prior investment in the development of its constituent, and that ACAP tends to develop cumulatively (Cohen and Levintal, 1990, p. 131). ACAP thus has a long-term focus on learning and development of strategic and operational knowledge (Alkalha et al., 2019).We

therefore suggest that in a crisis, the functioning of ACAP will be challenged by how well the firms' knowledge base connects to and is capable of effectively associating with and assimilating the radical novelty of the situation and how rapidly this process may occur.

For SCR, the time perspective in the adaptive process seems somewhat different in that the many practices that support firms to achieve SCR might have a long-term orientation and outcome yet can be initiated within a short-term horizon (Ali et al., 2017). Nonetheless, the unprecedented nature of events may still challenge firms' capabilities to establish the high level of preparedness that is essential to the SCR construct (Singh et al., 2019). In general, an economic crisis that is driven by large-scale unprecedented environmental jolts - like the crisis ignited by the Covid-19 pandemic – thus significantly challenges the boundary conditions for the theorizing on the dynamic capabilities associated with ACAP and SCR, respectively.

Against these backdrops, the purpose of this paper is to advance the understanding of the functioning and the potential boundary conditions of SCR and ACAP, respectively. The Covid-19 crisis here presents itself as an extreme case being not only a high-impact, low frequency disruption (Roh et al. 2022) but also a disruption of unprecedented and highly ambiguous character involving many unknown unknowns (Ramasesh and Browning, 2014). Deriving insights on ACAP and SCR under such extreme circumstances is important because it is exactly when such jolts are present that these dynamic capabilities stand their test. Using a dynamic capability perspective (Eisenhardt and Martin, 2000), the paper introduces theorizing that specifically distinguishes between crisis mitigating capabilities and performance effects from ACAP and SCR that may occur during a crisis but are not directly related to the capacity to handle the specific crisis. From this theorizing hypotheses are developed for a) the direct effects of ACAP and SCR on firm performance during the Covid-19 crisis and b) for how these relationships indirectly are mediated specifically by crisis-mitigation. The hypotheses are tested using a unique sample of 174 Danish Manufacturing, and Transport & Logistics companies, examined during Marts and April 2021. At this time the Danish Government had just started easing lockdown restrictions of several businesses and educational institutions, while still maintaining strict restrictions on social activity and travelling.

The paper is organized into five main sections. The following section presents the theoretical frame of references and develops the hypotheses. Next section describes the applied method. Then follows a section presenting the results, a section discussing the findings and finally a section

concluding the paper presenting with theoretical and practical implications, discussion of limitations, and suggestions for future research.

2. Theoretical frame of references and hypotheses development

2.1 Developing resistance to disruptions

Companies pursue strategic changes due to changes in their business environment. Such changes have been classified as continuous, or first-order, changes and as discontinuous, or second-order, changes (Meyer et al., 1990). Continuous change occurs within a stable system that itself remains unchanged whereas discontinued change transforms fundamental properties or states which may destabilize the entire system. Environmental jolts are transient perturbations whose occurrence is disruptive and potentially inimical (Meyer, 1982) where companies operate with unknown unknowns (Ramasesh and Browning, 2014). One can argue that Covid-19 is not a short-termed event since its first occurrence at a fish market in Wuhan, China and still is present in China. However, the Covid-19 pandemic is in this paper perceived as an example of a discontinued change and thus an environmental jolt as it occurred suddenly and unprecedentedly. Other environmental jolts that may disrupt global supply chains are trade wars (Johnson and Haug, 2021), geopolitical issues (Roscoe et al., 2022), climatic phenomenon (Ghadge et al., 2020), and energy crises (Emenike and Falcone, 2020). In this paper, the focus is on two approaches to deal with such environmental jolts (Meyer, 1982) i.e., SCR and ACAP.

Organizations work with building supply chain robustness in different ways. One way is to look at SCR in phases of readiness, response, and recovery (Ponomarov and Holcomb, 2009), which later has been supplemented with a fourth phase of growth (Hohenstein et al., 2015; Chowdhury and Quaddus, 2016). Possible strategies can be divided into two categories, proactive or reactive strategies (Dabhilkar et al., 2016; Hohenstein et al., 2015; Wieland and Wallenburg, 2013). The proactive strategy, ex-ante, acts before it is an absolute necessity. The reactive strategy, ex-post, responses after experiencing a disruption. Thus, a proactive strategy is concerned with the readiness phase and a reactive strategy with the response, recovery, and growth phase. A combination of proactive and reactive strategies might be developed e.g., in a cube of calamity where one evaluates the consequences of possible disruptions and their likelihood ex-ante and then the detectability lead time of the disruption ex-post (Sheffi, 2015, p. 44).

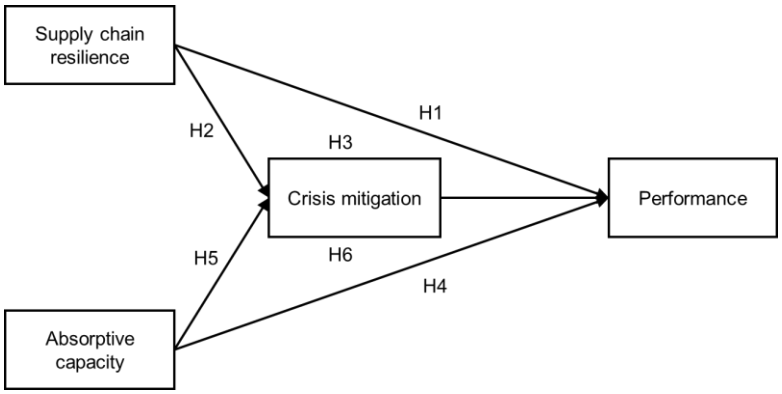
Another approach to deal with discontinued change is to develop a company's ACAP. Cohen and Levinthal (1990) have stressed the importance to strengthen abilities to exploit external knowledge as a critical component for internal innovation capabilities. Cohen and Levinthal (1990, p. 28) define ACAP as an "ability to recognize the value of new information, assimilate it, and apply it to commercial ends". ACAP is concerned about how much knowledge can be absorbed in the company. Originally it has been divided into three stages: 1) acquire or search for knowledge, 2) store and share knowledge, and 3) analyze and use knowledge. Zahra and George (2002) extended these three stages into four stages: acquisition, assimilation, transformation, and exploitation. Flatten et al. (2011) have, based on a comprehensive literature review, developed operational scales for the four stages ACAP construct.

Both SCR and ACAP are focused on developing resistance to disruptions but at different levels and by different means. SCR can, from an engineering perspective, be seen as being tool-oriented with operational initiatives that can be prepared in contingency plans (Adobor and McMullen, 2018). SCR constitutes an important element in a company's overall risk management (Ribeiro and Barbosa-Povoa, 2018). The two perspectives supplement each other. SCR is concrete, and content-focused, whereas ACAP is process-oriented i.e., how boundary-spanning activities are linked between the firm and its environment. Furthermore, ACAP can be seen as a proactive concept for generating and applying new useful knowledge, whereas SCR only is proactive in the first phase and then reactive in the last three phases.

As dynamic capabilities, both SCR and ACAP provide means for firms to deal with uncertain environments. In the abrupt occurrence of a significant disruption, there will be a focus on the short-term benefits hereof and primarily on the capability of the firm to mitigate adverse consequences of changing contingencies and to restore operational efficiency. This capability may be referred to as a "crisis mitigating" dynamic capability. When environments are less turbulent, strategic focus tends to be more long-term and with a view on dynamic capabilities as means for exploration and innovation. These more long-term dynamic capabilities are thus of a more "opportunity generating" kind. A third advantage of dynamic capabilities is the "spill-over effects" on operational performance, which associate with a higher degree of managers professionalism and a higher managerial awareness of operational contingencies. For example, installing risk management procedures, scenario planning, and contingency plans to strengthen SCR would typically associate with increasing the effectiveness of current operations.

When considering dynamic capabilities in a specific context, it is important to distinguish between these three effects. The approach taken in this paper is to make a distinction between on the one hand the effects generated from capability of ACAP and SCR to mitigate the adverse operational consequences of the Covid-19 crisis, and on the other hand, the performance consequences of ACAP and SCR that derive from either longer-term opportunity generating capabilities or which associate with spill-over effects. Analytically, the former effect is modelled as an indirect effect of ACAP and SCR on performance mediated by crisis mitigation. The latter effects are modelled as direct effects, as they are not driven by crisis mitigation (see Figure 1).

Figure 1. Analytical model



Source: Authors own creation

2.2 Relationship between supply chain resilience, firm performance, and crisis mitigation

The extant studies on the relationship between SCR and performance has found a positive relationship between SCR practice and firm performance (Chowdhury et al., 2019). Improved SCR in terms of agility and robustness enhances customer value (Wieland and Wallenburg, 2013). And, supply chain preparedness, alertness, and agility, associate positively with financial performance (Li et al. 2017; Yu et al. 2019). Based on a literature review, Singh et al. (2019) translates resilience concepts into an SCR framework, to create a managerial tool for improving performance. What these studies have in common is that their surveys have been completed without a preceding crisis like Covid-19. Thus, knowledge is limited concerning actual capabilities to manage an environmental jolt.

Notably, some effects of SCR do not relate directly to crisis mitigation. At first, benefits of SCR may derive from the very benefits of implementing it. Implementation of SCR involves

consciously considering strengths as well as the shortcomings and risks of a firm's current supply chains (Ponomarov and Holcomb, 2009). Hence, this process alone may improve firms' performance. In addition, implementing SCR signifies a certain management competence level in a firm (Mandal, 2021), which may by itself associate positively with firm performance. Importantly, neither of these effects occur as an effect of diminishing the effects of incurred external disturbances but are rather to be considered as spill-over effects from SCR implementation.

Other effects from SCR implementation that do not explicitly relate to the ability to navigate under a specific jolt, concerns the ability to respond to non-jolt related events, i.e., event of a more known character. Such events may occur simultaneous to those sparked specifically by a jolt. Finally, firms' risk management, scenario planning and contingency planning, etc. may also associate with opportunity generating capabilities that on a more long-term basis may provide firms with relatively more competitive positions and more solid strategic postures (Ambulkar et al., 2016). Such impacts would typically be reflected in comparisons of firms' performances during a jolt, while not specifically reflecting their relative crisis mitigating capabilities.

We hypothesize that under a jolt (here the Covid-19 crisis specifically), spill-over effects in combination with more long-term and more opportunity generating mechanisms associated with SCR will drive a direct positive effect of SCR on firm performance, i.e., an effect that is not caused by the crisis mitigating capabilities of the firm (H1):

H1: During a crisis, there is a direct positive effect of supply chain resilience on firm performance.

The main tenet of SCR is that it provides firms with the ability to maneuver in an uncertain environment and to react to disturbances to the supply chain. Such disturbances may be firm-specific involving dynamics in the firm's business domain. New competitors may disrupt the bargaining balance with suppliers, new technologies may change the relative importance of suppliers, etc. However, when such dynamics arise out of larger environmental jolts that fundamentally shift the availability and costs of resources, interdependencies and uncertainty increases across a much wider span of economic actors, as we have witnessed amongst others during the financial crisis in 2008 and lately with the Covid-19 crisis (Ozili and Arun, 2023).

Crisis mitigation involves dealing at a fast pace with significant radical changes, changes that in the case of Covid-19 are particularly challenging for firms given the high ambiguity with the

many unknown unknowns (Paul and Chowdhury, 2020). This implies that the situation faced by firms will typically be outside the scope and imagination of existing preparedness in the form of risk management, scenario planning, contingency plans, etc. To the extent that this is the case, there will expectedly be a dampening of the effect of SCR on firms' abilities to mitigate the consequences of the given jolt.

Nonetheless, it is conceivable that firms that have been actively engaged in SCR in the form of risk management, scenario planning, contingency planning, etc. will still have the advantage of being able to quickly realign such planning as the ambiguity and uncertainty of new contingencies gradually starts to resolve (Cheng and Lu, 2017). Such firms will typically be more aware of the relative weaknesses and strength of their operating system under the previous circumstances and can use this knowledge as they evaluate possible system changes (Singh et al., 2019). Also, they will be familiar with and trained to use important tools that can practically guide them in doing so. For these reasons, we expect that SCR will have a positive association with firms' crisis mitigation capabilities under a jolt such as the Covid-19 disruption (H2). We also expect that this capability in turn will promote firm performance, such that there will be a positive indirect effect of SCR on firm performance mediated by a positive impact of SCR on crisis mitigation (H3):

H2: Supply chain resilience is positively related to crisis mitigation

H3: In case of crisis, crisis mitigation mediates the effect of supply chain resilience on performance

2.3 Relationship between absorptive capacity, firm performance, and crisis mitigation

Several extant studies have found positive associations between ACAP and firm performance in terms sales and market share (Dobrzykowski et al., 2015), innovation performance (Fosfuri and Tribó, 2008; Huang and Rice, 2009; Liao et al., 2010), exploration and exploitation (Zhou and Wu, 2010), performance of international venturing (Zahra and Hayton, 2008), and financial performance (Kostopoulos et al., 2011). The main emphasis is here on the effects of knowledge acquisition and assimilation capabilities in proactively searching the environment for new knowledge that can be effectively transformed into product and market innovations and successfully exploited in the form of new business opportunities.

Since innovation is typically a long-term strategy, ACAP in this sense is more associated with proactive opportunity generating capabilities as opposed to reactive capabilities and crisis

mitigation (Alkalha et al., 2019). Not considering the specific crisis mitigation capabilities, we would, however, still expect a positive relationship between ACAP and firm performance also when assessed during an environmental jolt. Part of the effect of previous innovation activity, which has been supported by high ACAP would here still be visible in the product portfolio and the strategic posture of a firm. The main mechanism operating here would be a combination of spill-over effects (Lin et al., 2016) from ACAP implementation and more long-haul effects of opportunity generating capabilities (Zahra and George, 2002). These effects would be independent on capabilities to navigate specifically in the context of an environmental jolt (H4):

H4: During crisis, there is a direct positive effect of absorptive capacity on firm performance

Several studies make the connection between firms' ability to cope with internal or external disruptions, and firm's acquisition, assimilation, transformation, and exploitation capabilities (Cheng and Lu, 2017; Gölgeci and Kuivalainen, 2020). ACAP has also been found to play a vital role in reducing supply chain risk such as closing a knowledge gap on how to handle a critical situation (Ambulkar et al., 2016; Gölgeci and Kuivalainen, 2020). Through ACAP, firms will be capable of quicklier discovering potential threats from a disruption. This will give firms more time to prepare a response (Craighead et al., 2007). Also, firms with higher ACAP will be more capable of using external knowledge resources to develop entrepreneurial responses in case of disruptions (Van Doorn et al., 2017).

Yet, although ACAP is often referred to as a general dynamic capability to proactively create and utilize new knowledge, looking more deeply into its defining components also reveals a certain domain-specific boundedness that firms face when absorbing. Zahra and George (2002) take notice of these bounds in that the direction of acquisition is path-dependent and that search for knowledge is biased by the areas of expertise that are at any time held by the firm. Knowledge that falls outside firms' search zones is often overlooked, and even if noticed, it may be difficult to comprehend (Cohen and Levinthal, 1990).

With large environmental jolts, it is plausible that the boundary conditions of ACAP will be challenged. Firms may experience a need to stretch their current areas of expertise as they expand their search into unknown territories. They will be challenged to make inferences for situations for which they may have no previous knowledge. Similarly, firms will be challenged to invoke an intensity and speed in their knowledge acquisition that reaches far over the usual level. Environmental jolts in this way truly put firms' ACAP to a test, a test, which is quite different from

the proactive creative and gradual development of firms' resource base. This test is a test of reactive capability to conquer a specific, significant, and radical environmental jolt.

Despite the potential limitations in jolt-specific crisis mitigating capabilities associated with ACAP, it is still a credible claim that firms with higher levels of ACAP, i.e., capabilities to read into and understand changing environments and capabilities to transform new understandings into strategy and action, will be more capable of responding to situations of unprecedented and high impact environmental change (H5). And, consequently, that this higher ability to mitigate crisis will partly mediate the relationship between ACAP and firm performance under an environmental jolt (H6):

H5: Absorptive capacity is positively related to crisis mitigation

H6: Crisis mitigation mediates the relationship between absorptive capacity on performance

3. Method

3.1 Data collection

To address the purpose of this paper, data was collected from a questionnaire survey carried out in March and April 2021 among Danish manufacturers and transport providers in the Region of Southern Denmark. The respondents have been asked questions about their practices since Covid-19 erupted. A list of manufacturing and logistics and transport companies ranging within the European NACE codes from 10 to 33 and 49.10 to 53.20 was extracted from the database "Bisnode", which holds information on approximately 214.000 Danish companies. The focus of manufacturing and logistics and transport companies in the same survey was a demand from the funding partner of the research. Excluding companies with no contact information, companies that are registered in the database as being protected against commercial practices, and those that appeared on the list in error identified a netlist of 568 companies to be contacted. The companies were contacted individually by a personal email sent to the CEOs, supply chain managers, and plant directors. When no personal contact data was available on the company's homepages, an email was addressed "To whom it may concern". In total, 189 agreed to receive a link to the electronic questionnaire. Of these, 174 responded and thus resulting in a response rate of 30,6% out of the 568 contacted companies. Characteristics of the respondents and the companies are included in Tables 1 and 2.

Table 1. Characteristics of the respondents

	Manufacturers		Logistics and Transport		
Job titles of the respondents	0–250 employees	> 250 employees	0–250 employees	> 250 employees	Total
CEO	48	7	10	1	66
CFO	1	0	0	1	2
COO	9	0	0	0	9
Customer Service Associate/Manager	0	3	0	0	3
Factory/Operations Manager/Director	16	3	0	0	19
General Manager/Divisional Manager	1	1	0	1	3
Head of Strategy & Executive Assistant; Business Development	0	2	0	0	2
Head of Technology & International Business, Digital Innovation/CIO/Mechanical Engineering	3	0	0	2	5
Human Resource Director	0	2	0	0	2
Lean & IT Solution Manager, Supply Chain Development	2	3	0	0	5
Management Assistant/Team Manager/Project Manager	2	1	0	0	3
Master Planner/Planning Manager/S&OP Manager	1	4	1	0	6
Owner	2	0	0	0	2
Project Buyer/Manager, Purchaser, Category Manager	1	3	1	0	5
Purchasing/Logistical Manager/Director	10	7	0	1	18
Sales Manager/Director	3	0	0	1	4
Supply Chain Manager/Director	12	8	0	0	20
Total	111	44	12	7	174

Source: Authors own creation

Table 2. Characteristics of the companies

	Manufacturers	**Logistics and Transport**	**Total**
Firm size			
0–250 employees (small and medium)	111	12	123
251 and above employees (large)	44	7	51
	155	19	174
Industry type (in%)			
Manufacture of food products (10)	6,3%		
Manufacture of beverages (11)	1,7%		
Manufacture of tobacco products (12)	1,1%		
Manufacture of textiles (13)	2,3%		
Manufacture of leather and related products (15)	0,6%		
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (16)	1,7%		
Manufacture of paper and paper products (17)	0,6%		
Printing and reproduction of recorded media (18)	1,1%		
Manufacture of coke and refined petroleum products (19)	0,6%		
Manufacture of chemicals and chemical products (20)	5,2%		
Manufacture of basic pharmaceutical products and pharmaceutical preparations (21)	0,6%		
Manufacture of rubber and plastic products (22)	5,7%		
Manufacture of other non-metallic mineral products (23)	6,9%		
Manufacture of basic metals (24)	0,6%		

Manufacture of fabricated metal products, except machinery and equipment (25)	12,1%		
Manufacture of computer, electronic and optical products (26)	2,9%		
Manufacture of electrical equipment (27)	5,2%		
Manufacture of machinery and equipment n.e.c. (28)	15,6%		
Manufacture of motor vehicles, trailers and semi-trailers (29)	0,6%		
Manufacture of other transport equipment (30)	2,3%		
Manufacture of furniture (31)	3,4%		
Other manufacturing (32)	11,5%		
Repair and installation of machinery and equipment (33)	0,6%		
Waste collection, treatment, and disposal activities; materials recovery (38)		1,1%	
Land transport and transport via pipelines (49)		4,6%	
Water transport (50)		0,6%	
Warehousing and support activities for transportation (52)		3,4%	
Postal and courier activities (53)		1,1%	
Total	89,2%	10,8%	**100,0%**

Numbers in parenthesis are the respective European NACE codes.

Source: Authors own creation

3.2 Measures

This section operationalizes the dependent, independent, mediating, and control variables using questionnaire items from the cross-sectional survey.

3.2.1 Dependent variable. Inspired by Beamon (1999) and Chowdhury et al., (2019), the dependent variable firm performance is measured based on six five-point Likert scale questionnaire items. Managers were asked to assess the extent to which the firm 1) has satisfactory growth, (2) achieve earning expectations, (3) is cost-effective, (4) delivers the expected quality, (5) delivers at the expected time, and (6) is flexible towards customer demands (see Appendix 1 and 2). Principal component analysis of the six items returns a two-factor solution with factor 1 (item 1, 2, and 3) and factor 2 (item 4, 5, and 6) explaining 40.826 percent and 21.489 percent of the total variance, respectively (see Appendix 3). Factor 1 including growth, earnings, and cost-effectiveness can here be perceived as an *economic* performance construct. Factor 2, including quality, time, and flexibility can be perceived as an *effectiveness* performance construct, effectiveness being assessed on the ability of firms to continually align with environmental demands (Miles et al., 1978; Miles and Snow, 2007). Cronbach alpha is used to assess instrument reliability (Tavakol and Dennick, 2011). Cronbach's alpha is 0.788 for factor 1, and thus above the .70 minimum threshold suggested by Nunnally (1978). For factor 2, however, Cronbach's alpha is only 0.515, suggesting that an index combining items 4, 5, and 6, should be perceived as a formative index. Results from

confirmatory factor analysis (CFA) indicate a fit between the data and the two-factor model: $\chi 2/DF=0.920$; CFI=1.000; TLI=1.005; RMSEA=0.054; SRMR=0.031. This fit is marginally better than for the one-factor model: $\chi 2/DF=1.070$; CFI=0.998; TLI=0.996 RMSEA=0.020; SRMR=0.044. Following these results, two indexes are used to indicate firm performance: EconPerf based on factor 1 and EffePerf based on factor 2. Both indexes are, as for the remaining indexes in the analysis, calculated as the means of the standardized items. The mean average score of the items in factor 1 is 3.34 with std.dev. 0.892 and a range from 1 to 5. For factor 2 mean score is 4.18 with std.dev. 0.533 and a range of 2.33 to 5 for factor 2. This shows that firm in the sample overall considers their effectiveness higher relative to their economic efficiency.

3.2.2 Independent variables. Based on Gölgeci and Ponomarov (2015), the independent variable, SCR is measured using an index containing six five-point Likert scale questionnaire items (see Appendix 3). Managers were asked to assess the extent to which the firm was capable of (1) reacting to unexpected disturbances by quickly reestablishing product or service flows, (2) quickly return to normal after disturbances, (3) move to new and more advantageous states after disturbances, (4) being well-prepared to handle financial consequences of supply chain disturbances, (5) have the ability to retain an aspired level of control over structures and functions in case of disturbances, and (6) has the ability to extract meaning and useful learning from unexpected events. The mean average score of the six items is 3.22 with std.dev. 0.569 and a range from 1 to 4.67. Principal component analysis confirms a one-factor solution explaining 50.15 percent of the variance, and with factor loadings ranging from .625 to 7.87. Cronbach's alpha is .799. Results from CFA indicate model fit: $\chi 2/DF=1.506$; CFI=0.987; TLI=0.976; RMSEA=0.054; SRMR=0.031.

To measure the independent variable ACAP, we applied the 14 items developed by (Flatten et al., 2011) (see Appendix 4). Principal component analysis of the standardized items confirms the four factors identified by Flatten et al. (2011) with factor loading from the individual items ranging from .648 to .866. The four identified factors, Acquisition, Assimilation, Transformation, and Exploitation explains 9.48 13.74, 36.81, and 8.90 percent of the total variance, and with Cronbach Alpha values .845, .825, .793, and .773, respectively. The mean average weighted score of items in the four factors is 3.37 with std.dev. 0.517 and a range from 1.15 to 4.58. We standardize the indexes from the four factors to construct a combined ACAP index. Principal component analysis

of the four indexes shows a single factor solution explaining 53.10 percent of variance with loadings ranging from .568 to .821. Cronbach's alpha for the combined index is .699, which is marginally below Nunnally's (1978) recommendation of a minimum level of .7 for adequate internal consistency. Uncorrelated second-order CFA indicate model fit: $\chi 2/DF=1.590$; CFI=0.956; TLI=0.945; RMSEA=0.058; SRMR=0.054.

3.2.3 Mediating variable. The mediator variable is crisis mitigation (CM), which is measured using similar performance dimensions as above, this time asking managers on a five-point Likert scale to assess the influence of Covid-19 on the three performance dimensions. Managers are specifically asked whether their company perform better or worse after Covid-19 relative to the six performance parameters. Low scores indicate relatively lower performance on the given performance parameter after Covid-19 relative to before Covid-19. Higher scores thus indicate higher crisis mitigation capabilities. The six questionnaire items again return a two-factor solution with factor 1 (item 1: growth, item 2: earnings, and item 3: cost-effectiveness) and factor 2 (item 4: quality, item 5: time, and item 6: flexibility) accounting for 35.313 percent and 26.230 percent of the variance, respectively. Cronbach's alpha is 0.711 for factor 1 and 0.607 for factor 2. Results from CFA for the two-factor model indicate model fit: $\chi 2/DF=0.774$; CFI=1.000; TLI=1.017; RMSEA=0.000; SRMR=0.025. In line with the dependent variable, we thus construct two indexes as indicators of crisis mitigation: Economic Crisis Mitigation (EconCM) as the mean of the standardized items 1 (growth), 2 (earnings), and 3 (cost-effectiveness), and Effectiveness Crisis Mitigation (EffeCM) as the mean of standardized items 4 (quality), 5 (time), and 6 (flexibility). The mean average score of the items in factor 1 is 3.14 with std.dev 0.773 and a range from 1 to 5. For factor 2 the mean is 3.02 with std.dev. 0.422 and a range of 1 to 5 for factor 2. This provide evidence on some variance in how firms in the sample have been affected by the crisis.

3.2.4 Control variables. Several control variables were included. Firm size is measured by the total number of employees logged. Firm size generally relates to performance, yet also relates to firms' abilities to cope with a crisis. Small firms may here benefit from a higher level of flexibility, while larger firms may thrive on resource and power advantages (Ali and Gölgeci, 2019; Bak et al., 2020). Firms' exporting is measured as the share of total turnover. Exporting may on the one hand expose firms to certain risks. This has particularly been the case with Covid-19 with borders closing due to

the pandemic. On the other hand, the level of exporting may signify a certain level of competence and professionalism, which may help firms endure crises. A third control is the number of blue-collar workers relative to the number of white-collar workers. We term this measure production intensity (ProdInt) using it as an indication of the extent to which production involves manual labor. This measure similarly indicates the technological intensity of production: the higher the proportion of white-collar workers, the higher the technological intensity. Three variables are included to control for the extent to which firms have suffered from the Covid-19 situation: (1) on the customer side (SufCust), (2) internally in the company (SufInt), and (3) on the supply side (SufSup). Each variable was measured on a single item five-point Likert scale. Finally, we control for differences between the two industries included in the sample (Manufacturing and Transportation), keeping Manufacturing as reference.

3.3 Data analysis

Path analytical techniques as implemented in Mplus 8.4. software (Muthén and Muthén, 2017) are applied to assess the total, direct, and indirect effects conjectured in H1 to H6. Effects are assessed using Maximum Likelihood estimation and using the Monte Carlo method to generate 95% bootstrapped confidence intervals, which are based on 2,000 random draws of the estimated sampling distributions of the estimates (Selig and Preacher, 2008).

To control for discriminant validity of the ACAP and the resilience construct, principal component with varimax rotation was conducted on the four identified ACAP dimensions and the six resilience items. Since the sixth item of the resilience construct loaded 4.55 and 4.57 on the two initially identified factors, the item was removed from the analysis. This returns a two-factor solution discriminating between the ACAP and the resilience construct (see appendix 5). CFA indicate model fit for this two-factor structure: $\chi 2/DF=1.564$; CFI=0.970; TLI=0.955; RMSEA=0.057; SRMR=0.044. To accommodate these results, item six was removed from the resilience construct.

To control for common method bias, we employed Harman's single-factor test (Harmann, 1967). Including all study items in a fixed one-factor un-rotated factor solution explains 24.77 percent of the total variance. This is well below the 50 percent threshold recommended by

(Podsakoff et al. 2012). In comparison, a five-factor solution explains 54.38 percent of the total variance, suggesting that common method bias is not an issue.

4. Findings

Table 3 shows the means, standard deviations, and correlations of variables. A noticeable observation is that there is considerably more variance in firms' crisis-effect than in their overall performance. Consistent with this, there is also a sizable variance in firms' exposure to the Covid-19 crisis as indicated by the three control variables Sufcust, SufInt, and SufSup. As expected, there is a significant (and large) positive correlation between the two dependent performance variables and the associated crisis mitigation variables. This gives a first indication of the performance consequences of the Covid-19 crisis. Similarly, in line with expectations, both SCR and ACAP correlate significantly and positively with both performance variables. SCR correlates significantly and positively with EconCM, but the association with EffeCM is not significant. The correlation of ACAP with EconCM and EffeCM are both insignificant. The highest correlation among the independent variables is .51, and is between SCR and ACAP, indicating that firms with high SCR also tend to have high ACAP. The size of the correlations among the independent variables, and Variance Inflation Factors (VIFs) all being below 1.56 do not suggest multicollinearity concerns.

Table 3. Means, Standard deviations and correlations

Variables	Means	Std.dev	1	2	3	4	5	6	7	8	9	10	11	12
1 EconPerf	0	.838												
2 EffePerf	0	.718	.26**											
3 EconCM	0	.796	.61**	.17*										
4 EffeCM	0	.760	.05	.23**	.15*									
5 SCR	0	.732	.40**	.41**	.22**	.05								
6 ACAP	0	.725	.36**	.27**	.14	-.01	.51**							
7 Size (ln)	4.881	1.603	.14	-.09	.08	-.13	.07	-.03						
8 Export	49	34.758	.06	-.08	-.04	-.21**	.06	.08	.05					
9 ProdInt	2.405	2.919	.04	-.07	.22**	.05	-.17*	-.20**	.15	-.29**				
10 SufCust	2.77	1.292	-.36**	.02	-.31**	-.20**	-.06	-.04	.01	.08	-.20**			
11 SufInt	2.167	.968	-.04	.00	-.07	-.18*	.08	-.02	.30**	.08	-.14	.32**		
12 SufSup	2.851	1.118	.04	-.01	.03	-.21**	-.03	.11	.13	.22**	-.14	.10	.31**	
13 Industry [a)]	.109	.313	.18*	.10	.21**	-.08	.10	-.11	.06	-.17*	.22**	-.02	.02	-.10

** *p<0.01,* * *p<0.05,* [a)] Reference=Manufacturing

Source: Authors own creation

Table 4 shows the results from the path analysis of the relationship of EconPerf with SCR and ACAP. The results show a significant positive relationship between SCR and EconPerf. This is indicated both by the significant direct effect (b=.198; p=.000) and the significant total effect (b=.238; p<.012). Confidence intervals not containing zero confirm the association. This supports H1 that firms with higher SCR have higher performance.

Table 4. Direct, indirect, and total effects (standardized) of SCR and ACAP on economic performance

	Dependent variable							
	EconCM				EconPerf			
	Estimate	S.E[b)]	p-value	C.I.[c)][	Estimate	S.E	p-value	C.I.
EconCM					.472***	.054	.000	[.369;580]
Size (Ln)	.023	.077	.764	[-.120;.181]	.098	.065	.129	[-.035;.217]
Export	.025	.069	.720	[-.105;.162]	.068	.060	.258	[-.048;.188]
ProdInt	.190*	.085	.025	[.028;.361]	-.053	.111	.636	[-.266;.159]
SufCust	-.260**	.075	.001	[-.412;.-114]	-.212**	.065	.001	[-.336;-.093]
SufInt	-.017	.082	.833	[-.160;.162]	.009	.070	,899	[-.135;.143]
SufSup	.097	.069	.161	[-.036;.235]	-.002	.052	.976	[-.099;.109]
Industry [d)]	.167+	.089	.060	[-.013;.306]	.095	.062	.127	[-.020;.221]
SCR								
Direct effect	.177*	.081	.029	[.018;.329]	.154***	.061	.000	[.024;.266]
Indirect effect					.083*	.039	.034	[.011;.166]
Total effect					.238**	.063	.012	[.108;.352]
ACAP								
Direct effect	.086	.076	.261	[-.060;.247]	.198**	.066	.002	[.060;.319]
Indirect effect					.040	.036	.264	[-.027;.116]
Total effect					.238**	.077	.003	[.075;.376]
R-square	.214***	.061	.000		.529***	.055	.000	

***) p < .001; **) p < .01; *) p < .05 Two-tailed test. [a)] DV= Dependent variable. [b)] S.E.= Standard Error. [C)]C.I.=Confidence intervals Lower 2.5%;Upper 2.5%]. [d)] Reference=Manufacturing

Source: Authors own creation

The association between SCR and EconCM is also positive and significant (b=.177; p=.029) and with zero not contained in the confidence interval. This supports H2 that firms with higher SCR

would be less vulnerable to the Covid-19 crisis. A similar indication comes from the mediation model. The indirect effect of SCR through better crisis mitigation (EconCM) is positive and significant (b=.083; p=.034), with zero not contained in the confidence interval. This supports H3, that the performance effects from SCR are in part explained by an increased ability to specifically address the challenges that associate with the Covid-19 pandemic.

There is a significant positive direct (b=.198; p=.002) and a significant positive total effect (b=.238; p=.003) of ACAP on EconPerf; zero is not contained in the confidence intervals. This supports H4 that firms with higher ACAP have higher performance. While positive, the association between ACAP and crisis impact is not significant (b=.086; p=.261), and zero is contained in the confidence interval. Thus, H5 that ACAP alleviates some of the firms' challenges arising from the Covid-19 situation, is not supported. The indirect effect of ACAP through crisis mitigation on performance is also positive but insignificant (b=0.040; p=264), with zero contained in the confidence interval. This suggests that the better performance arising from higher levels of ACAP during the pandemic has not been caused by crisis mitigating capabilities. Hence, H6 is not supported.

Table 5 shows the results from the path analysis of the relationship of EffePerf with SCR and ACAP. There is a positive direct (b=.099; p= .025) and total (b=.183; p=.028) effect of SCR on EffePerf, with zero not contained in the confidence interval. This further brings confirmation to H1 of a positive relationship between SCR and firm performance also for the effectiveness dimension. The relationship between SCR and EffeCM is positive but insignificant (b=.098; p=.271) and with zero in the confidence interval, thereby not supporting H2. Also, the indirect effect from SCR through EffeCM on EffePerf is positive, but insignificant (b=.084; p=.265) and with zero in the confidence interval. Thus, H3 is not supported for the effectiveness dimension of performance.

Table 5. Direct, indirect, and total effects of SCR and ACAP on EffePerf

	Dependent Variable							
	EffeCI				EffePerf			
	Estimate	S.E[b)]	p-value	C.I.[c)]	Estimate	S.E	p-value	C.I.[c)]
EffeCI					.862***	.035	.000	[.783.915]
Size	-.083	.040	.238	[-.056;.100]	-.049	.040	.224	[-.130;.033]
Export	-.191*	.043	.019	[-.002;.004]	.009	.043	.839	[-.071;.101]
ProdInt	-.013	.045	.857	[.009;.095]	-.066	.045	.145	[-.167;.017]
SufCust	-.157*	.044	.017	[-.347;.-094]	-.005	.044	.900	[-.088;.085]
SufInt	-.056	.048	.520	[-.126;.141]	.003	.048	,957	[-.091;.091]
SufSup	-.128+	.045	.096	[-.032;.193]	-.003	.045	.954	[-.102;.078]
Industry [d)]	-.135	.046	.168	[-.030;.903]	.045	.046	.329	[-.049;.127]
SCR								
Direct effect	.098	.044	.271	[-.014;.351]	.099*	.044	.025	[.008;.180]
Indirect effect					.084	.076	.265	[-.067;.229]
Total effect					.183*	.084	.028	[.015;.347]
ACAP								
Direct effect	-.051	.044	.583	[-.064;.285]	.016	.044	.721	[-.066;.107]
Indirect effect					-.044	.080	.580	[-.196;.107]
Total effect					-.029	.095	.761	[-.206;.166]
R-square	.134**	.048	.005		.773	.044	.000	

***) p < .001; **) p < .01; *) p < .05 Two-tailed test. [a)] DV= Dependent variable. [b)] S.E.= Standard Error. [C)]C.I.=Confidence intervals [Lower 2.5%;Upper 2.5%]. [d)] Reference=Manufacturing

Source: Authors own creation

The direct (b=.016; p=.721), indirect (b=-.044; p=.580), and total (b=-.029; p=.761) effects of ACAP on EffePerf are all insignificant and with zero contained in the confidence interval. Similar is the case for the relationship between ACAP and EffeCM (b=-.051; p=583). Hence, results do not support H4 of a direct association between ACAP and performance. Also, these results do not support H5 that ACAP promotes crisis mitigation, nor H6 that ACAP increases performance indirectly through better crisis mitigation.

4.1 Post-hoc analysis

To assess the robustness of results, analyses were performed using the six pairs of performance and crisis mitigation items separately. The main results are shown in Table 6. The results confirm H1 of a positive association between SCR and performance, both for the economic and the effectiveness performance items. There is also support for H4 of a positive association between ACAP and the economic performance items, but not for the effectiveness performance items. A similar pattern is identified regarding H2 and H5 for the relationships of the crisis mitigation items with SCR and ACAP, respectively, and consequentially for the mediated relationships predicted by H3 and H6. Noticeable, the results in Table 6 suggests that SCR most strongly alleviate negative performance impacts by helping firms deal with crisis in a cost-effective way, and thereby help firms to a higher extent to maintain earnings throughout the crisis.

Table 6. Direct, indirect, and total effects of SCR and ACAP on firm performance (3)

		Direct				Indirect				Total			
Dep.Var.	Ind.Var	Estimate	S.E[b)]	P	C.I.[c)]	Estimate	S.E[b)]	P	C.I.[c)]	Estimate	S.E[b)]	p	C.I.
Growth	SCR	.113+	.060	.058	[-.005;.225]	.014	.041	.724	[-.064;.096]	.128+	.074	.082	[-.015;.270]
	ACAP	.167*	.069	.015	[[.026;.298]	.039	.040	.330	[-.033;.125]	.206*	.083	.013	[.034;.357]
Earnings	SCR	.167**	.063	.008	[.040;.281]	.073+	.041	.075	[-.005;.159]	.240**	.070	.001	[.108;.374]
	ACAP	.130+	.072	.071	[-.020;.266]	.030	.038	.430	[-.042;.108]	.160+	.082	.050	[-.012;.308]
Cost-eff.	SCR	.144+	.077	.062	[-.018;.294]	.086*	.034	.013	[.025;.165]	.230**	.072	.001	[.082;.361]
	ACAP	.209**	.073	.004	[.059;.340]	.023	.029	.417	[-.029;.084]	.232**	.077	.003	[.067;.368]
Quality	SCR	.185*	.085	.030	[.018;.349]	-.006	.012	.614	[-.051;.007]	.179*	.084	.032	[.015;.336]
	ACAP	.087	.095	.359	[-.106;.268]	.006	.013	.614	[-.006;.047]	.093	.096	.332	[-.103;.271]
Time	SCR	.276**	.085	.001	[.108;.440]	.033	.024	.165	[.001;.104]	.309***	.084	.000	[.142;.471]
	ACAP	.144	.093	.121	[-.039;.319]	-.031	.026	.233	[-.104;.001]	.114	-.096	.234	[-.076;.297]
Flexibility	SCR	.281**	.087	.001	[092;.395]	.052	.037	.165	[-.015;.111]	.332**	.096	.001	[.133;.499]
	ACAP	.023	.087	.790	[-.125;.180]	-.020	.035	.558	[-.086;.038]	.003	.093	.976	[-.157;.166]

***) p < .001; **) p < .01; *) p < .05 Two-tailed test. [a)] DV= Dependent variable. [b)] S.E.= Standard Error. [C)]C.I.=Confidence intervals [Lower 2.5%;Upper 2.5%]. [d)] Reference=Manufacturing.

Source: Authors own creation

5. Discussion

The purpose of this study has been to examine the functioning of SCR and ACAP in their capacities for firms to respond specifically to the challenges imposed by the Covid-19 pandemic. Findings add to previous findings that higher levels of SCR and ACAP, respectively, associate with higher levels of growth, earnings, and cost-effectiveness (Chowdhury et al., 2019; Li et al., 2017; Wieland and Wallenburg, 2013; Yu et al., 2019). This study shows evidence of similar positive relationships in the case of a disruption (here examined by the Covid-19 jolt). Moreover, the results from this study casts important nuances on the mechanisms driving these effects in the context of a crisis. The results confirm the important distinction between spill-over effects, the effects of long-term opportunity generation, and short-term crisis-mitigating dynamic capabilities.

Notably, crisis mitigating capabilities were confirmed for the functioning of SCR with results showing a significant partly mediation of the relationships between SCR and performance through crisis mitigation. This suggests that the preparedness inherent in SCR practices, such as risk management, scenario planning, and contingency planning, etc., along with the higher-level competencies in performing such practices, constitute significant crisis mitigation dynamic capabilities that provide a guard against even very impactful and unparalleled environmental jolts such as in this case the Covid-19 crisis. The finding of a "residual", i.e., non-crisis mitigating, direct effect from SCR on performance suggest that also spill-over effects from SCR implementation and possibly more long-term opportunity generating mechanisms also play a role in providing firms with competitive advantages throughout a crisis. For example, companies in their preparation for SCR might identify supply chain practices that can be optimized (e.g., master data or lead-time, re-

order points, and delivery terms). Advantages hereof are seemingly present both in less turbulent times and in times of crisis.

For ACAP, the results suggest a slightly different functioning. With no significant mediation, the crisis mitigating dynamic capabilities could not be confirmed as driving the relationship between ACAP and performance. While previous studies have found that ACAP can enable a company to handle crisis better (Ambulkar et al., 2016; Gölgeci and Kuivalainen, 2020), this result casts doubt on the extent to which ACAP is effective in specifically mitigating crisis impacts when faced with unprecedented high-impact disruptions. One interpretation is that the high ambiguity surpasses the structural flexibility encompassed by firms' capacity to acquire, assimilate, transform, and exploit any external knowledge relevant to making sense of and acting in the unknown territory of the Covid-19 business environment. This would imply that the dynamic capabilities essential to ACAP are to a higher extent long-term and more opportunity-generating in nature as opposed to short-term crisis mitigating.

The positive direct effect, i.e., not crisis-mitigating effect, of ACAP on performance supports these assertions. Seemingly, ACAP primarily functions in times of unparalleled high-impact disruption by promoting firm performance through much similar mechanisms as when firms are facing more familiar and less volatile environments. Thus, firms' advantages from ACAP during the Covid-19 crisis originate in more long-term oriented opportunities generating dynamic capabilities associated primarily with innovation (Huang and Rice, 2009; Liao et al., 2010). Along these lines, ACAP can be perceived as more strategic and proactive as compared to SCR that when taking an engineering approach includes more reactive elements. ACAP might not be a sufficient approach to handle such a powerful jolt as Covid-19 where it is difficult upfront to search for the unknown of such crises. In contrast, SCR stimulates through its reactive components of response and recovery to take concrete actions based on readiness and contingency plans. ACAP might have the robustness to handle disruptions with long detectability lead times where the companies have time to prepare strategically (e.g., growing demand for energy and natural resources in China and India) and familiar crises and not for disruptions with short or no warnings such as Covid-19 and the blockage of the Suez Canal.

6. Conclusions

This paper has investigated the relationship between SCR, ACAP, crisis mitigation, and firm performance in the context of the Covid-19 crisis. Results reveal a significant positive relationship between SCR and performance and thus support H1. The results also confirm a positive relationship between SCR and crisis mitigation (H2) and that there is an indirect effect of SCR on performance through better crisis mitigation (H3). The results also reveal a significant positive effect of ACAP on performance (H4). There is, however, no discernable positive relationship between ACAP and crisis mitigation (H5) and followingly no discernable indirect effect of ACAP on performance through better crisis mitigation (H6). These results suggest that the underlying mechanisms driving the effects of SCR and ACAP during the Covid-19 crisis differ. Specifically, the performance effects of SCR were driven by both short-term crisis-mitigating dynamic capabilities and potentially spill-over effects from SCR implementation. Performance effects of ACAP were the opposite primarily driven by longer-term opportunity-driven dynamic capabilities.

6.1 Theoretical implications

The constructs of SCR and ACAP both define dynamic capabilities (Zahra and George, 2002; Ponomarov and Holcomb, 2009). Yet, it is important to understand the differences as well as the resemblance in their underlying mechanism, and to understand how external contingencies affect their relative prominence. The distinction between short-term crisis-mitigating dynamic capabilities, long-term opportunity generating dynamic capabilities, and spill-over effects from SCR and ACAP implementation is a useful step in distinguishing between the two constructs and in examining the boundary conditions of their impacts on firm performance.

The finding that crisis-mitigating mechanisms drives part of the performance effects from SCR under the Covid-19 crisis is a notable contribution to SCR research. This signify that the preparedness to deal with changing competitive dynamics, and the higher-level competencies in establishing such preparedness, can be effective in dealing with very extreme conditions with high ambiguity and highly unfamiliar contingencies, adding to extant theorizing that have questioned this reach (Singh et al. 2019). Yet the findings also suggest that several of the mechanisms underlying SCR, which functions under less volatile conditions, and which are not crisis-related, also contributes to performance under more extreme conditions.

Previous studies finding positive associations between ACAP, and firm performance have similarly argued for a crisis-mitigation effect from ACAP (Ambulkar et al., 2016; Gölgeci and Kuivalainen, 2020). Findings in this study provide a somewhat different interpretation, showing that while ACAP do associate positively with performance in a crisis context, this effect presumably does not originate in specific crisis-mitigating capabilities but rather in more long-term innovation advantages originating in opportunity generating capabilities. To the extent that ACAP does afford crisis-mitigating capabilities, such affordance would likely be constrained by the path-dependent nature of ACAP and the degree of unfamiliarity of the challenges imposed by a given environmental change (Zahra and George, 2002).

6.2 Practical implications

Companies are facing a number of different supply chain disruptions such as pandemics, natural disasters and geopolitical instabilities. Companies must increase their preparedness with proactive and reactive strategies to cope with such disruptions. In line with earlier work, the results presented in this paper show that it pays off for companies to work with and implement SCR (Chowdhury et al., 2019; Li et al., 2017; Wieland and Wallenburg, 2013). The study also confirms previous studies in that it pays to work proactively with acquiring, assimilating, transforming, and exploiting knowledge (Dobrzykowski et al., 2015, Huang and Rice, 2009; Liao et al., 2010). Yet, with the occurrence of many unparalleled and impactful disruptions, it is particularly important that managers carefully distinguish between the independent effects of SCR and ACAP. While SCR and ACAP are likely to promote firm performance also extreme crisis situations, the ability to develop quick and effective response and to specifically mitigate crisis impact on performance predominantly resides predominantly in the dynamic capabilities associated with SCR.

6.3 Limitations and suggestions for future research

This paper is not without limitations. Firstly, the paper is based on a questionnaire survey that informs about the extent to which companies pursued the investigated practices. Future research can supplement this study through qualitative research e.g., through case studies to more detailly address how specific pursued practices were invoked to address specific challenges from a given crisis. Data in this study gives only a little information of the specific firm conditions during the

Covid-19 crisis. Secondly, since data is based on only a single respondent from each company there is the risk of respondent bias. Future research can include multiple respondents from each company.

Another limitation relates to the contextual nature of this study. Because of the variance in countries' business eco-systems, and since different countries has approached Covid-19 differently (OECD, 2022), firms in different countries may have been impacted different and consequently experienced different effects from the dynamic capabilities associated with SCR and ACAP, respectively. Industry differences are similarly likely to be reflected in the relative effectiveness of SCR and ACAP. The industries examined in this study, i.e., manufacturing and transport and logistics were both adversely affected by the crisis (Ozil and Arun, 2022; Shen et al., 2020). This may have given prominence to the crisis-mitigating effects of SCR, while the opportunity generating mechanisms may likely have shown more prominent if examining firms in industries that more generally benefited from the Covid-19 situation, such as in the food, healthcare, pharmaceutical and telecommunication industries (Ozil and Arun, 2022)

The timing of the survey is also likely to influence managers' experiences of how the crisis impacted their companies. At the time of the survey (Marts and April 2021), Denmark had just initiated a gradual lessening of a lockdown that took its beginning from marts 11th 2020 with moderate openings during the summer period of 2020 again to restrengthen during the fall and winter of 2020. For example, hairdressers were again allowed to operate their businesses from April 6th, 2021. At the time being there was thus still high ambiguity about how the situation would develop. Yet many of the companies had also had some time to adjust to the radically different operating conditions. It is reasonable to infer that the effects of more short-term responses to the crises would be readable at this time. The timing of the survey may consequently favor the identification of short-term crisis-mitigating effect of SCR over the more long-term effects of ACAP. This is, however, well in line with the theorizing presented. Given the cross-sectional design of the study, there is no data on the medium or long-term benefits from holding higher levels of SCR and ACAP during the Covid-19 crisis. Also, it should be acknowledged that firms in the sample at the time of the survey would likely have worked to increase their level of especially SCR as a response to the crisis. It would be interesting agendas for future studies to pursue such dynamics.

It is an important agenda further exploring the relative impact of crisis-mediating dynamic capabilities, opportunity generating dynamic capabilities, and spill-over effects from the

implementation of SCR and ACAP in other crisis situations. The environmental jolt analyzed in this paper is the Covid-19 pandemic where companies was impacted through e.g., lockdowns of sectors and thus no or limited revenue, shortage or absence of raw materials, components, and finished goods, and a health care system under massive pressure. Another jolt being relevant to study might be an energy crisis. Some companies earn a lot on renewable energy while others are burden much due to increased gas and oil prices. Yet other jolts might be climate crises, for example when the Rhine dried out, natural disasters, terrorism, or geopolitical crisis such as trade wars and Brexit. Common for such jolts is that SCR and ACAP might be approaches that can be used to navigate through the disruptions they will generate in the supply chains.

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Appendix 1: Principal component analysis, performance

Please evaluate to what degree the following performance statements is valid for your company? (1 = to a very low degree and 5 = to a very high degree) (Adapted from Beamon, 1999; Chowdhury et al., 2019)	Factor loadings
1. We have a satisfactory growth	.822
2. We achieve the expected revenue	.918
3. We are cost-effective	.773
Variance explained (percent)	70.506
Cronbach's alpha	.788

Source: Authors own creation

Appendix 2: Principal component analysis, crisis impact

Please evaluate whether your company perform better or worse after COVID-19 at the following performance statements? (1 = to a very low degree and 5 = to a very high degree (Adapted from Beamon, 1999; Chowdhury et al., 2019).	Factor loadings
1. We have a satisfactory growth	.798
2. We achieve the expected revenue	.894
3. We are cost-effective	.695
Variance explained	63.923
Cronbach's alpha	0.711

Source: Authors own creation

Appendix 3: Principal component analysis, supply chain resilience practice

Please evaluate to what degree the following statements is valid for your company (1 = to a very low degree and 5 = to a very high degree) (Scale based on Gölgeci and Ponomarov, 2015)	Factor loadings
1. Our firm's supply chain is able to adequately respond to unexpected disruptions by quickly restoring its product flow	.736
2. Our firm's supply chain can quickly return to its original state after being disrupted	.744
3. Our firm's supply chain can move to a new, more desirable state after being disrupted	.625
4. Our firm's supply chain is well prepared to deal with financial outcomes of supply chain disruptions	.703
5. Our firm's supply chain has the ability to maintain a desired level of control over structure and function at the time of disruption	.787
6. Our firm's supply chain has the ability to extract meaning and useful knowledge from disruptions and unexpected events	.640
Variance explained	50.152
Cronbach's alpha	.799

Source: Authors own creation

Appendix 4: Principal component analysis, absorptive capacity

(Scale adapted from Flatten et al., 2011)	Factor loadings			
	Acq.	*Ass.*	*Trans.*	*Expl.*
Acquisition. Please specify to what extent your company uses external resources to obtain information (e.g., personal networks, consultants, seminars, internet, database, professional journals, academic publications, market research, regulations, and laws concerning environment/technique/health/security):				
The search for relevant information concerning our industry is every-day business in our company.	.752			
Our management motivates the employees to use information sources within our industry.	.866			
Our management expects that the employees deal with information beyond our industry.	.830			
Assimilation. Please rate to what extent the following statements fit the communication structure in your company:				
In our company ideas and concepts are communicated cross-departmental.		.671		
Our management emphasizes cross-departmental support to solve problems.		.770		
In our company there is a quick information flow, e.g., if a business unit obtains important information, it communicates this information promptly to all other business units or departments.		.789		
Our management demands periodical cross-departmental meetings to interchange new developments, problems, and achievements.		.777		
Transformation. Please specify to what extent the following statements fit the knowledge processing in your company:				
Our employees have the ability to structure and to use collected knowledge.			.737	
Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.			.848	
Our employees successfully link existing knowledge with new insights.			.798	
Our employees are able to apply new knowledge in their practical work.			.774	
Exploitation. Please specify to what extent the following statements fit the commercial exploitation of new knowledge in your company (NB: Please think about all company divisions such as R&D, production, marketing, and accounting):				
Our management supports the development of prototypes.				.793
Our company regularly reconsiders technologies and adapts them accordant to new knowledge.				.785
Our company has the ability to work more effective by adopting new technologies.				.648
Variance explained	9.483	13.736	36.808	8.904
Cronbach's alpha	.845	.825	.793	.773
Factor loadings of the combined index	.568	.821	.744	.757
Variance explained of the combined index				53.097
Cronbach's alpha of the combined index				.699

Source: Authors own creation

Appendix 5: Principal component analysis, absorptive capacity

	ACAP	Resilience
Four dimensions of ACAP (average of standardized items):		
Acquisition (3 items)	.497	
Assimilation (4 items)	.803	
Transformation (4 items)	.731	
Exploitation (3 items)	.738	
Item 1-5, Supply chain resilience:		
1. Our firm's supply chain is able to adequately respond to unexpected disruptions by quickly restoring its product flow		.771
2. Our firm's supply chain can quickly return to its original state after being disrupted		.790
3. Our firm's supply chain can move to a new, more desirable state after being disrupted		.525
4. Our firm's supply chain is well prepared to deal with financial outcomes of supply chain disruptions		.670
5.Our firm's supply chain has the ability to maintain a desired level of control over structure and function at the time of disruption		737
Variance explained	13.262	40.532
Cronbach's alpha	.699	.783

Source: Authors own creation