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Strategic flexibility and Business valuation

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Doctoral Thesis (PhD)

Strategic flexibility and Business valuation

Peter Ström

King's Business School

King's College London | University of London

October 2023

Declaration

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Name: Peter Ström

Date: 30th October 2023

"Nobody accepts randomness in his own success, only in his failure."

N.N. Taleb

Abstract

Business valuation¹ is essential at every stage of the firm life cycle, from establishing investment value for early and later stage growth venture capital funding to pricing of private equity transactions or initial public offerings, and for assessment of stock prices in public markets. Firms typically evolve in markets under competition and demand dynamics where uncertainty around their future opportunities has implications for investments, survival and available strategic choices. Value creation under such circumstances is dependent on strategic flexibility in response to changes in the business environment that introduce path-dependency and significant non-linear effects into the earnings processes. In spite of its importance, studies uncover that fundamental business valuation approaches commonly applied within venture capital, private equity and public equity are unable to effectively explain non-linear effects, and also that we know comparably little about how firms' strategic behaviour and decisions relate to firm performance and value across firm development stages.

Hence, the purpose of this thesis is to contribute to knowledge by investigating how increased understanding of strategic flexibility at all firm development stages can lead to improved fundamental business valuation. Given the fragmented state of the research, this study opens with a critical review of the literatures, followed by two research papers that each address identified limitations using large samples of listed firms to allow for estimation of implied growth options useful to the analysis. The first paper addresses the open question whether business model dimensions can provide an effective approach to peer selection. The findings, despite an early contribution, suggest that strategic dimensions provide incremental information over common industry-anchored approaches with applications suitable for firms with limited financial history. In the second paper, recent evidence in the real options research that links effects of fundamental skewness to realised firm-level flexibility is extended to address the lack of a comparable proxy for strategic flexibility in the strategic management literature by proposing a novel proxy (*strategic intensity*). The proxy is applied to analyse and answer open questions about firm-level flexibility, growth, survival and value creation across stages of firm development. Findings confirm a general positive relationship between realised strategic flexibility and performance, and uncover that higher levels of strategic flexibility exhibit long-term persistence, and can predict future levels of profitability and market value.

The thesis makes two major methodical contributions in line with the purpose. The addition of *strategic intensity* adds a lens to increase our understanding of how firms are able to realise strategic flexibility with applications in research and valuation, and peer selection on strategic choice via business model dimensions provides a succinct method suitable for firm valuation.

¹ In this thesis, terms such as *business valuation*, *firm valuation* or *company valuation* are used synonymously.

To Sarah

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Through the PhD endeavour, motivated by the pleasure of finding things out and the scientific curiosity that followed from inspirational readings of among others Richard Feynman in early age and later of Nicholas Taleb on the important and valuable role played by randomness for decisions under uncertainty in science, life and business, and later still, explored through the corporate and research ventures I have been fortunate to be part of, there are many that I am indebted to. This also has to include all the scholars that laid the fundamentals over many years and made seminal contributions from which I have been able to benefit. Not least, the highly influential and relevant contributions of Franco Modigliani and Merton Miller that after sixty years still remain both debated and the bedrock for much of what can be considered modern corporate financial management, business valuation, options theory, and more.

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1. Introduction

Theoretical background and research problem

Business valuation play important roles for investment and funding decisions for privately held firms in early or growth stages, for pricing of private equity transactions or initial public offerings (IPOs) in later stages, and also for analysis of market prices for listed firms. However, growing evidence in the literature suggests that standard approaches for valuation of private and public firms at all development stages suffers from inability to capture and explain value creation, indicating limitations in our understanding and application of firm valuation (e.g. Colombo et al., 2023; Gornall and Strebulaev, 2020; Köhn, 2018; Chen et al., 2019; Bell, 2014; Mayhew, 2010; Lopez, 2008).

The research that examines firm valuation in the venture capital funding context attributes observed low survival and growth rates² of emergent ventures to effects consistent with costly funding, undercapitalisation and resulting financial constraints due to funding frictions (i.e. information asymmetry, transaction costs, or moral hazard) associated with a shortage of effective valuation approaches for firms in this context (Colombo et al., 2023; Köhn, 2018; Engel and Stiebale, 2014; Zheng et al., 2010). Financial constraints have direct implications for venture capital backed firms which commonly evolve in dynamic and uncertain competitive markets where their strategic choices, performance and survival depend on available funding for investments into and subsequent exercise of growth options (e.g. Balafas and Kostakis, 2017; George, 2005). As many of these firms are privately held and in early or growth stages of their development, operating with limited financial history and negative cash flow, they have no means of internal generation of funds to alleviate their financial constraints and are limited in their access to debt-based finance, leaving them with equity-issues as primary source of funding (e.g. Engel and Stiebale, 2014; Festel et al., 2013). Hence, firm valuation in this setting is critically important as it determines how much funds can be raised, and consequently the accuracy of valuations have direct implications for these firms' growth investments and available strategic choices (Berger and Köhn, 2020; Cumming and Dai, 2011).

In addition to these findings, the studies that investigate valuation of more established firms in private or listed firm contexts, report that standard market-based multiples and accounting-

² Studies report that less than 30% of new ventures survive their seventh year in operation (Damodaran, 2009) and fewer than five percent become high growth firms (Daunfeldt et al., 2015; Henrekson and Johansson, 2010; Stangler, 2010).

based residual income or discounted cash flow methods that are commonly featured in this setting are also suffering from low accuracy and resulting undervaluation linked to inability of these approaches to effectively capture value effects from options and changes in the underlying market conditions (e.g. Jorgensen et al., 2011; Chen et al., 2019; Ho et al., 2017).

In observing such limitations, papers across several literatures draw attention to that value creation in contemporary competitive markets is likely to depend on firms' strategic choices and abilities to exert flexibility over their flow of future options rather than over their assets in place alone (e.g. Hiemann, 2020; Claussen et al., 2018; Del Viva et al., 2017; Driouchi and Bennett, 2012; Sanchez, 1995). More specifically, it is argued that *strategic flexibility* and *strategic choice* have positive effects for performance by providing firms with learning-based adaptability to address environmental uncertainty and competitive dynamics to limit effects of downturns and improve outcomes of upsides in the shorter term, and in capturing growth opportunities in the longer term (see Herhausen et al., 2021; Brinckmann et al., 2019; Claussen et al., 2018; Geroski, 1995). These terms are defined in this study by bridging the strategic management and real options literatures and following the temporal separation in Bowman and Hurry (1993), by defining *strategic flexibility* as the firm's decisions and adaptability that optimises the set of organisational resources in the short-term, while *strategic choice* represents the longer-term decisions and resulting flexibility concerned with the firm's organisational structure and strategic positioning, both in response to uncertain changes in the business environment (e.g. Trigeorgis and Reuer, 2017; Driouchi and Bennett, 2012)³.

Studies examining fundamental business valuation provide explanations and argue that linear models commonly applied in valuation of firms in the venture capital, private equity and listed firm settings to most part ignore value creation related to firm flexibility and real options that is non-linear by nature (see Hiemann, 2020; Chen et al., 2019; Herath et al., 2015). Since flexibility and options are available to actively managed firms at all stages of development, omission of effects associated with strategic information in firms' flexibility and choices is likely to result in significant valuation errors due to underestimation bias (Chen et al., 2019; Yee, 2000; Burgstahler and Dichev, 1997). Though, research that addresses non-linear effects in equity valuation is growing, recent studies reveal that comparatively little appears to be empirically known about how strategic behaviour is related to firms' decisions across life cycle development stages or its effect on value creation over these stages (Hiemann, 2020; Claussen

³ Hence, strategic choices can be interpreted as strategic flexibility in terms of the organisational strategy itself.

et al., 2018). In relation to the research problem, analysis under the real option perspective of the firm (see Bowman and Hurry, 1993) and use of real options-based methods (e.g. Trigeorgis, 1996) are well-suited in this setting, but applications and empirical research remain limited (e.g. Lee, 2017). Moreover, while studies in the strategic management literature emphasise the importance of strategic flexibility to competitive advantage and performance for firms in dynamic markets (e.g. Brinckmann et al., 2019; Dai et al., 2018; Nadkarni and Narayanan, 2007), contributions in this research remain mostly theoretical (Combe et al., 2012) revealing a shortage of empirical efforts due to scarcity of comparable measures of firm-level flexibility (Brozovic, 2018).

Thesis position and Research Question

Given the above limitations across literatures and central to the thesis argued in this study holds that in order to develop effective *fundamental* valuation approaches for the pricing, assessment and funding of businesses evolving in uncertain markets, particularly noting the criticality of valuation for survival and performance in the venture capital funding context, the roles of *strategic flexibility* in the shorter term and *strategic choice* in the longer term in value creation deserve more attention. Hence, this thesis takes a combined financial management (real options) and strategic management (strategic choice) perspective on strategic flexibility (in the short and long term) to contribute to fundamental firm valuation grounded in accounting research guided by the thesis research question: “*How can an increased understanding of strategic flexibility improve business valuation*”.

Structure of the thesis and introduction to chapters

The study is organised into chapters following the research paper format, each holding an independent contribution in the form of a journal article. As the literature is fragmented across academic fields (Colombo et al., 2023) the first study in chapter 2 provides a critical review that identifies open directions for research of strategic flexibility in the business valuation setting. This is followed by two empirical research papers in chapters 3 and 4 that address limitations identified in the review related to the roles of strategic flexibility and strategic choice in value creation and implications for firm valuation.

While each of these chapters provides a free-standing contribution that holds related literatures, methods, results and conclusion of findings, these chapters also form a combined contribution to knowledge related to the examination of the role of strategic flexibility in value creation within the firm valuation context. Following the prior literature, and noting that the empirical

questions addressed in each paper are applicable to both businesses in the unlisted (*pre-IPO*) and listed (*post-IPO*) firm settings, the empirical research papers rely on samples of listed firms as these provide both comprehensive financial statement information across life cycle stages and market price information allowing for implied value of future growth options to be estimated and used in the analysis (e.g. Chen et al., 2019; Callen et al., 2013). Each study is summarised in more detail over the following paragraphs.

The business valuation literature landscape is explored in the review paper in chapter 2 entitled “*Business valuation and strategic flexibility: A critical review of the literature*” guided by the thesis research question. The following findings and limitations in the extant literature appear relevant and provide directions for future research to shed light on *the relationship between firm valuation and strategic flexibility*: First, *empirical studies* of firm valuation with strategic considerations for growth-oriented firms and their evolution still remain in short supply due to historical data access limitations, and more work is needed. Second, *higher moments extensions to the traditional financial statement literature* that this far owing to its mean-variance centric focus has been unsuccessful in providing models to address uncertainty efficiently, could offer new insights into how asymmetric effects in earnings processes due to firm-level strategic flexibility and strategic choice under uncertainty, could add to explanations of value creation. Third, studies on *firm real options decision-making under financial constraints* are very rare in the extant literature, despite the theoretical importance of future growth option value. Fourth, addressing the limitations of and need for *new valuation frameworks* is central to the research problem. For example, the literature suggests that simulation-based models that integrate real options, managerial and strategic flexibility could provide useful approaches for testing value relevance of real options decision-making. In addition, prior studies uncover open directions for research with inclusion of firms’ life cycle stage and business model dimensions in comparable valuation that could offer improvements suitable for valuation as both life cycle and business model data are suggested to provide information linked to strategic choice applicable in identification of relatedness for firms with limited financial history.

The second paper entitled “*Strategic Peers: Strategic choice and business model comparability in peer selection*” in chapter 3 addresses the open direction uncovered in the review paper suggesting that business model information could improve peer selection and comparable valuation via inclusion of *strategic choice* over firms’ value creation structures on dimensions of strategic relatedness that also represents a long-term source of strategic flexibility. In addition, firm life cycle stage information is investigated in the same setting. This paper takes

a strategic management perspective on the underlying fundamental statement research problem in a contribution to the strategic group, business model and peer selection literatures driven by the questions: “*How related are the strategic group and business model concepts, and to what extent is strategic similarity through business model dimensions a viable approach to peer selection?*” The paper contributes by proposing a new peer selection approach based on strategic similarity to form strategic peers that extends from prior research in business model and strategic group literatures. It tests predictions of efficacy by applying established research designs for peer efficacy via group homogeneity, intra-group variance and valuation accuracy. The findings confirm that strategic groups and business models are related concepts and reports that while peer selection based on firm life cycle information independently appears less effective, peer selection on strategic choice via dimensions of business models provides an effective alternative approach to firm-relatedness useful in valuation.

The third paper in chapter 4 “*Strategic intensity: A real options measure of strategic flexibility*” contributes to the financial management, strategic management and financial statement literatures through addressing two empirical research spaces by investigating value effects of firm-level decision-flexibility associated with higher moments in fundamental earnings, and by examining the evolution of firms’ growth opportunities and realised strategic flexibility under the real options lens. These spaces are operationalised and addressed in a study that focus on direct effects of strategic decision-making by proposing and applying a real options proxy for realised strategic flexibility termed Strategic Intensity that measures the compound intensity of decision-driven flexibility at the firm-level through fundamental skewness in the firm’s earning processes. The empirical contributions are directed at investigating effects of strategic flexibility on value creation, growth and survival across the firm life cycle. The paper is guided by the question: “*What are the implications of strategic flexibility for firm value creation and survival?*” The empirical findings infer a general and positive relationship between realised strategic flexibility and performance in options creation, growth and value creation at the firm-level consistent with the theorised chain-effects in the literature. More specifically, the paper uncovers that firms with higher levels of strategic flexibility not only exhibit long-term persistence in realised flexibility, but also reveals that current levels of strategic flexibility consistently can predict future levels of profitability and market value.

In chapter 5 the main findings and contributions of the thesis are concluded; limitations and future research are outlined and implications for research and practice indicated.

2. Business valuation and strategic flexibility:

A critical review of the literature

Abstract

Valuation of businesses in presence of uncertainties about whether these firms' will be able to fund their operations, invest competitively and extract value from future growth opportunities is both important and challenging. The literature reports of a lack of efficient approaches to capture value in presence of options and uncertainty for firms at all development stages. Research is starting to address the roles of managerial decision-making and strategic flexibility in the firm fundamental value creation setting that might shed light on the valuation puzzle. This paper provides a critical review under the real options lens to outline and map recent progress, report limitations in the literature on business valuation and the role of strategic flexibility in this context across early and later stages of firm development.

2.1 Introduction

Business⁴ valuation is important for privately held firms in early or growth stage funding, for equity transactions or initial public offerings (IPOs), and for assessment of market price of listed firms in public markets. However, the literature reports that valuation approaches used for emergent and more established businesses are challenged to explain value creation at all stages of development, suggesting that our understanding of firm valuation is incomplete. The strand of research that examines valuation methods for early and growth stage firms argues that these issues are related to findings that models commonly applied in the venture capital (VC) investment setting were designed for stable firms in liquid markets and hence are unable to capture value creation sufficiently in this context, yielding great variability in valuation outcomes related to information uncertainty (e.g. Dubard Barbosa et al., 2019; Vara, 2013; Davila et al., 2012; Miloud et al., 2012). In addition, these models are also found ineffective of explaining dynamics and optionality characterising value creation under uncertainty prominent in early and growth stages of firm development (e.g. Trigeorgis and Ioulianou, 2013; Audretsch and Link, 2012). The research that investigates valuation approaches for more established private and listed firms in public markets also find that frequently applied accounting-based (e.g. residual income or discounted cash flow) and comparable multiple valuation methods are

⁴ In this paper, the terms *business*, *firm*, *venture* and *company* are used interchangeably.

unable of sufficiently explaining value creation for these firms (e.g. Jorgensen et al., 2011; Chen et al., 2019; Ho et al., 2017). This have led papers to conclude that fundamental business valuation accuracy is unsatisfactory both for emergent and more established firms across private and public markets and in need of attention (e.g. Colombo et al., 2023; Gornall and Strebulaev, 2020; Köhn, 2018; Chen et al., 2019; Bell, 2014; Mayhew, 2010; Lopez, 2008).

A growing body of research has started to address the underlying problem that value creation in presence of options and uncertainty over future outcomes depends on decisions related to strategic, managerial or financial flexibility that introduces path-dependence and non-linear effects which are missed by standard linear valuation models (see Hiemann, 2020; Claussen et al., 2018). Omission of strategic value effects due to decision-flexibility which are likely to be more important in emergent growth firms and for businesses in fast-moving markets increases the risk of undervaluation (see Milanesi et al., 2015a; Zambujal-Oliveira and Serradas, 2014; Trigeorgis and Ioulianos, 2013; Athanassakos, 2007; Willinge and Lerner, 2002). In addressing such shortcomings, studies in the financial statement literature suggests that both non-financial and financial information grounded in economy- and industry-wide value drivers (accounting ratios) can serve as complementary predictors in valuation, but fundamental value relevance studies focusing on for example private firms are rare (Gavious and Schwartz, 2011; Faugère and Shawky, 2000; Hand, 2003; Nissim and Penman, 2001). From a valuation perspective, the real options literature provides a framework that is suitable for valuation by taking into account strategic information related to flexibility and optionality, but empirical research also remains limited (Lee, 2017; Trigeorgis and Ioulianos, 2013). In addition, empirical studies have established and highlighted the importance of firm-level strategic flexibility as an intrinsic source of value that induces higher moments in fundamental earnings processes due to real options that could provide opportunities for research to improve the understanding of value creation for firms in both early and later stages of development (see Jia et al., 2017; Milanesi et al., 2015a; Del Viva et al., 2013).

These observations in the extant literature raise questions about how firms that evolve under varying levels of uncertainty over their future growth options should be valued, what role financial information plays, and particularly how strategic flexibility⁵ as a result of decision-

⁵ Firm-level flexibility as the set of real options decisions in the firm context is classified into strategic (growth), operating or managerial, and financial flexibility. The focus in this study is on *strategic flexibility* relevant to the firm's overall real options decision-making in response to uncertain changes in the business environment (see Trigeorgis and Reuer, 2017; Driouchi and Bennett, 2012).

making in relation to real options over the life cycle of firms should be considered to improve valuation accuracy and narrow the firm valuation gap. Hence, the purpose of this review is to contribute to the literature by identifying limitations in business valuation and the role of strategic flexibility under the real options lens by providing a comprehensive and critical review of relevant literatures within finance, accounting, business venturing, and strategic management. The review is guided by the research question (RQ): “*How can an increased understanding of strategic flexibility improve firm valuation*”

The paper argues that shedding light on the role of strategic flexibility could lead to new insights and improved valuation. The main objectives are thus to increase the understanding of what is known about the issues of business valuation and to identify gaps and possible routes to contributions within the current body of the research. To obtain a higher degree of detail, this review separates analysis into early stages where issues are reported as more acute from valuation at later stages of firm development. This is to the best of the author’s knowledge the first critical literature review that considers the implications of *strategic flexibility* under the *real options lens* for the *fundamental valuation of firms*.

To achieve these objectives, the remainder of this review proceeds as follows. Section 2.2 outlines the review methodology. Sections 2.3 and 2.4 discuss issues in the early stages while section 2.5 concentrates on valuation at later phases of firm development. Sections 2.6 through 2.8 provide critical reviews of previous research relating to firm-level flexibility, financial constraints, financial statement information and life cycle in the firm valuation setting. Section 2.9 builds a conceptual map with linkages from the findings and discusses open research opportunities available to be addressed in future work. Finally, section 2.10 concludes.

2.2 Methodology

In addressing the objective of this review paper, an extensive analysis of the current state of the knowledge in the relevant fields related to the research problem is undertaken that can serve to identify gaps and form a theoretical background for subsequent research (Saunders et al., 2016; Levy and Ellis, 2006). The method for identifying, reviewing and analysing the literature in this research is informed by the systematic procedure in Xiao and Watson (2019) and complemented by the structured identification and assessment suggestions in Paterson et al. (2016, chap.3). Different from Xiao and Watson a review protocol associated with systematic reviews is excluded since the objective is a traditional (*critical*) review (Paterson et al., 2016).

Inclusion criteria and source selection

The inclusion criteria for the review considers literature from all countries and industries across all levels of analysis, for theoretical, conceptual and empirical research. Given reported fragmentation of firm valuation (specifically in the venture capital context) within the literature (e.g. Köhn, 2018), it is motivated to include articles published in the *top-tier* journals⁶ across a wide array of relevant research fields (*subjects*) *Finance*, *Accounting*, *Business venturing* (entrepreneurship and small business), *Strategy* and *Management* (strategic management). For the purpose of finding, identifying and creating a list of the top journals as sources, the ABS 2018⁷ and ABCD 2016⁸ journal quality lists are used to obtain current journal ranking information. In addition, given that not all journals are covered by literature rankings equally for more specialised areas (Stewart and Cotton, 2013) such as business venturing, the top-tier journal list is complemented following Sassmannshausen (2012) and Carraher and Paridon (2008). The selection of sources in Strategic Management has been guided by Azar and Brock (2007). The above inclusion criteria generated a list of 58 top-tier and select journals (combined *high-tier* journals) provided in Appendix 2.A⁹. These journals are extended in the search process with all relevant sources of studies (e.g. working or conference papers, published PhD theses, reports, pre-print and open access publications) not covered in the high-tier journals.

Literature identification process, keyword development and search

The literature identification process is undertaken in four steps: Keyword development, literature search, inclusion screening, and quality assessment.

As a first step, and guiding the search, the following keywords were developed from the research question: “*firm*”, “*business*”, “*company*”, “*venture*”, “*entrepreneurial*” combined with variation on the terms “*valuation*”, “*value creation*”, “*value*”, “*market value*”, “*real options value*”, “*flexibility*”, “*strategic flexibility*”, “*firm flexibility*” and “*real options flexibility*”. In the second step, the literature is *searched* based on the keywords starting with the high-tier journals within the selected fields to build a list of articles wherein titles, keywords and abstracts are analysed to identify further sources and keywords which then are used to

⁶ In this study journals with a quality ranking of 4/4* following ABS 2018 (A/A* for ABCD 2016) are referred to as top-tier sources, while works with a rank lower than 3 (B/C for ABCD 2016), and unranked or unpublished studies are referred to as lower-tier.

⁷ Chartered Association of Business Schools (CABS) journal quality guide (<https://charteredabs.org>).

⁸ The Australian Business Deans Council journal quality list (<http://www.abdc.edu.au>).

⁹ In addition, Appendix 2.B contains a detailed list with the author’s subject-based source ranking.

Table 2.1 – Descriptive statistics of selected literatures

The table provides descriptive statistics of selected literature sources across types and paper subjects within in Finance, Accounting, Business venturing, Strategy and Management and other subjects. Notes: *Ranked refers to papers that are both listed and ranked either ABS 2018, ABS 2015, JCR, SJR or ABCD 2018. Unranked are papers that are listed in ABS 2018/2015, JCR, SJR, ABCD 2016 or DOAJ. Papers neither ranked, nor listed are denoted Unlisted. ABS 2018 and ABS 2015 refer to Chartered Association of Business Schools (CABS) Journal Quality Guides and ABCD 2016 the Australian Business Deans Council journal quality list. JCR (Web of Knowledge Journal Citation Reports, Clarivate Analytics, avg.5 year, 2008-2012) extracted from the CABS 2015 Guide (N/A in ABS2018). SJR (SCImago Journal Rank from the Scopus database, Elsevier, avg.5 year, 2010-2014, following method in ABS 2018). **Journal predatory list maintained by Jeffrey Beall (<https://bealllist.weebly.com/>).

<i>Panel A: Descriptive statistics of references by type (n=172)</i>						
	Obs.	Prop.	Ranked*	Unranked*	Unlisted*	Predatory**
<i>Journal papers</i>	133	77,3%	126	2	5	0
<i>Working papers</i>	22	12,8%				
<i>Books</i>	10	5,8%				
<i>Conference papers</i>	2	1,2%				
<i>Book chapters</i>	2	1,2%				
<i>Reports (other)</i>	3	1,7%				

<i>Panel B: Papers (journal, working and conference) by literature subject (n=157)</i>		
	Obs.	Prop.
<i>Finance</i>	63	40,1%
<i>Strategy and Management</i>	42	26,8%
<i>Business venturing</i>	26	16,6%
<i>Accounting</i>	22	14,0%
<i>Other</i>	4	2,5%

extend the list with iterations of backward and forward searches using the following databases and search engines: Academic Search (EBSCO), JSTOR, Science Direct, Wiley Online Library, SAGE Journals, Taylor & Francis Online, Scopus, Social Sciences Research Network (SSRN), EconBiz, Emerald Management (Ejournals), ISI Web of Science, DOAJ and Google scholar. The literature search in this step identified 373 articles.

Screening and quality assessment of the search result

In the third step, the extended list of articles is *screened* against the review inclusion criteria, followed in step four by the *assessment on quality*, using ranking information for journals applying ABS2018 and ABCD2016 impact scores extended by the Directory of Open Access Journals (DOAJ)¹⁰ listings for pre-print and open access articles. Due to the emergent and debated controversy relating to so called '*predatory*' journals published by non-reputable publishers (see Perlin et al., 2018; Somoza-Fernández et al., 2016; Shen and Björk, 2015) all sources are cross-referenced to *Beall's list of predatory journals*¹¹. Overall, the outcome of the literature identification process as presented in Table 2.1 resulted in a final selection of 172 articles from journals, working or conference papers, books and reports, whereof 157 are papers across the relevant research fields. A more detailed table of studies by their literature subject is provided in Appendix 2.C.

¹⁰ For DOAJ listed publications the DOAJ tick and seal are treaded as indicators of quality (<https://doaj.org>).

¹¹ Journal predatory list maintained by librarian Jeffrey Beall (<https://bealllist.weebly.com/>).

Analysis and synthesis of the selected literature

The selected articles are analysed and synthesised to inform the critical review across the sections in this paper, and to build a conceptual model and linkage map of the research problem.

2.3 Valuation of early stage firms in the venture capital context

Access to funding for *new firms*¹² has been shown to be important both for survival¹³ and growth of these firms (Atherton, 2012). Many new growth firms are dependent on external finance such as venture capital funding (Damodaran, 2009) to provide sufficient capitalisation in order to bridge the firm over unanticipated challenges in early stages of firm development and into cash flow-positive operation. The uncertainty in this stage is high and lack of progress or insufficient funding are conditioned by investor fatigue and risk of failure (Goldman, 2008).

The focus of this section is on the literature discussing valuation and funding of firms in earlier stages of development in the venture capital context. The relationship between venture capitalist and entrepreneurs is characterised by a number of frictions in the literature that are related to early stage funding problems: *information uncertainty*, *forecasting bias*, *complexity* issues and *information asymmetry*.

Information uncertainty

One of the most challenging problems in the valuation process is information uncertainty, were the lack of financial data due to short operating history and uncertainty about the firm's future prospect in emerging markets is a well-recognised problem (e.g. Dusatkova and Zinecker, 2016; Ge et al., 2005) that commonly leads to that investors turn to secondary sources of information to complement their analysis (Stankevičienė and Žinytė, 2011). However, evidence suggests that in many cases information about target sectors of a firm's future operations is scarce or not available (Moscoso Escobar and Botero Botero, 2013). In addition, most firms in early stages of development are privately held and there might not be a presence of mature financial markets for these firms. Instead venture capital markets are characterised as illiquid, and with private transactions in small numbers (e.g. Ge et al., 2005; Denis, 2004; Jarvis, 1996; Willinge and Lerner, 2002).

¹² In this study the terms start-up, new firm, emergent venture, or variations thereof are used with equal meaning.

¹³ Following prior research this paper defines *survival* as an exit by closure (*liquidation or failure*) in contrast to successful exits via mergers or acquisitions (e.g. Wennberg et al., 2016; Hyytinen et al., 2014).

Entrepreneurial cognition and forecasting bias in business planning

Forecasting future cash flows of emergent growth firms is critical for appropriation of funding and resources for firm survival (Goldman, 2008), and challenging due to the lack of financial history (e.g. Moscoso Escobar and Botero Botero, 2013; Damodaran, 2012). Two important dimensions of entrepreneurial forecasting that are commonly reported in the literature are entrepreneurial cognition (awareness) and moral hazard (misrepresentation).

Entrepreneurs are generally found to be cognitively biased upwards in their optimism about the future business development (Dubard Barbosa et al., 2019). However, there exists evidence to suggest that early stage forecasting also is affected by experience in assessing the future opportunity (Cassar, 2014) as well as understanding of the industry and opportunity space at the venture planning stage (Dimov, 2010). Entrepreneurial managers driven by overconfidence (Cassar, 2014) are frequently found to underestimate the venture risk (Dubard Barbosa et al., 2019) and to overstate the value of future growth opportunities (Vara, 2013). The overestimation of future opportunities or underestimation of the risks taken due to entrepreneurial awareness, and manifested as cognitive bias may lead to under- or overinvestment (Fraser et al., 2013). An interesting finding is that where estimates of survival in new firm forecasting process are provided, the effect of cognitive bias in the forecasting is reported to be less prominent than when only forecasts were submitted (Hyytinen et al., 2014). In addition, entrepreneurs are likely to misrepresent their future forecasts of sales and cash flows in an action of moral hazard to place themselves in a better negotiation position in the funding and valuation process (Vara, 2013). Problems with entrepreneurial and management aspects in forecasting are well-known (Trigeorgis, 1996) and constitutes an important driver of friction in the funding process due to resulting information asymmetry leading to that investors increase discount rates to compensate and hence effectively undervaluing these firms (Willinge and Lerner, 2002).

Complexity of the venture

Another driver of friction in the funding process is complexity of the firm's offering. New and emergent firms that have a higher degree of sophistication and commercial complexity in their business models or value propositions (product and service bundle) are viewed as less risky and receives higher valuations, while firms with higher technological complexity are perceived as more risky (Scott and Scott, 2016).

Information asymmetry and resulting agency issues

The information asymmetry that results from information uncertainty due factors such as short financial history, market incompleteness and lack of complementary industry data, in combination with moral hazard and outcome reliability issues in forecasting and business planning is typically significant (Ge et al., 2005). For investors the asymmetric information (hidden information) and moral hazard (hidden action) constitutes the primary informational problems within the principal-agent framework (Pratt and Zeckhauser, 1985) that drive risk perception issues and their consequences for valuation and funding in this context. In a marketplace of investment opportunities with different quality investments on offer, if an investor is unable to differentiate between good bets and risky bets, and there is no effective way for good bets (e.g. new firms) to signal their value, the investor will be forced to treat all investments as *equally risky* (Akerlof, 1970). The signalling problem is further compounded by reports of high default rates of new ventures, where venture capital investors have been found to experience average default rates as high as up to 30% (Cumming and MacIntosh, 2003).

Valuation of new and emergent firms is offered at high cost

The investors' expectations of future outcomes and risk perception play a critical role in the valuation of new and emergent firms (Hartmann-Wendels et al., 2008). Venture capital investors are found to demand excessively high returns, effectively undervaluing any venture systematically to compensate for both perceived default risk and uncertainty of future outcome (e.g. Köhn, 2018; van de Schootbrugge and Wong, 2013; Houlihan Valuation Advisors, 1998; Willinge and Lerner, 2002). Consequently, venture capital funding in most cases is offered at high cost, with reported return rates based on excess market premiums of between 20 – 75% (Davila et al., 2012). The undervaluation effectively reveals some arbitrariness in the venture capitalist approach to valuation, and that pricing of new firm funding is more of a subjective negotiation process than objective and fundamental valuation (e.g. Sammut, 2012; Ge et al., 2005). In cases where comparable firms with similar characteristics can be located in public markets it has been shown that some effects of the likely undervaluation can be mitigated as new firm valuations are found to be positively driven by public equity valuations (Köhn, 2018; Gompers and Lerner, 1999). Low valuations are an important part of the venture capitalist–entrepreneur conflict (Miloud et al., 2012) that due to the significant dilution involved often leads to failed transactions where the entrepreneurs with the valuable investments withdraw, while less economically viable projects would accept, in what is called adverse selection (Vara,

2013). Another important trade-off for both entrepreneurs and investors is the finding that valuations are also the basis for the motivation of the entrepreneurs and related to their performance (Bell, 2014). The most pressing issue is the lack of mechanisms to establish a fair value in a range that both venture capital investors and entrepreneurs can accept (Köhn, 2018). This issue is related to information asymmetry, adverse selection, and the resulting underfunding problem that is linked to firm financial constraints.

Alternative sources of funding

The focus of this section has been on issues in funding and valuation of early stage firms in the equity-oriented venture capital context. Other sources of external funding could have been considered, such as loans from financial institutions. Findings suggest consistent with the pecking-order theory (Myers and Majluf, 1984) that entrepreneurs seek to minimize ownership dilution in the financing process and would prefer debt over equity issues (Kim and Wagman, 2016). However, the information uncertainty problem is also relevant in the case of debt funding, and credit market frictions in this respect are a major hurdle for new growth firms (Kerr and Nanda, 2009) resulting in high transaction costs (Hechavarría et al., 2016). In addition, small and new firms are less likely to receive bank finance (Rostamkalaei and Freel, 2016) and terms for loans offered are commonly found to be unfavourable (Luo et al., 2016). This suggests that new growth firms with a high-risk profile and a long time to positive cash flow would not be eligible or in a position for substantial debt funding. This is supported by evidence of that many technology and growth firms in early stages of development are completely financed through equity (Festel et al., 2013).

2.4 Early stage venture valuation methods

This section discusses thematically findings relating to valuation methods that are applied in the venture capital context of early stage firms.

New firm valuation research

The literature on early stage valuation methods in the venture capital context is described as sparse (Goldenberg and Goldenberg, 2009), fragmented (Köhn, 2018), and with only a few papers available (Miloud et al., 2012). Given low survival odds of new firms, incomplete understanding of firm growth and the agency issues evidenced in the emergent firm funding process, there is a critical necessity to address and improve valuation of early stage ventures

that constitutes an understudied research area (Kotova, 2014; Audretsch and Link, 2012; Stankevičienė and Žinytė, 2011; Ge et al., 2005).

The VC context research on investment lacks focus on valuation

In entrepreneurial finance and venture capital investment, most of the research has been focused on access to funding and on investment evaluation processes, but very little attention has been paid to improving understanding of and methods for valuation of new and emergent firms (Ge et al., 2005). This is surprising given the importance of new firms, and that the most contentious and misunderstood part that is critical to the investment process and negotiation of funding, is the valuation (Bell, 2014, p.60).

Early stage growth is difficult to value

Among the explanations in the prior literature for limited progress of research, the difficulty of valuing firms in early stages is the most prominent, and attributed to the characteristics of new and emergent firms (Köhn, 2018; Festel et al., 2013; Milanese et al., 2013; van de Schootbrugge and Wong, 2013; Miloud et al., 2012; Steffens and Douglas, 2007; Willinge and Lerner, 2002). Also, the limitations in access to high quality financial data for firms in early stages that are largely privately held has been reported as a challenge in the literature (Bell, 2014; Denis, 2004; Ottoo, 2000). Information uncertainty combined with the difficulty of estimating implied volatility and hence risk associated with cost of capital for these firms has been suggested complicating factors in development of new models (Milanese et al., 2013). The lack of progress has led to that multiple valuation methodologies are commonly applied by venture capital investors and entrepreneurs, yielding high variance in valuations, causing frustration and leading to adverse selection (Miloud et al., 2012). Though this has reportedly led to improvements in pricing and deal-making success rates (Dittmann et al., 2004), the application of valuation approaches that were developed for established public companies in complete markets are not suitable for private firms in illiquid markets in their early stages of development (Goldman, 2008).

This reveals that there is a gap in the current body of knowledge related to valuation models and approaches for early stage growth firms in the venture capital context. More specifically there is a growing demand in the literature for new ideas for models that are more practical, systematic and are able to deal with issues of information uncertainty (Zambujal-Oliveira and Serradas, 2014; Festel et al., 2013; Moscoso Escobar and Botero Botero, 2013; Audretsch and Link, 2012; Mayhew, 2010; Lopez, 2008).

Valuation models applied to new firms

The literature uncovers that application of traditional net present value (NPV) or discounted cash flow (DCF) based approaches to valuation along with valuation multiples; net asset methods and the venture capital method (VCM) are dominating in early stage valuation (Ge et al., 2005). These approaches are dependent on the existence of efficient markets, make assumptions about long-term stability under low levels of uncertainty and availability of accounting information (e.g. Steffens and Douglas, 2007; Damodaran, 2012; Robbie and Wright, 1997). The lack of comprehensive financial statement information (Stankevičienė and Žinytė, 2011) in combination with deficiency in assumptions for these approaches to be applicable for new or emergent firms offer a basis for explanations for why valuations often lead to a very wide scatter in outcomes and unrealistic numbers, as in these firms most of the value does not originate from assets-in-place, but from their future growth assets (Damodaran, 2009). Another important issue with traditional valuation methods is the use of a constant risk-adjusted discount rate to account for all future uncertainty. It is common practice in venture capital investments to adjust the rate to be sufficiently high to account for the perceived risk subjectively (van de Schootbrugge and Wong, 2013). Even though particularly high technology firms are reported to be mainly funded via equity (e.g. Festel et al., 2013), the use of a constant weighted average cost of capital (WACC) is an inherent limitation of the traditional approaches such as DCF and NPV that also implies that there will be no future change in the capital structure.

Issues with application of traditional firm valuation models in early stages

The most popular and accepted approach for firm valuation is DCF. It has become widely adopted due to its simplicity of application and decision rule for rejection or acceptance of an investment (Trigeorgis and Ioulianos, 2013). However, the nature of the approach where cash flows are projected with a high degree of certainty does not take into account the uncertain characteristics of emergent firms (Gavious and Schwartz, 2011) or the timing flexibility of the firm's investments (Botteron and Casanova, 2003), or the value contingent on follow-up tactical investments into future value-creating potential (Buckley et al., 2002). In addition, these approaches also risk missing value embedded in R&D growth options from early strategic investment (Banerjee, 2003). Due to the high environmental hazard and reported failure rates in venture capital investment, the value of the abandonment option that can be considerable for investors is also ignored by traditional valuation approaches and so is the common staging of investment that will change the investment risk profile over time (Goldenberg and Goldenberg,

2009). Generally, the literature is in agreement over that the main issue with NPV- and DCF-based models, is that they fail to recognize or capture the value of flexibility under uncertainty that is embedded into the management of future opportunities and contingent decision-making in the face of new information (see Festel et al., 2013; Trigeorgis and Ioulilianou, 2013; León and Piñeiro, 2004; Ottoo, 2000; Willinge and Lerner, 2002).

Use of valuation multiples based on comparable firms

A commonly accepted approach in venture capital assessment is to consider economically comparable firms from recent trade transactions or public firms in liquid stock markets with similar products or services or characteristics as a relative benchmarks for valuation (Gavious and Schwartz, 2011). The reliance on multiples under the assumption that market-priced firms on a scaled basis should be applicable as comparative peers to a private firm is arduous, as new or emergent firms have very little historical data and that there are limited variables to compare (Damodaran, 2009). The perhaps most challenging assumption underlying this approach is the implied degree of *economic similarity* in the sense that selected peer firms operate under sufficiently similar business models in comparable markets or industries in terms of future growth opportunities compared to that of the target firm under valuation. The approach has drawn criticism due to the challenges involved in identification of comparable firms (see Milanesi et al., 2013; Audretsch and Link, 2012; Damodaran, 2009) and it has been suggested that the use of multiples, despite issues involved, is best explained by a lack of alternative methods (Gavious and Schwartz, 2011). Two approaches to economic comparability discussed in the literature, and reported as commonly used by analysts, that appear not yet to have been applied in systematic comparable firm selection, that could potentially improve the valuation for firms with limited historical data, are identification of comparable firms based on business model-relatedness (e.g. Dierynck and Verriest, 2020; Mercer, 2009) and similarity by life cycle stage (see Vorst and Yohn, 2018; Drake and Martin, 2020).

Venture capital methods to early stage valuation

There are two approaches to new firm valuation that grew out of the necessity to find a price in early stage negotiations that can best be explained as a combination of an exit multiple and discounted cash flow analysis (van de Schootbrugge and Wong, 2013). First, the Venture Capital Method (VCM) that was proposed by Sahlman and Scherlis (1987), and considers a single value for the firm. Second, the First Chicago Method (FCM) that complements the VCM analysis by a weighted probability over a best case, base case and worst case applying standard

scenario analysis (see Achleitner and Lutz, 2005). Though FCM adds a degree of flexibility to future outcomes, both approaches have received criticism for only being ‘rule of thumb’ pricing mechanisms that are not consistent with professional valuation standards (Goldman, 2008), and are both inaccurate and unjustifiable (Miloud et al., 2012; Ge et al., 2005).

Decision-tree analysis and real options valuation

Decision-tree analysis (Hertz, 1964; Magee, 1964) was introduced due to early critique of traditional valuation approaches as a method to incorporate managerial flexibility in firm valuation to allow the expectation of a distribution of outcomes and not only the single point pre-determined expectation to be accounted for as is the case of standard NPV and DCF valuation approaches. This approach takes into account decision nodes and is both easily understood and well-accepted due to its scientific roots in engineering. It is however suffering from a fundamental flaw in assuming that any contingent decision is associated with the same constant risk by its application of constant discount rate (see Trigeorgis, 1996). It has been argued that decision-tree analysis in spite of the rate issue is more suitable in early stage technology firm valuation compared to alternative approaches such as real options. It is argued that risks in growth firms are mostly idiosyncratic and alternative approaches such as real options that rely on assumptions of systematic risk and market completeness for pricing would not be motivated based on the complexity of standard real options approaches in combination with the possible errors that are made in locating comparable assets as twin security to establish as replication portfolio (Steffens and Douglas, 2007).

Other approaches have been suggested to address the lack of tradability and market incompleteness issues such as the Market Asset Disclaimer approach (MAD) that suggests using the firm itself for the portfolio replication (Copeland and Antikarov, 2003). On the other hand the risk-adjustment itself is arguably also a problem in NPV and DCF approaches that need to estimate a single discount rate that is both market priced and that takes into account all future changes in risk characteristic (e.g. Luehrman, 1997). The debate on trade-offs in spanning of assets and the problem of observability of growth rate volatility and subjective rates is not novel to the literature (e.g. Schwartz, 1994).

As firms in their early stages of development are likely to go through several rounds of finance (staged funding), are operating under high uncertainty with considerable risk of default (abandonment) and have a value that is to most part based on future growth opportunities where firm-level decision-flexibility impacts on the value creation, there is a not only critique in the

literature, but overwhelming evidence of that real options approaches in this valuation context is both suitable and under-researched (Zambujal-Oliveira and Serradas, 2014; Milanese et al., 2013; Trigeorgis and Ioulianos, 2013; Audretsch and Link, 2012; Bank and Wibmer, 2011; Botteron and Casanova, 2003).

2.5 Business valuation in later stages of firm development

To complement the findings of early stage valuation this section extends the discussion to include what is known about valuation in later stages of firm development.

Investments in later firm life cycle stages are commonly structured into growth stage (e.g. development) and later funding stages (e.g. scaleup) which are followed by exit alternatives such as initial public offerings (IPOs) or private equity acquisitions (e.g. Colombo et al., 2023; Miloud et al., 2012; Seppä and Laamanen, 2001). A common notion in the literature suggests IPO as primary exit strategy for venture capital investors (e.g. Damodaran, 2018), however, evidence implies that only about one in five of exits are through IPOs, while a larger group of surviving firms that received venture capital investment remain privately held (see Gompers et al., 2020; Iliev and Lowry, 2020)¹⁴. At each of these fundraising or transactional milestones, valuation is a critical part of the process (Colombo et al., 2023; Kim and Ritter, 1999). While valuation accuracy in later life cycle stages is expected to increase as frictions in valuation and funding processes reported for early stage firms are found to lower with both firm age and size (e.g. Kim and Ritter, 1999; Alford, 1992), and hence firms at later and more established stages should be easier to value (Damodaran, 2012). Yet the literature suggests that later stage valuation remains challenging due to uncertainty around future strategy, payoffs and growth (Gornall and Strebulaev, 2020; Seppä and Laamanen, 2001). The most featured approaches in valuation of established firms are accounting-based models (e.g. NPV or DCF) and valuation using comparable firm multiples. In terms of valuation accuracy, studies find that accounting-based models commonly yield relatively high valuation errors, even when applied to samples of more established firms (i.e. Ho et al., 2017; Chang et al., 2012; Jorgensen et al., 2011). The evidence from multiples-based valuation also suggests that these models struggle to explain value without extensive adjustments (Alford, 1992; Kim and Ritter, 1999; Gompers et al., 2020). Overall, such observations reveal knowledge gaps and provide indicators of that accuracy of fundamental firm valuation in the current state appears unsatisfactory and in need

¹⁴ These studies report that around 15 - 21% of exits are through IPOs.

of more attention (Chen et al., 2019). One underlying problem is related to that commonly applied valuation models omits value creation related to firm flexibility and real options that is non-linear in nature by assuming a linear mapping between past and future performance (e.g. Hiemann, 2020; Herath et al., 2015)¹⁵. Though, growth options are expected to be more dominant in earlier stages of valuation, value effects due to firm flexibility related to for example, operative management decisions and abandonment options are present at all stages of firm development (e.g. Herhausen et al., 2021; Claussen et al., 2018; Koller et al., 2010; Del Viva et al., 2017). The literature further reveals that despite growing efforts to include real options information in valuation (Chen et al., 2019), we still know comparatively little about how strategic behaviour is related to firms' decisions and the effects they have on value creation (e.g. Hiemann, 2020; Claussen et al., 2018).

Taken together, this section adds to the findings from the analysis of early stage ventures in suggesting that in order to improve accuracy of firm valuation across all stages of development we need to further our empirical understanding of roles played by strategic choices and flexibility in presence of real options.

2.6 Strategic flexibility, options and higher moments in valuation

This section discusses relevant literatures on specific themes of managerial flexibility and decision-making in presence of real options to highlight open research spaces and implications for the issues reported in the firm valuation context.

Firm value through the real options lens rests on the idea that the firm is expected to make future investments as a going concern under uncertain demand, and critically on that the firm has a right but no obligation to act, as investments depend on the availability of future growth opportunities (Myers, 1977). The firm's available decisions for each discretionary investment opportunity give rise to strategic, financial and managerial flexibility¹⁶. Strategic flexibility refers to the firm's set of abilities to effectively respond to uncertain changes in the business environment (Sanchez, 1997, p.72), and under the real options view its ability to manage and exercise growth options (Del Viva et al., 2013, p.4). It is also suggested that firms' choice of

¹⁵ As argued by Hiemann (2020), management can for example take profit-maximizing decisions in respect to opportunities, and flexibility over such strategic decisions create a path-dependency for value that cannot be explained by standard linear valuation models.

¹⁶ In this study, managerial or firm-level flexibility are used when flexibility is discussed generally. When flexibility around the firm's operating real options is concerned, strategic or managerial flexibility is used.

business model is a *strategic choice* that provides the firm with an option and a degree of *strategic flexibility* under uncertainty over its long-term structures and assets involved in creation and capture of value (e.g. Smit and Trigeorgis, 2004; Teece, 2010). In addition, the firm has managerial flexibility to optimise the operating capital resources to maximise efficiency and asset utilisation by changing scale of operations or switching resources between projects. In the same sense the firm's shareholders has financial flexibility regarding capital structure decisions or a trade sale on the firm itself (Trigeorgis, 1996). Flexibility in an uncertain competitive environment with threats and opportunities has mainly been associated with the optionality to keep a decision open under uncertainty, but there is a trade-off between this flexibility (e.g. wait for uncertainty to unfold) and commitment to e.g. pre-empt by an early investment (e.g. Smit and Trigeorgis, 2004). The importance of managerial flexibility to firm value creation and its relationship to higher moments (skewness and kurtosis) in fundamental returns (payoffs) has also been highlighted in recent empirical research (Del Viva et al., 2017; Jia et al., 2017; Milanesi et al., 2015b). Despite researchers' interest in and understanding of value relevance of firm-level flexibility since it was introduced by Stigler in 1939 (Renner et al., 2014), and the critical importance of strategic and managerial flexibility to firm valuation via the asymmetry that it introduces in the firm-level returns in form of skewness, investigations of higher moments in relation to return concepts remain scarce in the research literature (Del Viva et al., 2017; Jia and Yan, 2016; Grigoletto and Lisi, 2009). In addition, all of the studies to the author's best knowledge have so far only investigated listed firms in complete markets, leaving a gap in the literature as no studies have examined unlisted new or emergent firms. This is surprising as reported empirical evidence suggests that the value-effects linked to higher moments is particularly prominent in small, newly formed or financially constrained firms in volatile sectors such as technology (Del Viva et al., 2017; Smit and van Vliet, 2001).

The firm's real options and the positive impact of managerial flexibility

The firm under the real options perspective can be described as an indefinite sequence of projects (Copeland and Antikarov, 2003) in an unfolding process (Garnsey et al., 2006) where management redistribute the firm's resources and capabilities while maintaining and exploiting a portfolio of real options to achieve its strategic objectives under competition and uncertain demand (Luehrman, 1998; Bowman and Hurry, 1993; Kester, 1984).

The real options available to the actively managed firm are typically classified into operational, strategic (growth) and financial options (Trigeorgis, 1996). In addition real options can be

divided into expansion (call) options and protective or contraction (put) options (Del Viva et al., 2013). Strategic options (growth options) are compound expansion options (Geske, 1979) that represents an early growth investment with an expected strategic future value for the firm. In other words, the firm acquires a capability (e.g. a technology) that gives the firm a better position (e.g. margins or time-to-market) with respect to competition. If this initial investment (strategic investment) is undertaken by the firm, it can then realistically hope to get more out of the anticipated future growth opportunities (Kulatilaka and Perotti, 1998). Operational options are normally simple and in the form of expansion options (e.g. scale up production or wait for new information) or contraction options (e.g. divest equipment, scale down production) that are concerned with the firm's ongoing activities, but this class also includes more complex options, such as switching options (e.g. reverting resources from one project to another project) or the option to stop and restart operations (e.g. temporarily close a plant during low demand). Financial options are generally under control of shareholders where the firm itself rather than its activities are considered. These options include capital structure changes (e.g. leverage or share issues), sale of the firm's assets (e.g. trade sale) or abandonment (e.g. liquidation). These are some examples of real options available to the firm. For a more comprehensive list of the firm's options see Trigeorgis (1996). The impact of strategic and managerial flexibility in the presence of the firm's portfolio of real options has several positive effects on the value of the firm. Managerial flexibility changes the risk profile and lower risk under uncertainty due to the effect of real options decision-making in changing the course of investments in the face of new information as uncertainty unfolds. This effect gives rise to skewed characteristics in fundamental returns, and it has been empirically shown that managerial flexibility even in firms with losses are less risky than classical theories would suggest, and command a negative risk premium (Del Viva et al., 2017). Another example is venture capital funding where investments are typically staged (e.g. Lukas et al., 2016). From the venture capital investor perspective the option not to follow-up the agreed staged investment in face of unfavourable outcomes is associated with exit or abandonment option value that can be considerable (e.g. Trigeorgis and Iouliaou, 2013).

Flexibility and higher moments in firm valuation

Though effects of flexibility as an important determinant of firm value creation under uncertainty is well-established, the prior literature on firm valuation addresses flexibility either via individual real options valuation or basic scenario analysis (e.g. Trigeorgis, 1996), and only a few studies consider higher moments in this context (Del Viva et al., 2017).

The critique that traditional net present value-based approaches, including the discounted cash flow model, do not capture flexibility is frequently reported (e.g. Trigeorgis and Ioulilianou, 2013; Copeland and Antikarov, 2003), but also equilibrium market models such as the standard capital asset pricing model (CAPM) ignores value of higher moments (Kapadia, 2006; Smit and van Vliet, 2001). The underlying problem as introduced in the previous section is the assumption of linear value mapping and normally distributed outcomes. Milanesi et al. (2013) suggest that the standard assumption of normal distributions applied to many models is likely to cause under- or over-valuation. The main insight is that under the traditional perspective, the firm's investments are made under the assumption that all future decisions are fixed irrespectively of arrival of new information. Under the real options perspective a firm has a discretionary right to revise past decisions in light of new information (Schwartz, 2013, p.164).

Sources or causes of asymmetric returns

The overall evidence in the literature on managerial flexibility in real options decision-making and its effect on firm value via higher moments in the return distribution posits that the value relevance of this effect is stronger in firms that are new or emergent, high growth firms, R&D firms or firms that are financially constrained (e.g. Trigeorgis and Lambertides, 2014; Grullon et al., 2012; Duffee, 1995). The asymmetry in the return distribution is dependent on uncertainty and a function of rational managerial flexibility that increases the convexity of the firm's value in respect to its underlying assets. The mathematical explanation for the phenomena can be understood by applying Jensen's inequality (see Li and Sick, 2011, p.11). Though it has been recently shown that the main source of return asymmetry in the form of skewness is driven by real options flexibility (Del Viva et al., 2017), there are several firm-level factors that could contribute. In addition, as independent variables or their interactions are typically unobservable from available data analysed in studies, the exact underlying processes are not known (Grullon et al., 2012), which indicates further research opportunities. In the literature three classes of fundamental return asymmetry sources are reported. The first source is earnings. For example managerial flexibility that impacts on the firms operating margins by changes in cost structures, or on input pricing that vary with output, will induce skewness in the firm's earnings processes (Grullon et al., 2012). The second source is demand. In the real options literature demand uncertainty around a firm's products or services is a representation of implied growth opportunities that is commonly featured as it has a natural link to the origins of the theory and the firm's discretionary investments (Kulatilaka and Perotti, 1998). The third source is leverage that represents financial flexibility and induces skewness

in returns due to changes in the capital structure and its resulting implications for free cash flows due to lower cost of capital and tax shields on interest (Copeland and Antikarov, 2003). In addition to these sources, and different from the focus of this study, there are a number of market related factors that can induce skewness in market-based returns (see Del Viva et al., 2017).

Mean reversion and flexibility

It is well-known that mean reversion in firm-level fundamental variables and returns is an effect of the firm's adjustment to industry or economic levels due to factors that are mainly exogenous to the firm (e.g. Nissim and Penman, 2001). An interesting empirical observation from the financial statement literature that has not drawn much discussion in the real options research is that the mean reversion rates in firm fundamentals and returns are direction-asymmetrical (upwards slower than downwards correction) and also appear to be firm size dependent (Nordal and Næs, 2012; Fama and French, 2000; Fairfield et al., 1996). Nordal and Næs (2012) finds that smaller firms revert faster than larger, and argue that smaller firms are more flexible. They test the relationship between investment activity and profitability, and find some evidence that firm's investment activity is related to profitability. Benoit et al. (2011) argue consistent with Dixit (1989) that one explanation could be the firm's entry and exit decisions that can give rise to a hysteresis effect that does not have to be symmetrical in mean reversion. Another interesting explanation is given by Chen and Lin (2011) who evidence and argue that the asymmetries in mean reversion rates are consistent with catering theory (Shefrin and Statman, 1984). The explanation within this theory holds that management would adjust flexibility to keep a downward shock (e.g. due to a demand shift) slowly rising to cater to investor expectations of improvements upwards, rather than correct immediately. The mixed outcomes in combination with unexplored links between mean reversion and real options indicate possible behavioural aspects of managerial flexibility open for research. This research opportunity is supported by the finding that underlying drivers of mean reversion only recently have started to engage researchers (Halsey, 2010).

Survival and flexibility

A related explanation holds that firms that are less flexible in response to exogenous changes (e.g. shifts in prices or costs), also exhibit *slower mean reversion*. Based on this explanation it has been suggested that there might be a significant relationship between firm-level flexibility

in response to such changes and firm failure (Suvas, 1996, p.618). Given the high failure rate of newly started firms, this opens an opportunity for investigations.

Normalisation of return distributions with age

The findings in the literature are in agreement on that return asymmetry is tending to normalise with firm age. One explanation suggests that that smaller (and younger) firms are more flexible than larger (and more mature) firms (Nordal and Næs, 2012). Schwartz and Moon (2001) argue that competition drives all firms to become normalised over time. In addition, small or new firms with growth options often have small asset bases compared to large firms making their returns more sensitive to variation in earnings (Del Viva et al., 2017). These explanations combined with the theoretical expectation that small growth firms should consist of comparably higher shares of growth options than large value firms that have more assets in place and strategic value is consistent with real options theory (e.g. Trigeorgis, 1996). An open question that appears not to have been addressed in the literature is how this normalisation or return asymmetry evolves across time or life cycle stages and what role management flexibility has in these processes. There is a need for such empirical investigations to test if firms behave as the real options theory predicts (Lambrecht, 2017).

Organizational perspectives on real options and managerial flexibility

The behavioural perspective of real options decision-making has started to receive more attention in the literature but is still under-researched. It challenges the rationality of the real options perspective that views managers as unbiased agents undertaking optimal investment policies involving the firm's portfolio of real options (e.g. Ipsmiller et al., 2019; Ragozzino et al., 2016; Trigeorgis, 2014; Driouchi and Bennett, 2012). The attention-based view (ABV) is an emergent firm-level perspective that recognises bounded rationality of decision-makers in real firm contexts where limitations might form managers ability to attend to and act on real options (Barnett, 2008). This behavioural perspective holds that under real conditions manager might not act rationally or even make the observations necessary for real options logic to work (Barnett, 2008). Specifically, this new view is critical towards real options reasoning (ROR), arguing that if managers are not able to note or respond effectively to changes in the firm's environment, the real options reasoning suggestion that firms can take on more risky strategic projects assuming downsides can be limited, is unrealistic and places firms at risk (Trigeorgis and Reuer, 2017).

Rationality of an option map to examining real options decision patterns

The importance of real options research to direct more attention to behavioural aspects of managerial flexibility in real options decision-making at the firm- or business unit level is also evident in recent reviews (Trigeorgis and Reuer, 2017; Ragozzino et al., 2016). The observation that managers in actual firm settings intuitively apply real option logic to decision-making under uncertainty is not new (Banerjee, 2003; Amram and Kulatilaka, 1999; Trigeorgis, 1996), but the critique of real options reasoning and the emerging attention based perspective indicate that there is a need to move past the dominating focus on cross-sectional analysis on the industry-level that lacks the ability to capture heterogeneity of real options decision-making on the firm-level (Trigeorgis and Reuer, 2017). Ragozzino et al. (2016, p.19) proposes an interesting idea for addressing this gap in the literature that they label an “option map”. It is consistent with the concept of a real options-based view of the firm as suggested by Trigeorgis and Reuer (2017, p.56). Ragozzino et al. suggest that actual firm-level management flexibility and real options driven decision-making patterns should be framed and valued as a real options portfolio in an integrated framework (taking into account option interaction) that is built around the firm’s main uncertainties, and that represents the firm’s strategic context under uncertainty. An operational interpretation of this idea could involve observing and codifying decision rules and factors such decisions maximise. From evidence of bounded rationality and biases, in the literature, such decision rules might not in all circumstances be expected to be aligned with shareholder wealth-creation objectives. However, framing such rules quantitatively in a real options-based decision model could lead to improved understanding of how actual decision-patterns impact on *real* firm performance and outcomes (e.g. value or survival rate). In a related paper Del Viva et al. (2017, pp.219–220) present how real options decision-making translates into a dynamic value-model of the firm that could provide a useful framework for further analysis.

Entrepreneurial aspects of firm-level flexibility

Also, in the venture capital investment context there are behavioural driven entrepreneurial flexibility patterns with real options characteristics that have emerged over recent years that could potentially offer insights into and explanations for early stage firm development. The literature on real options logic that examines entrepreneurship is reported as limited with many unexplored avenues open for research (Ipsmiller et al., 2019). Bootstrapping (cash minimising) and Bricolage (asset limiting) are two resource optimisation strategies that also have option-like nature. In addition to these, the related emerging concept of effectuation (Sarasvathy,

2001) holds that entrepreneurial decision-making under uncertainty is guided by available resources and acceptable losses in considering a distribution of possible futures, rather than setting out objectives in business plans and appropriating resources and capabilities expected to be required. This explorative approach to explaining entrepreneurial behaviour stands in stark contrast to the causal (rational) perspective of firm development that dominates the literature, but at the same time it holds real options characteristics that could be considered in a real options model of entrepreneurial investment. The effectuation theory is offering an alternative behavioural-based explanation for new firm's decision-making flexibility that also leads to questions about how effectuation and causation approaches are comparably related to higher moments in outcome variables. These typical entrepreneurial strategies have not been investigated as real options, and could offer valuable understanding of effects of entrepreneurial decision-making under uncertainty.

2.7 Business valuation under financial constraints

Businesses in their early and growth stages of development are more likely than later stage firms to experience funding constraints due to neither being able to sufficiently *access external capital*, nor being able to *generate internal finance* via their cash flows. This section reviews the literature on financial constraints in the context of firm valuation.

Definition – what constitutes a financially constrained firm?

The *definition* varies across the existing literature that range from early studies by Stiglitz and Weiss (1981) who considered debt funding and the *credit rationed firm* as a firm that is willing to meet the lenders conditions fully, but is still not given as much credit as it desires. The sourcing problem of *external finance* associated with the term *funding gap* generally leads to a definition of financial constraints due to frictions in the supply of capital (Fraser et al., 2015). Specifically for firms in the venture capital investment context financial constraints are related to *equity funding* and commonly found to arise from the chain of early stage investment frictions discussed earlier in this paper, and reported as strongly associated with information asymmetry, uncertainty and lack of reliable data (e.g. Farre-Mensa and Ljungqvist, 2016; Fraser et al., 2015; Coad, 2010; Hadlock and Pierce, 2010; Fazzari et al., 1988). In this review, and a definition grounded in the extant literature, a firm that cannot meet its funding requirements (*internal* and *external*) in support of its investment opportunities it will be defined as a financial constrained firm (e.g. Fraser et al., 2015; Carpenter and Petersen, 2002; Fazzari et al., 1988).

The empirical financially constraint firm literature

The previous empirical studies that investigate financial constraints on a variety of firm outcome factors have focused primarily on established and listed firms (e.g. Ayyagari et al., 2008; Musso and Schiavo, 2008; Almeida and Campello, 2007; Becchetti and Trovato, 2002). Only a few studies in this literature have considered and analysed effects of financial constraints and their implications for new ventures (Wamba et al., 2017; Stucki, 2014; Saridakis et al., 2008, 2013; Huynh et al., 2010; Cressy, 1996). The firm effects of financial constraints in the literature are mostly reported as negatively related to performance when compared to less constrained firms concerning profitability, growth and survival, R&D and innovation (e.g. Scott and Scott, 2016; Savignac, 2008). Contrary to this there is some evidence suggesting that moderate levels of financial constraints can lead to higher innovative productiveness and that overfunding tends to increase investment into less valuable R&D (Almeida et al., 2013). The overall effect of financial constraints is confirmed negatively associated with value creation processes and firm value (Greene, 2017). The negative impacts of constraints on profitability and survival in early stages of the firm life cycle that are expected to diminish with firm age has been addressed by a few studies, but *persistence* of such effects in constrained new growth firms is an open question (Stucki, 2014). The supply side research is the dominant perspective in the extant literature and the findings point to that these constraints are particularly likely and severe for growth and survival of firms that are pursuing *new technology* (Bertoni et al., 2011) or otherwise *growth oriented* (Ponikvar et al., 2018), are of *small size* (Carpenter and Petersen, 2002) and *privately held* (Saunders and Steffen, 2011).

The firm's investment behavior under financial constraints

Taking the demand perspective, the literature on firm-level investment behaviour recognises that management flexibility over *investment* and *cash holdings* in relation to the firm's expected *growth opportunities* is important (see La Rocca et al., 2019; Denis, 2011; Denis and Sibilkov, 2010). The extant literature has hypothesised that the firm's investment and cash balance policies are both an effect of the availability and cost of external finance, and of the firm's operating cash flow capabilities. Explanations hold that firms with valuable growth opportunities are expected to hoard cash in order to be in position to invest in face of anticipated financial constraints (Denis, 2011).

The literature provides several examples to suggest that firms have a level flexibility over options under financial constraints including cash holding policies (Erel et al., 2015),

investment smoothing and timing (Fazzari and Petersen, 1993), and capital structure choices (Hadlock and Pierce, 2010). In an early study Cressy (1996) finds that human capital plays an important role in the explanation for the firm's investment behaviour under constraints and concludes that the explanation for the firm's performance might not be solely significantly grounded in available liquidity. The strand of the literature that explores influence of managerial flexibility in this context is just emerging (e.g. Ramezani, 2011). To date there appear to be a gap in this literature related to behaviour of constrained new ventures.

Real option decision-making, strategic flexibility and financial constraints

Only a few papers have addressed the effects of real options under financial constraints and most studies on real options do not consider that in reality firms might have to prioritise or abstain from investments due to financial constraints (Erel et al., 2015; Yang et al., 2014). Consequently, such effects are more relevant and costly for new ventures with valuable embedded options (Flynn, 2016). Moreover, standard theoretical assumptions based on the Modigliani-Miller theorem (1958) that underpins real options are violated under constraints having a potential negative impact on realised growth options and firm value (Wang et al., 2012). Early studies that consider real options effects in financially constrained firms from different temporal perspectives (Boyle and Guthrie, 2003; Mello and Parsons, 2000) find that financing constraints are likely to restrict the firm's option set. However, these studies only consider growth investment options that might be muted by lack of internal finance. The literature is empirically silent about how real options decision-making and strategic flexibility effects resulting from other options such as switching or protective contraction options impact on value creation in new ventures under constraints.

The two *internal finance* strategies Bricolage (capital asset) and Bootstrapping (cash balance) mentioned earlier in this review are relevant to the financially constrained firm and have not yet been explored under the real options framework. Bricolage is an approach to employ asset resourcefulness in the presence of financial constraints by approaching opportunities with e.g. used or a combination of old and borrowed assets instead of investing (Baker and Nelson, 2005). In addition, due to lack of available cash resources firms are also frequently applying bootstrapping tactics involving minimizing external funding requirements by e.g. delaying payments, share resources with other firms or customers, and rely more on human capital (Salimath and Jones, 2011).

Measures of financial constraints

As the degree of firm-level financial constraints is not empirically observable via e.g. balance-sheet items, prior research has proposed a variety of measures and methodologies to capture and proxy for these constraints (Farre-Mensa and Ljungqvist, 2016; Fraser et al., 2015; Hadlock and Pierce, 2010). These measures include internal finance proxies based mainly on firm factors of investment–cash flow sensitivities (Whited and Wu, 2006; Kaplan and Zingales, 1997; Fazzari et al., 1988) and direct (self-reported) measurements of the presence of financing constraints (e.g. Canepa and Stoneman, 2008; Savignac, 2008). The variation in outcomes from investment–cash flow sensitivity approaches is still a debate open to new contributions. Multiple factor indices are commonly suggested to reduce these effects (e.g. Musso and Schiavo, 2008; Whited and Wu, 2006; Kaplan and Zingales, 1997).

2.8 Financial statement and firm life cycle value relevance

Evidence from the literature argues that information uncertainty and asymmetry being more prominent in earlier firm stages are partly caused by a lack of access to financial history and reliable forecasts to account for growth opportunities in the firms' markets. It has been argued that financial and non-financial information from industry-level variables as unbiased predictors can play an important role in narrowing the information gap that is more severe in early stages (e.g. Köhn, 2018), but studies of value relevance of complementary information in the private firm contexts are rare (Davila et al., 2012; Gaviious and Schwartz, 2011).

Financial statement analysis and firm valuation

Industry-level financial ratios have been found value-relevant, stable over time, and unbiased predictors of mean reverted firm fundamentals suitable for valuation, but application in the financial statement research is limited (Soliman, 2004). Prior research in this field investigate value relevance of accounting variables and mean reversion with a focus on time series and cross-sectional data (Nordal and Næs, 2012; Fairfield et al., 1996, 2009; Soliman, 2004; Nissim and Penman, 2001; Fama and French, 2000; Sloan, 1996; Freeman et al., 1982). Most studies analyse public firms and there are only a few articles that cover investigations of financial statement information and mean reversion in unlisted firms (Nordal and Næs, 2012; Suvas, 1996; Osteryoung et al., 1992). More specifically there is a gap in the literature due to that no studies are investigating the value relevance of financial ratios in samples of new or emergent firms. Nissim and Penman (2001) investigates the long-term cross-sectional behaviour and

value relevance of financial ratios and *unbiased* DuPont¹⁷ elements in an extensive longitudinal study. They find that many value drivers are exhibiting persistence and mean reversion patterns that are correlated to the age and industry of firms. They specifically note that such patterns can be useful in models for firm valuation. The existence of mean reversion at the industry-level leads to information that can be useful in estimation of assumed competitive advantage periods, as noted by Penman (2010). In the analysis of financial statement information, the DuPont scheme offers a logical and detailed decomposition of the firm's financial ratios that reflect the value creation paths of the firm. Yet it is rarely featured in research (Nissim and Penman, 2001). It could be useful in obtaining value drivers for valuation to simplify the parameterization of valuation models. A stochastic example is the Schwartz and Moon model (2001), where the authors suggested that value drivers could be used to minimize complexity in the parameter estimation process. In addition, the DuPont model as a disaggregation is found to increase forecast accuracy over of firm-level return variables (Fairfield and Yohn, 2001).

Moreover, Nissim and Penman (2001) open for future research to examine fundamental ratios via higher moments by concluding that their approach focuses on central tendency and convergence, and do not consider effects of uncertainty (Nissim and Penman, 2001, p.148), leaving future work to extend financial statement investigations into higher order moments.

The firm life cycle and financial statement analysis

Decisive prior studies on firm life cycle and financial statement value relevance research include Anthony and Ramesh (1992) and Black (2003). The life cycle concept used in early studies evolved from Mueller (1972) and was based on the original product life cycle concept by Levitt (1965). Anthony and Ramesh (1992) are the first to use the firm life cycle concept in explaining market performance. They find that earnings, unexpected sales growth and unexpected capital investment variables are significant in explaining excess returns for growth firms. Black (2003) investigate value relevance of financial statement variables in relation to firm life cycle stages. He finds that cash flow information is incrementally informative in early stage firms, and that the value relevance of earnings increases with each firm life cycle stage. The earlier firm life cycle research suffered from comparability issues between studies due to use of different firm characteristics and variations in definitions of stages (Stepanyan, 2012).

¹⁷ A contribution in Nissim and Penman (2001) is their introduction of a DuPont model that only considers operating assets to avoid bias from non-operating capital use, and hence a financially *unbiased* DuPont model.

Table 2.2 – The Dickinson (2011) firm life cycle model (illustrative with accounting proxy variables)

Cashflow type	Variable	Introduction	Growth	Maturity	Shake-out			Decline	
		1	2	3	4	5	6	7	8
Operating	<i>CFO</i>	–	+	+	–	+	+	–	–
Investing	<i>CFI</i>	–	–	–	–	+	+	+	+
Funding	<i>CFF</i>	+	+	–	–	+	–	+	–

The problem of a comparable firm life cycle model was solved with the event of a seminal paper by Dickinson (2011) who proposed a life cycle model based on cash flow patterns (see Table 2.2). The Dickinson firm life cycle model has generated a stream of research that relates development stages to financial statement variables, mean reversion and other economic factors. The evidence from applications of this model is shedding new light on the relationship between firm- and industry-level outcomes and life cycle stages that might offer new insights and opens for new avenues and re-evaluation of research problems in controlling for life cycle of firms. In a recent study Lee (2017) applies the Dickinson life cycle model to a sample of listed Taiwanese technology firms and finds significantly higher levels of real options in early life cycle stages. This indicates that the cash flow pattern life cycle model might provide new explanations for evolution of real options and firm-level flexibility. In addition, Vorst and Yohn (2018) who re-examined mean reversion patterns in growth and profitability based on the Dickinson life cycle model, find that the new model improves accuracy in the analysis and also reveal that analysts fail to fully incorporate life cycle information. Moreover, Anderson et al. (2017) report that financial statement variables appear to be differentially informative at different stages of the firm life cycle.

It appears that the new life cycle model based on operating, investing, and financing cash flows to proxy for development stages has potential to improve understanding of firm-level variable relationships. Dickinson (2011, p.1969) argues that life cycle stage progression results from external and internal factors including strategic activities and managerial ability. This suggests a link between flexibility over real options and firm life cycle, and ultimately firm performance.

This raises open questions about whether the new model is able to explain relationships between life cycle stages and firms' ability to exercise real options, or alternatively between strategic flexibility and firm survival (or hazard rates) across venture the life cycle stages.

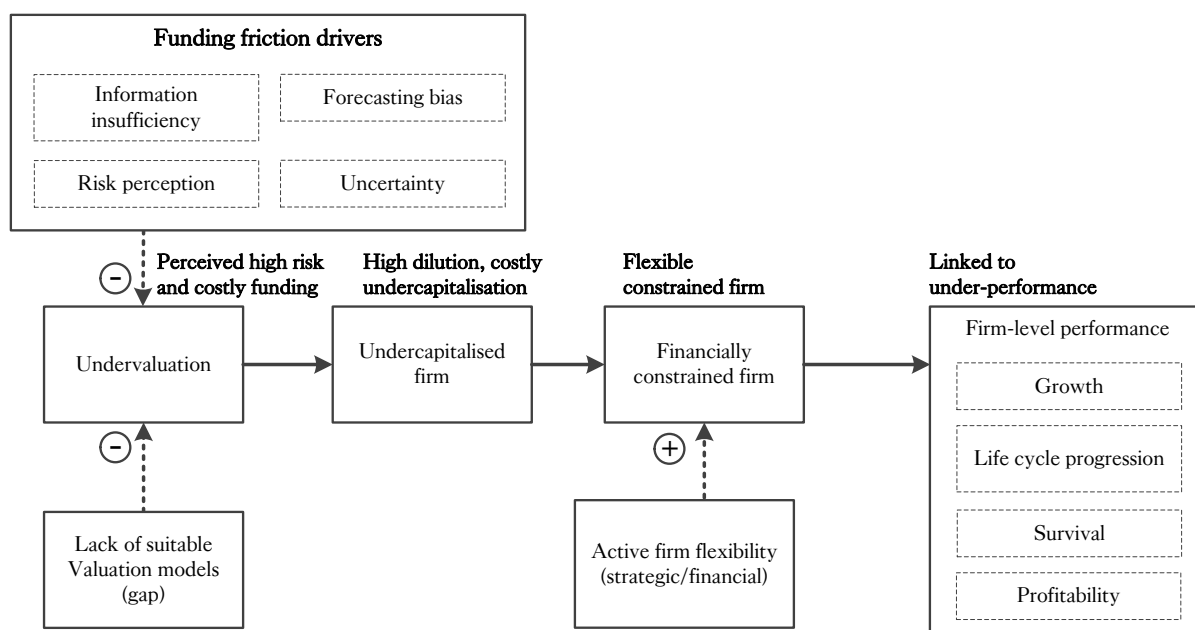


Figure 2.1 – Conceptual map of the research space.

2.9 Review findings, conceptual map and future directions

This section synthesizes open themes and limitations in the literature relevant to improvement of firm valuation and strategic flexibility. It opens with a *succinct summary of issues uncovered in the reviewed literatures* from the perspective of the research question and constructs a conceptual map. It then turns to discuss some important gaps and suggests how future research might contribute to the existing literature by addressing the limitations.

Review findings and conceptual map

The research question for the review is concerned with how valuation of firms with growth prospects at all development stages can be improved and what roles strategic flexibility plays. The findings in the extant literatures, illustrated in Figure 2.1, suggest that friction drivers in the valuation and funding processes of firms with uncertain future options that are more intense in earlier stages of development (e.g. Vara, 2013) combined with a lack of suitable valuation models across all stages of development (e.g. Köhn, 2018; Bell, 2014; Mayhew, 2010; Lopez, 2008; Ge et al., 2005) negatively impacts capitalisation and increase the risks of creating financially constrained firms (e.g. Davila et al., 2012). More specifically, it is found that high investor risk perception fuelled by frictions due to lack of information (e.g. Dusatkova and Zinecker, 2016; Ge et al., 2005), venture complexity (Scott and Scott, 2016), forecasting bias (e.g. Vara, 2013) and their resulting agency effects (Vara, 2013; Akerlof, 1970) contribute to

costly funding (e.g. Willinge and Lerner, 2002) and likely result in venture undercapitalisation (Fazzari et al., 1988). While the literature indicates that friction effects due to information uncertainty are expected to be stronger in early firm stages, it is also reported that effects consistent with information asymmetry tends to become stronger in later stages with greater degree of separation between ownership and control as organisational complexity increase and shareholding becomes more fragmented (Colombo et al., 2023; Iliev and Lowry, 2020). Further, findings in the literature also suggest that strategic flexibility is important and can influence performance of firm-level resource and investment processes as well as positively impact value creation via higher moments in the return distribution (Del Viva et al., 2017; Jia et al., 2017; Milanesi et al., 2015b). In addition, it is proposed that firm-level flexibility is particularly relevant for small, newly formed or financially constrained firms in volatile growth sectors (e.g. Del Viva et al., 2017; Smit and van Vliet, 2001). It has also been proposed that undercapitalised (financially constrained¹⁸) firms are less likely to survive (Cressy, 2006).

On this evidence base, it is reasonable to suggest that the combined (holistic, and complex) relationships between funding friction factors and the lack of suitable valuation approaches are negative related to firm performance outcomes (via mechanisms of undervaluation and undercapitalisation). Moreover, the financial constraint literature reports of links between internal finance, external sources of funding and their impact on real options decision-making via strategic flexibility effects on performance and survival that are suggested more important in early life cycle stages. In addition, internal finance strategies such as Bricolage and Bootstrapping are suggested to have a positive effect on undercapitalisation, while value of real growth options might be negatively impacted for emergent ventures in early or growth stages by inability to access or generate sufficient cash to support the exercise of such options.

Against this background it is proposed that undercapitalised (financially constrained) firms have flexibility, but that this flexibility might mostly be in the protective downwards direction (e.g. limiting investment or divesting capital assets) as the invested capital required for a certain industry or business model (capital structure) might not suffice in order to invest competitively. This is equal to stating that even if management is active and can create a higher firm value from avoiding downsides, they risk running into cash resource limits that reduces investment capability, even in cases where they otherwise could have taken advantage of growth

¹⁸ It follows from the definition that a firm that is undercapitalised to invest at a level to meet its requirements for growth opportunities is constrained financially.

opportunities. Therefore, in order to capture full value of flexibility in a going concern valuation perspective¹⁹ it could be suggested that the median firm needs to be sufficiently capitalised on at least on its peer group industry level.²⁰

Research spaces and future directions

From the position of the research question in this review, and recognising that valuation issues vary across the firm development continuum, four distinct identified limitations in the extant literatures related to real options, firm-level decision-making, strategic flexibility and valuation could provide avenues for future research leading to new contributions and valuation frameworks to addresses frictions and improve firm valuation.

First, from a financial statement literature perspective, evidence of mean reversion in fundamental ratios (Nordal and Næs, 2012; Fama and French, 2000; Fairfield et al., 1996) and normalisation of growth options (e.g. Schwartz and Moon, 2001) are suggested linked to active firm flexibility with a firm's returns becoming more normally distributed over time, reveal gaps in the empirical understanding of how firm-level factors, options and firm flexibility evolve with firm development that could be addressed in future research. This is further supported by evidence on the importance of financial and non-financial information in industry-level variables and that early stage or private firm investigations are scarce (Nordal and Næs, 2012; Suvas, 1996; Osteryoung et al., 1992). In addition, there appear to be no study addressing firm-level factors in new firms in the venture capital investment context.

Second, if flexibility is important in the enterprise value context and linked to firm-level behaviour resulting in non-linear and asymmetric value effects over options, then this value needs to be established ex ante by for example real case evidence in order to increase awareness and further understanding for the importance of firm-level strategic flexibility as a complement to standard mean-variance modelling in the financial statement literature (e.g. Chen et al., 2019). This suggests that there are open directions to further extend the traditional valuation approaches that is also supported by calls for more integrated analysis of real options approaches at the firm-level to examine effects of real options decision-making by taking a real options view of the firm (e.g. Trigeorgis and Reuer, 2017). Moreover, empirical examinations of fundamental higher moments and firm flexibility remains rare, and there appear to be a gap

¹⁹ This study treats firm valuation under going concern assumptions, e.g. a firm is valued as a long-term perpetual investment (e.g. Penman, 2013). Under long-term assumptions all costs are considered as variable.

²⁰ E.g. Nissim and Penman (2001) shows via asset turnover rate (ATO) that levels of capital investment are relatively stable over the longer term, suggesting that investment in support of sales relationship is significant.

in this research in relation to unlisted, new or emergent firms (Del Viva et al., 2017; Jia and Yan, 2016; Grigoletto and Lisi, 2009).

Third, it has been suggested that there might exist a relevant association between firm-level flexibility and firm failure (Suvas, 1996, p.618). It has also been held that firm-level activity and managerial ability are related to life cycle stage progression (Dickinson, 2011, p.1969). In this context the real options literature on constrained firms propose that the assumptions of market completeness underpinning real options theory might be compromised for constrained venture's ability to apply flexibility, yet there appear to be a gap in this literature related to real options decision-making of constrained emergent firms. Taken together, given the importance of firm-level flexibility in emergent firms that are at high risk of being financial constraint, there appears to exist opportunities to extend the knowledge by empirically exploring and testing suggested relationships in new and emergent unlisted firms under financial constraints.

Fourth, a central part of the research problem under investigation relates to that there is an important void in the literature due to the lack of suitable valuation methods for firms with growth prospects (e.g. Zambujal-Oliveira and Serradas, 2014; Festel et al., 2013; Audretsch and Link, 2012; Mayhew, 2010). A particular whitespace within the model gap relates to the need to explore how valuation approaches can be designed in order to alleviate funding frictions and improve negotiations for venture capital or private equity investments rather than merely focus on explanatory power of valuation outcomes (see Köhn, 2018; Dusatkova and Zinecker, 2016). For example, the theoretical framework presented in Del Viva et al. (2017) could provide a real options-based dynamic model of the firm that is linked to the firm's value creation processes. In addition, the real options-map idea presented by Ragozzino et al. (2016) outlines a concept for integrated analysis and codifying of behavioural (real options reasoning-driven) decision-making. These two concepts combined allow researchers to include option-driven decision-flexibility within a dynamic asset model to test and analyse the value relevance of real options decision-making. Schwartz (2013) and also in part Trigeorgis and Reuer (2017, p.59) suggest Monte Carlo Simulation with dynamic programming features as a suitable framework for more complex real options analysis that could incorporate behavioural and managerial aspects. Another potential direction is to investigate whether comparable valuation could be improved and made more suitable in relation to development stage by inclusion of firm life cycle or business model information. Both concepts offer alternative routes to potential contributions, are less dependent historic financial data and suggested to provide

information related to firms' strategic decisions and long-term strategic flexibility over operating assets relevant to firm value creation under uncertainty.

These findings and suggestions derived from the extant literature provide empirical directions for meaningful contributions for future research in order to improve valuation and mitigate the inherent funding and constraint issues for growth-oriented firms at all life cycle stages by recognition and inclusion of value driven by strategic choice and flexibility.

2.10 Concluding remarks

This critical review of literatures related to business valuation and strategic flexibility under the real options lens reveals that the lack of approaches for valuation of emergent and later stage firms are not only due to reported data issues, but also grounded in the need for more research to shed light on how the dynamics of higher moments in firm fundamentals complement and add to the explanation of the value creation processes under uncertainty.

Moreover, the findings also suggest that firm-level flexibility is under-represented in research on fundamental valuation and venture capital investment. In addition to this, if flexibility was better explained, and valuation approaches better integrated active managerial and strategic flexibility, it is argued that this would likely help reducing funding frictions, and consequently such flexibility could not only improve downside protection, but also put firms in a better position to take advantage of upsides and growth opportunities due to sufficient capitalisation. Specifically, and consistent with findings in the extant literature, scarcity of empirical studies is likely a significant contributor to the incomplete understanding of emergent firm valuation.

This paper has indicated open spaces in four direction for research related to firm-level strategic flexibility and firm valuation, including (i) extended empirical analysis to investigate links between active management flexibility, mean reversion and normalisation of options over firms' life, (ii) examination of the relationship between strategic flexibility and firm-level decision-making under the real options view of the firm via fundamental higher moments, (iii) study of real options decision-making under financial constraints, (iv) narrowing the firm valuation gap by for example new simulation approaches based on option maps and strategic decision rules, or via improved comparable valuation by inclusion of implicit strategic choice and flexibility linked to life cycle and business model information.

Appendix 2.A – Journal index

Table 2.A.1 – Journal index of high-tier journals in Finance, Accounting, Business venturing, Strategy and Management (n=58)

Journal	Subject	Abbr.	ABS 2018	ABCD 2016	SJR	DOAJ tick
Abacus	Accounting	AB	3	A	-0.207	
Academy of Management Annals	Management	AMA	4	A*	10.099	
Academy of Management Discoveries	Management	AMD		A		
Academy of Management Journal	Management	AMJ	4*	A*	6.458	
Academy of Management Review	Management	AMR	4*	A*	5.215	
Accounting and Business Research	Accounting	ABR	3	A	0.013	
Accounting, Organizations and Society	Accounting	AOS	4*	A*	1.459	
Administrative Science Quarterly*	Public sector	ASQ	4*	A*	6.133	
American Business Review	Management	ABR		A		
Annals of Actuarial Science	Finance	AAS		A		
Auditing: A Journal of Practice and Theory	Accounting	AU	3	A*	1.069	
British Journal of Management	Management	BJM	4	A	0.497	
Business Ethics Quarterly	Management	BEQ	4	A	1.235	
Contemporary Accounting Research	Accounting	CAR	4	A*	1.809	
Entrepreneurship and Regional Development	Business venturing	ERD	3	A	0.57	
Entrepreneurship: Theory and Practice	Business venturing	ENT	4	A*	3.292	
Financial Analysts Journal	Finance	FAJ	3	A	0.525	
Financial Management	Finance	FM	3	A	-0.119	
Financial Review	Finance	FR	3	A	-0.276	
Harvard Business Review	Management	HBR	3	A	-0.137	
Industrial and Corporate Change	Management	ICC	3	A	1.14	
Industrial Relations: a journal of economy and society	Management	IR	4	A*	0.206	
International Review of Finance	Finance	IRF		A	0.136	
International Small Business Journal	Business venturing	ISBJ	3	A	1.185	
Journal of Accounting and Economics	Accounting	JAE	4*	A*	5.672	
Journal of Accounting Research	Accounting	JAR	4*	A*	4.098	
Journal of Business Venturing	Business venturing	JBV	4	A*	4.243	
Journal of Corporate Finance	Finance	JCF	4	A*	0.141	
Journal of Financial and Quantitative Analysis	Finance	JFQA	4	A*	0.789	
Journal of Financial Economics	Finance	JFE	4*	A*	3.704	
Journal of Financial Intermediation	Finance	JFI	4	A*	0.398	
Journal of International Business Studies	Management	JIBS	4*	A*	6.516	
Journal of Management	Management	JM	4*	A*	3.534	
Journal of Management Studies	Management	JMS	4	A*	2.674	
Journal of Service Research	Management	JSR	4	A*	3.256	
Journal of Small Business Management	Business venturing	JSBM	3	A	0.498	
Journal of World Business	Management	JWB	4	A	2.188	
Long Range Planning	Strategy	LRP	3	A	0.464	
Management Accounting Research	Accounting	MAR	3	A*	0.952	
Management Science	Management	MS	4*	A*	4.525	
R&D Management*	Operations research	RM	3	A		
RAND Journal of Economics*	Economics and econometrics	RJE	4	A*	1.295	

Research Policy*	Social Sciences	RP	4*	A*	3.996	
Review of Accounting Studies	Accounting	RAS	4	A*	1.288	
Review of Finance	Finance	RF	4	A*	0.961	
Review of Quantitative Finance and Accounting	Finance	RQFA	3	B	-0.264	
Small Business Economics: an entrepreneurship journal	Business venturing	SBE	3	A	1.07	
Strategic Entrepreneurship Journal	Business venturing	SEJ	4	A	2.247	
Strategic Management Journal	Management	SMJ	4*	A*	3.191	
Technovation	Innovation	TEC	3	A	1.437	
The Accounting Review	Accounting	TAR	4*	A*	3.48	
The European Accounting Review	Accounting	TEAR	3	A*	0.156	
The Journal of Business	Management	TJB		A*		
The Journal of Finance	Finance	TJF	4*	A*	5.813	
The Leadership Quarterly	Management	TLQ	4	A*		
The Review of Financial Studies	Finance	TRFS	4*	A*	3.731	
The Journal of Entrepreneurial Finance	Management	TJEF				Yes
Journal of Business Valuation and Economic Loss Analysis***	Int. Business	JBVE LA			-0.416	

Notes: *Multi-disciplinary journal that includes subjects such as innovation and strategic management relevant to the study. ** Also ranked in ISI JCR on Business and Management. *** Includes business valuation publications specific to the study. ABS 2018 refers to Chartered Association of Business Schools (CABS) Journal Quality Guides and ABCD 2016 to the Australian Business Deans Council journal quality list. SJR is the SCImago Journal Rank from the Scopus database, Elsevier (avg.5 year, 2010-2014, following method in ABS 2018). DOAJ tick and seal refer to Directory of Open Access Journals (DOAJ) online journal quality marks.

Appendix 2.B – Journal index (including subject rank)

Table 2.B.1 – Journal index (including subject rank) of high-tier journals in Finance (Fin), Accounting (Acc), Business venturing (BV), Strategy and Management (StratM) (n=58)

Journal	Subject	Abbr.	ABS 2018	ABCD 2016	SJR	DOAJ tick	Subject rank****			
							BV	StratM	Fin	Acc
Abacus	Accounting	AB	3	A	-0.207					10
Academy of Management Annals	Management	AMA	4	A*	10.099					
Academy of Management Discoveries	Management	AMD		A						
Academy of Management Journal	Management	AMJ	4*	A*	6.458		1	1		
Academy of Management Review	Management	AMR	4*	A*	5.215		2	2		
Accounting and Business Research	Accounting	ABR	3	A	0.013					11
Accounting, Organizations and Society	Accounting	AOS	4*	A*	1.459					1
Administrative Science Quarterly*	Public sector	ASQ	4*	A*	6.133			3		
American Business Review	Management	ABR		A						
Annals of Actuarial Science	Finance	AAS		A						
Auditing: A Journal of Practice and Theory	Accounting	AU	3	A*	1.069					7
British Journal of Management	Management	BJM	4	A	0.497					
Business Ethics Quarterly	Management	BEQ	4	A	1.235					
Contemporary Accounting Research	Accounting	CAR	4	A*	1.809					5
Entrepreneurship and Regional Development	Business venturing	ERD	3	A	0.57		12			
Entrepreneurship: Theory and Practice	Business venturing	ENT	4	A*	3.292		5	9		
Financial Analysts Journal	Finance	FAJ	3	A	0.525				9	
Financial Management	Finance	FM	3	A	-0.119				10	
Financial Review	Finance	FR	3	A	-0.276				11	
Harvard Business Review	Management	HBR	3	A	-0.137			11		
Industrial and Corporate Change	Management	ICC	3	A	1.14		10			
Industrial Relations: a journal of economy and society	Management	IR	4	A*	0.206					
International Review of Finance	Finance	IRF		A	0.136					
International Small Business Journal	Business venturing	ISBJ	3	A	1.185		9			
Journal of Accounting and Economics	Accounting	JAE	4*	A*	5.672					2
Journal of Accounting Research	Accounting	JAR	4*	A*	4.098					3
Journal of Business Venturing	Business venturing	JBV	4	A*	4.243		3	8		
Journal of Corporate Finance	Finance	JCF	4	A*	0.141				5	
Journal of Financial and Quantitative Analysis	Finance	JFQA	4	A*	0.789				4	

Journal of Financial Economics	Finance	JFE	4*	A*	3.704		2
Journal of Financial Intermediation	Finance	JFI	4	A*	0.398		7
Journal of International Business Studies	Management	JIBS	4*	A*	6.516	7	
Journal of Management	Management	JM	4*	A*	3.534	6	
Journal of Management Studies	Management	JMS	4	A*	2.674		
Journal of Service Research	Management	JSR	4	A*	3.256		
Journal of Small Business Management	Business venturing	JSBM	3	A	0.498	13	
Journal of World Business	Management	JWB	4	A	2.188		
Long Range Planning	Strategy	LRP	3	A	0.464	12	
Management Accounting Research	Accounting	MAR	3	A*	0.952		8
Management Science	Management	MS	4*	A*	4.525	5	
R&D Management*	Operations research	RM	3	A		13	
RAND Journal of Economics*	Economics and econometrics	RJE	4	A*	1.295	10	
Research Policy*	Social Sciences	RP	4*	A*	3.996	4	
Review of Accounting Studies	Accounting	RAS	4	A*	1.288		6
Review of Finance	Finance	RF	4	A*	0.961		6
Review of Quantitative Finance and Accounting	Finance	RQFA	3	B	-0.264		
Small Business Economics: an entrepreneurship journal	Business venturing	SBE	3	A	1.07	11	
Strategic Entrepreneurship Journal	Business venturing	SEJ	4	A	2.247	7	
Strategic Management Journal	Management	SMJ	4*	A*	3.191	6	4
Technovation	Innovation	TEC	3	A	1.437	8	
The Accounting Review	Accounting	TAR	4*	A*	3.48		4
The European Accounting Review	Accounting	TEAR	3	A*	0.156		9
The Journal of Business	Management	TJB		A*			
The Journal of Finance	Finance	TJF	4*	A*	5.813		1
The Leadership Quarterly	Management	TLQ	4	A*			
The Review of Financial Studies	Finance	TRFS	4*	A*	3.731		3
The Journal of Entrepreneurial Finance	Management	TJEF				Yes	15
Journal of Business Valuation and Economic Loss Analysis***	Int. Business	JBVELA			-0.416	14	

Notes: *Multi-disciplinary journal that includes subjects such as innovation and strategic management relevant to the study. ** Also ranked in ISI JCR on Business and Management. *** Includes business valuation publications specific to the study. **** The subject rank is by journal impact and subject. ABS 2018 refers to Chartered Association of Business Schools (CABS) Journal Quality Guides and ABCD 2016 to the Australian Business Deans Council journal quality list. SJR is the SCImago Journal Rank from the Scopus database, Elsevier (avg.5 year, 2010-2014, following method in ABS 2018). DOAJ tick and seal refer to Directory of Open Access Journals (DOAJ) online journal quality marks.

Appendix 2.C – Selected papers by literature subject

Table 2.C.1 – Selected papers (journal, working and conference) by literature subject (n=157)

Subject	Obs.	Studies
<i>Finance</i>	63	Gompers et al. (2020), Gornall and Strebulaev (2020), Iliev and Lowry (2020), Kim and Ritter (1999), Lee (2017), Jia et al. (2017), Del Viva et al. (2017), Lambrecht (2017), Greene (2017), Scott and Scott (2016), Kim and Wagman (2016), Jia and Yan (2016), Farre-Mensa and Ljungqvist (2016), Flynn (2016), Erel et al. (2015), Bell (2014), Kotova (2014), Renner et al. (2014), Trigeorgis and Lambertides (2014), Trigeorgis (2014), Moscoso Escobar and Botero Botero (2013), Trigeorgis and Ioulianou (2013), Del Viva et al. (2013), Schwartz (2013), Grullon et al. (2012), Nordal and Næs (2012), Wang et al. (2012), Stepanyan (2012), Chen and Lin (2011), Saunders and Steffen (2011), Denis (2011), Ramezani (2011), Coad (2010), Hadlock and Pierce (2010), Huynh et al. (2010), Denis and Sibilkov (2010), Goldenberg and Goldenberg (2009), Grigoletto and Lisi (2009), Ayyagari et al. (2008), Musso and Schiavo (2008), Saridakis et al. (2008), Canepa and Stoneman (2008), Almeida and Campello (2007), Kapadia (2006), Whited and Wu (2006), Denis (2004), Dittmann et al. (2004), León and Piñeiro (2004), Botteron and Casanova (2003), Boyle and Guthrie (2003), Carpenter and Petersen (2002), Smit and Vliet (2001), Schwartz and Moon (2001), Mello and Parsons (2000), Kaplan and Zingales (1997), Cressy (1996), Duffee (1995), Schwartz (1994), Fazzari and Petersen (1993), Dixit (1989), Fazzari et al. (1988), Sahlman and Scherlis (1987), Stiglitz and Weiss (1981)
<i>Strategy and Management</i>	42	Herhausen et al. (2021), Claussen et al. (2018), Seppä and Laamanen (2001), Ipsmiller et al. (2019), Köhn (2018), Trigeorgis and Reuer (2017), Dusatkova and Zinecker (2016), Luo et al. (2016), Lukas et al. (2016), Ragozzino et al. (2016), Milanesi et al. (2015a), Milanesi et al. (2015b), Stucki (2014), Yang et al. (2014), Vara (2013), Festel et al. (2013), Almeida et al. (2013), Driouchi and Bennett (2012), Stankevičienė and Žinytė (2011), Benoit et al. (2011), Salimath and Jones (2011), Dimov (2010), Teece (2010), Kerr and Nanda (2009), Barnett (2008), Savignac (2008), Athanassakos (2007), Garnsey et al. (2006), Achleitner and Lutz (2005), Banerjee (2003), Buckley et al. (2002), Sarasvathy (2001), Faugère and Shawky (2000), Gompers and Lerner (1999), Luehrman (1998), Kulatilaka and Perotti (1998), Luehrman (1997), Sanchez (1997), Bowman and Hurry (1993), Kester (1984), Hertz (1964), Magee (1964)
<i>Business venturing</i>	26	Colombo et al. (2023), Dubard Barbosa et al. (2019), La Rocca et al. (2019), Ponikvar et al. (2018), Wamba et al. (2017), Hechavarria et al. (2016), Rostamkalaei and Freel (2016), Fraser et al. (2015), Cassar (2014), Hyttinen et al. (2014), Fraser et al. (2013), Saridakis et al. (2013), Miloud et al. (2012), Atherton (2012), Audretsch and Link (2012), Gavius and Schwartz (2011), Lopez (2008), Goldman (2008), Hartmann-Wendels et al. (2008), Steffens and Douglas (2007), Cressy (2006), Ge et al. (2005), Black (2003), Becchetti and Trovato (2002), Houlihan Valuation Advisors (1998), Osteryoung et al. (1992)
<i>Accounting</i>	22	Hiemann (2020), Chen et al. (2019), Ho et al. (2017), Herath et al. (2015), Chang et al. (2012), Jorgensen et al. (2011), Alford (1992), Dierynck and Verriest (2020), Drake and Martin (2020), Vorst and Yohn (2018), Anderson et al. (2017), Schootbrugge and Wong (2013), Milanesi et al. (2013), Davila et al. (2012), Dickinson (2011), Penman (2010), Damodaran (2009), Hand (2003), Nissim and Penman (2001), Robbie and Wright (1997), Suvas (1996), Anthony and Ramesh (1992)
<i>Other</i>	4	Sammur (2012), Bertoni et al. (2011), Mayhew (2010), Baker and Nelson (2005)

3. Strategic Peers:

Strategic choice and business model comparability in peer selection

Abstract

This paper proposes a new peer selection approach based on *strategic similarity* to form *strategic peers* that extends from prior research in business model and strategic group literatures. The study is motivated by findings of intra-industry heterogeneity and reported inconsistencies associated with contemporary industry-centred approaches to peer firm formation and importance of peer selection to firm valuation. *Strategic peers* are operationalised and explored through fundamental strategic dimensions linked to business models using economy-wide deciles and a sum of absolute rank differences (SARD) approach to fundamental similarity. The empirical results confirm *strategic similarity* as a viable peer selection approach that provides not only generally higher levels of homogeneity in returns and fundamental ratios, lower median intra-peer-group variance over industry or life-cycle based peers, but also comparable valuation accuracy and an overall improvement over common multidimensional approaches such as the Warranted Multiple. The opportunity to group firms based on their business models also offer a new route to comparable valuation of new firms with limited financial history. Beyond its contribution to the peer selection literature, this paper also adds to the debate in the business model and strategic group literatures by theoretically showing that business models and strategic groups are closely related concepts, and by suggesting business models as one possible route to furthering and extending strategic group research.

3.1 Introduction

This paper argues that firms operating similar business models within or across industries or markets can be considered peers based on strategic similarity – *strategic peers*.

Peer selection is important for identifying and grouping *economically comparable firms* (or *peers*)²¹ for purposes such as valuation or performance benchmarking across academic fields and in practice by analysts (Ding et al., 2019; Ross et al., 2019; De Franco et al., 2015; Young and Zeng, 2015). The principal approaches in the peer selection literature are based on industry classes in combination with additional factors (e.g. Bhojraj and Lee, 2002; Liu et al., 2002; Kim and Ritter, 1999; Alford, 1992; Boatsman and Baskin, 1981). However, the literature reports of intra-industry heterogeneity and inconsistencies between industry classification schemes (e.g. Bhojraj et al., 2003), and find that these also are slow to recognise change or include new industries (Ding et al., 2019; Thomas and Pollock, 1999; Clarke, 1989). Such limitations have led to appeals for further research into alternative approaches to selection of peer firms (e.g. De Franco et al., 2011; Albuquerque, 2009).

In seeking to address the limitations related to the industry-centred approaches, one strand of papers is considering strategies to identify economically related firms using new text and search-based methods independently of or combined with industry or financial information (e.g. Ding et al., 2019; Hoberg and Phillips, 2016; Lee et al., 2015). Another set of studies examine peer selection efficacy and economic relatedness of firms grouped using multiple dimensions of performance across the economy or anchored within industry contexts (e.g. Knudsen et al., 2017; Bhojraj and Lee, 2002). Among new directions to improve peer selection, studies have started to recognise and argue the usefulness of firm development stage to capture firm relatedness in variation of economic fundamentals across firm life cycle stages (Cantrell and Dickinson, 2020; Drake and Martin, 2020; Vorst and Yohn, 2018). In addition to these initiatives, an emergent strand of papers investigates the role of accounting and financial statement comparability (*accounting similarity*) in the peer selection setting (e.g. Dierynck and Verriest, 2020; Ross et al., 2019; Young and Zeng, 2015; De Franco et al., 2011). These studies argue that accounting comparability, driven by exogenous regulation and firms' decisions over their accounting processes, provides *a second dimension of firm similarity* which is complementary to economic comparability that derives relatedness through commonalities of economic events and shocks in markets and industries (e.g. Young and Zeng, 2015).

Furthermore, other papers argue that firm's choice of *business model* provides a differentiator and conceptualisation of *strategic choice* that commonly features in the financial analyst

²¹ In this paper the terms *peers* and *comparable firms* are used interchangeably with the same meaning. While the traditional literature commonly referred to comparable firms (e.g. Alford, 1992), more recent studies use the expression peer firms (e.g. Lee et al., 2015), or as in this paper both terms equally (e.g. Knudsen et al., 2017).

literature, but has not yet been considered in a wider peer firm selection setting (e.g. Dierynck and Verriest, 2020; Drake and Martin, 2020; Kaustia and Rantala, 2019; Mercer, 2009), and additionally, a number of studies in the literatures claim that business models and strategic groups are related concepts (e.g. Badunenko et al., 2021; Marques and Alves, 2021; Mascarenhas and Mascarenhas, 2019; Dewitte, 2017; Amezcua and Ratinho, 2012; Porac et al., 2011). However, this association and whether these concepts can be useful for identification of peers remain unexplored in the literature. Moreover, studies suggest that firms' strategic choices and their business models vary with firm development stage, and that firms in same life cycle stages appear economically related (Cantrell and Dickinson, 2020; Drake and Martin, 2020; Vorst and Yohn, 2018; Olsen and Kolvereid, 1994).

Motivated by the importance of peer selection to valuation and observing that both firms' accounting decisions and strategic choices are examples of *firm conduct*, this paper examines peer selection under a strategic management lens to map conceptual relationships of firm comparability and explore the prospect of a new approach to peer selection based on strategic choice conceptualised through business model dimensions. Taking this perspective, and extending from the theoretical proposition claiming importance of business model relatedness to performance similarity in the accounting comparability literature (e.g. De Franco et al., 2015, p.89), leads the paper to argue that, all else equal, comparability in terms of firms' performance not only depends on underlying relatedness of economic events (*economic similarity*), or on similarity of their accounting decisions (*accounting similarity*), but also on similarity of their strategic choices (*strategic similarity*). Moreover, since the literature proposes that selection of business models are outcomes of strategic choice (e.g. Badunenko et al., 2021), and that firms with related business models are following similar strategies (e.g. Lanzolla and Markides, 2021; Morris et al., 2013), it follows that *a third dimension of firm similarity* could be provided through strategic similarity operationalised under dimensions of business model relatedness.

Hence, as studies suggest that firms' patterns of strategies and operations associated with business models could be captured through financial statement variables (De Franco et al., 2011; Yang et al., 2019) and given the implied relatedness between business models and strategic groups, this paper investigates the efficacy of a novel peer selection approach based on strategic similarity – strategic peers – operationalised by exploring peer forming on strategic group and business model dimensions within and across firm life cycle stages and industry boundaries, driven by the two research questions: *How related are the strategic group and*

business model concepts, and to what extent is strategic similarity through business model dimensions a viable approach to peer selection.

The paper has the following objectives. First, in applying a strategic management extended structure–conduct–performance (SCP) framework to analysis of peer selection literatures, it provides a wider theoretical justification for selection of similar firms on the basis of strategic choice. Second, it develops theory for a useful definition of strategic peers by drawing together the literatures on strategic groups and business models, answers the question of relatedness between the concepts, and shows how strategic dimensions can be mapped into business model elements to provide an operationalised model for firm strategy. Third, it tests general efficacy for strategic peers following a number of hypotheses to assess incremental performance of the proposed approach when compared to contextually selected peers primarily using group homogeneity tests and complemented by intra-group variance tests. Fourth, given the importance of peer selection to multiples-based valuations, it explores how strategic peers performs in multiple valuation in terms of both efficacy and valuation accuracy when compared to established multivariate peer selection approaches.

The research design to assess the efficacy of the strategic peer approach follows Bhojraj et al. (2003) and examines the ability for the new approach to provide groups on homogeneity in a number of hypotheses across explanatory variables such as market returns, valuation multiples, common fundamental ratios and growth indicators compared to peers formed in industry, in firm life-cycle stages or combined industry-firm-life cycle contexts. In addition, as low variation in explanatory variables within the peer group is also a preference in research, the paper complements the main homogeneity tests with an analysis of intra-peer-group variance developed by Guenther and Rosman (1994). Since relative valuation using market-based multiples is an important application for peer selection, the paper also explores the valuation accuracy performance in comparison to a recent SARD-based (*SARD_KN*) method (Knudsen et al., 2017), and the warranted multiple (*WARR*) approach (Bhojraj and Lee, 2002).

In these tests, strategic peers under business model dimensions are operationalised based on findings in the literature as a univariate model on deciles of business model leanness (*BMQ*) proxied by asset-turnover, and as a multivariate sum of absolute rank differences (*SARD_BM*) model that apart from business model leanness additionally applies further four strategic dimensions identified in the literature and associated with business model concepts. As in prior studies the tests are conducted in a large sample of US listed firms. The final sample consists

of 3 437 firms with annual financial statements from COMPUSTAT and monthly market returns from CRSP for the period 2007 – 2016. Analyses in the paper are based on annual peer selection performance and average overall results in the explanatory variables.

The findings in the main tests support most of the hypotheses posed, and confirms that peer groups formed on strategic business model dimensions, both as univariate and multivariate models, offer a consistent improvement in both homogeneity and intra-peer-group variance over peer selection based on any combination of industry or firm-life cycle. Specifically, it is found that the multivariate *SARD_BM* approach provides the strongest overall performance when peers are formed in the economy-wide context, and the univariate *BMQ* method when peers are grouped in the combined industry-life-cycle context. Furthermore, the valuation performance of strategic peers is providing comparable or marginally higher valuation accuracy compared to both *WARR* and *SARD_KN* for most of the valuation multiples and the highest overall accuracy. An interesting result is that the *BMQ* peer method despite its simplicity appears to offer a surprisingly high valuation accuracy when formed within the combined industry-firm-life-cycle context. Another compelling observation is that firm-life cycle stages as peer forming method yields lower heterogeneity and higher intra-peer-group variance than naïve industry peer grouping on its own. However, the results also propose, consistent with prior studies (e.g. Vorst and Yohn, 2018) that firm-life-cycle offer an incremental explanatory effect when firms are formed in the combined industry-firm-life-cycle context. Overall, these findings suggest that strategic peers provide a viable approach to identification of economically related firms.

This paper makes a number of contributions to the strategic group, business model and peer selection literatures. First, it demonstrates theoretically that business models are sufficiently related to strategic groups, and contributes to these literatures both by showing that business models are a possible route to strategic group membership identification, and more importantly by arguing that firms with similar business models could be perceived as peers on strategic similarity – *strategic peers*. Second, the paper contributes by providing a large-scale test of peer selection approaches using multiple-tests in assessment of efficacy of these methods, including testing firm life-cycle stage as an independent and interacting contextual element in peer selection that appears to best knowledge have not been investigated prior to this study. This includes the contributing finding that use of firm life-stages might not be effective as independent peer selection approach. Third, and a central contribution of this paper, is the results that support *strategic peers* as a viable alternative approach to peer group forming, and

one that performs at a comparable level of other published value-driven SARD and warranted multiple regression peer selection methods. This specifically applies to the firm-centric *SARD_BM* approach that also appears to exhibit degrees of independence from industry or life-cycle stage contexts.

The paper is structured as follows. Section 3.2 to 3.4 develops the argument for peers on strategic choice via business model similarity under the strategic management lens and discusses the theory through the relevant literatures. Section 3.5 defines strategic peers, identify proxies of business model characteristics and provide empirical models for testing of strategic peers under fundamental dimensions of business model comparability. Section 3.6 develops hypotheses. Section 3.7 describes the research design, methods and data. Section 3.8 presents the results. Section 3.9 undertakes some other tests, and section 3.10 concludes.

3.2 Peer firm selection

In a broad sense, peer firms (or comparable firms) are defined as related firms that share similar economic characteristics in the form of dimensions useful for grouping them for the purpose of e.g. performance comparison (benchmarking) or valuation (see Ding et al., 2019; Ross et al., 2019; De Franco et al., 2015; Young and Zeng, 2015). The literature is concerned with peer selection for a variety of applications, such as performance compensation comparability (Drake and Martin, 2020; Du and Shen, 2018; Francis et al., 2016; Albuquerque, 2009), reporting disclosure strategy (Tuo et al., 2020), accounting comparability (e.g. Dierynck and Verriest, 2020; Ross et al., 2019; Young and Zeng, 2015; De Franco et al., 2011) and relative valuation for which peer selection is critical to forming groups of economically comparable firms (i.e. Eaton et al., 2022; Knudsen et al., 2017; Liu et al., 2002, 2007; Bhojraj and Lee, 2002; Kim and Ritter, 1999; Alford, 1992; Boatsman and Baskin, 1981).

The industry approach and its limitations

The traditional approach to peer selection with origins in industrial organisation (IO) separates firms into groups based on *industry membership* as a first order of firm relatedness with addition of further dimensions of economic similarity²². For example, Boatsman and Baskin

²² Economic similarity is broadly defined in the literature as firms' being related on fundamental characteristics that drives and explains value-creation, such as risk, growth options, size, industry membership, performance of operations, or financing constraints (Albuquerque, 2009; Dierynck and Verriest, 2020). Underlying such factors is the tacit IO assumption that economically comparable firms are also defined by their environmental relatedness in face of and in response to shared exogenous economic events (e.g. De Franco et al., 2011).

(1981) considered growth rate within industries, Alford (1992) identified industry-peers based on risk and growth, Fama and French (1997) reclassified SIC codes into 48 industry groups with increased similarity in risk characteristics, and Albuquerque (2009) argued the importance of firm size in industry peer selection. However, despite the popularity among researchers, practitioners and analysts²³, the efficacy of the industry approach is hampered by limitations.

Intra-industry heterogeneity

A first limitation is linked to issues with heterogeneity within industrial contexts.

The industry approach assumes that firms within industries are related by a high degree of *homogeneity* in their output (products or services), underlying economic characteristics, and that performance of these firms' are similarly affected by *economic events and market shocks* (e.g. Li, 2017; Jennings et al., 2020; Yang et al., 2019). Hence, as the first condition of intra-industry homogeneity requires that all firms aside from their sizes²⁴, are sufficiently economically similar. However, reports of *mid-level industry concepts* such as strategic groups suggest that firms within industries might be able to differentiate themselves groupwise by their similarity on strategic related dimensions, while being distinctly economically different from other firms challenges the notion of intra-industry homogeneity (Hoskisson et al., 1999). Further, evidence of *product differentiation* driving change in competition dynamics and increased variation in degree of specialization within industries is also expected to contribute to heterogeneity (Hoberg and Phillips, 2016). Moreover, the literature suggests that *government policy* could affect the market conditions within and across industries adding to industry heterogeneity (e.g. Porter, 1980). The IO theory underlying economic similarity also relies on that all firms in the same environmental context are experiencing common economic shocks, and that these shocks also drive similarities in firm performance (Du and Shen, 2018). However, if firms within such contexts are impacted or react differently to economic shocks, the likely outcome is also heterogeneity in performance. In fact, the literature provides evidence of intra-industry heterogeneity driven by variation in how firms are impacted by economic events. For example, firms in *strategic groups* are argued to be more likely to respond to changes in industry conditions and economic news in similar ways (see DeSarbo et al., 2009; Nair and Filer, 2003). In addition, a growing number of studies maintain that firms in similar *life cycle stages* are also more likely to experience and be impacted by similar shocks (e.g.

²³ Prior studies find that over 90% of analyst-selected peers are derived on industry basis (De Franco et al., 2011).

²⁴ It is a finding consistent within traditional IO theory that firms of different sizes in industries are related both by common shocks and their constraints to react to such economic events (see i.e.. Albuquerque, 2009).

Vorst and Yohn, 2018; Drake and Martin, 2020; Dickinson, 2011; Anthony and Ramesh, 1992).

Industry classification inconsistencies

Another limitation of the industry approach is related to reported issues regarding inconsistencies of classifications schemes. As industry classification schemes (being based on firms' product or service offerings)²⁵ are found to be slow in identification of new industries and reclassifying firms, it has been suggested that such rigidity could lead to misrepresentation (Ding et al., 2019; Thomas and Pollock, 1999; Clarke, 1989). Also, the dominating use of COMPUSTAT reported industry classifications such as SIC in research papers is argued a risk due to that a single data source could result in biased findings, particularly since studies have reported such differences between CRSP and COMPUSTAT (e.g. Cattani et al., 2017; Weiner, 2005; Guenther and Rosman, 1994). In addition, studies report variation among different classification systems such as Fama and French (1997), NAICS, SIC and GICS (e.g. Bhojraj et al., 2003)²⁶.

The combined evidence of intra-industry heterogeneity and inconsistencies associated with industry classification schemes has led to calls for alternative theories of peer group selection and new approaches to improve economic relatedness useful for research studies and practical applications (e.g. De Franco et al., 2011, p.927; Albuquerque, 2009, p.86).

Alternative approaches to peer selection

Multivariate fundamental performance methods

In light of these limitations, one strand of research has turned from industry membership as primary source of firm relatedness and towards peer selection based on multiple dimensions of firm performance to target firm relatedness directly via drivers of interest (e.g. valuation multiples) across the economy or combined with industry information. In one of the most influential papers in this literature, Bhojraj and Lee (2002) propose a warranted multiple peer method based on regression of fundamental valuation characteristics anchored into industries that achieves distinct improvement over industry-selected peers. One of the most recent

²⁵ In this paper the terms industries and product-markets are treated as interchangeable.

²⁶ Bhojraj et al. (2003) find that GICS explains cross-sectional variations in valuation multiples and stock return co-movements better compared to other industry classification schemes tested. They suggest that their result depend in part on that GICS is financially oriented and more significant in explaining financial ratios, and partly on that firms in the system is manually selected by financial specialists (Weiner, 2005).

methodical additions to this literature is the sum of absolute rank differences (SARD) approach that derives peer firms within and across industries based on multiple dimensions of performance similarity (Knudsen et al., 2017). The authors claim the SARD approach offers higher explanatory power and simpler implementation of economic relatedness compared to the regression-based warranted multiple approach.

Novel text and search-based approaches

In other streams of the literature, researchers are considering alternative approaches to identify economically related firms using new text and search-based approaches. For example, Hoberg and Phillips (2010, 2016) argue for product-market as peer basis and propose the text-based network industry classification (TNIC) system derived from analysis of product descriptions in the 10-K filings, Lee et al. (2015) consider big-data approaches in peer firm selection by comparing product-market and industry-based so called Wisdom-of-Crowd schemes, Ding et al. (2019) develop a K-medians clustering algorithm for peer firm selection, and Yang et al. (2019) explore financial reporting pattern as approach to industry group identification.

New developments in peer selection

Firm life cycle relatedness

Among new the directions in peer selection research, one strand has started to recognise the usefulness of firm development stage as a financial statement measure associated with firm comparability. Vorst and Yohn (2018) show that life cycle models offer improvement over economy-wide and industry-specific models and argue that firm life cycle (FLC) is able to capture important firm-specific characteristics. Their results are reported as most significant for firms in stages with higher degree of uncertainty such as introduction or decline. Prior literature supports arguments for considering firm life cycle in assessment of industry comparability, by empirically evidencing that firms might transcend between industries over time (Hoberg and Phillips, 2016), and by suggesting that firms within industries are likely to develop at different rates (Cantrell and Dickinson, 2020). Drake and Martin (2020) provide some empirical evidence that supports arguments for the viability of firm life cycle as peer mechanism in order to capture common economic shocks.

Accounting decisions and financial statement similarity

An emerging strand of papers focus on the role of accounting and financial statement similarity in the peer selection setting (e.g. Dierynck and Verriest, 2020; Ross et al., 2019; Young and

Zeng, 2015; De Franco et al., 2011). Studies in this strand have explored opportunities for multidimensional financial statement measures of comparability and also consider further dimensions such as accounting practices and accounting quality (see Young and Zeng, 2015). These studies not only suggest that variation in accounting standard regulations (GAAP²⁷) are likely to affect firms' financial statements (Ross et al., 2019), but more specifically, argue that firms decisions over implementation of accounting processes and policies, including reporting choices constitutes a *second dimension of firm comparability*²⁸ beyond economic similarity (see Young and Zeng, 2015; De Franco et al., 2011). From a peer selection viewpoint, this argument proposes that any two firms are comparable, given the same economic events, if their accounting decisions and conduct are also similar resulting in comparable financial reporting outcomes.

Business models and the role of strategic choice

Furthermore, prior research suggests that aside from economic relatedness due to industry membership and accounting comparability, similarity of firms' business activities could be considered a dimension of firm relatedness from a peer selection perspective (De Franco et al., 2008a). Accordingly, though it remains an open avenue for research, a number of studies and reports emphasize business model as an important aspect in selection of economically related firms (e.g. Dierynck and Verriest, 2020; Drake and Martin, 2020; De Franco et al., 2008b; Mercer, 2009). Besides, other articles highlight that analysts and experts routinely include business models in their assessment of firm relatedness (De Franco et al., 2011; Ding et al., 2019; Kaustia and Rantala, 2019) and that analysts select peers producing more homogenous groups of firms compared those formed on industry basis alone (Kaustia and Rantala, 2019). In these and further papers, it is also argued that firms' patterns of strategies and operations associated with business models are reflected as measurable variation in financial statement variables (see De Franco et al., 2015; Yang et al., 2019; De Franco et al., 2011). Additionally, common financial statement textbooks and prior research papers suggest that business models are conceptualisations of firms' strategic choices that evolve with changes in strategy, and important determinants of firm value. For example, Penman (2013) argues that that firms' changes in strategic choice amounts to an overall evolving strategy, and that business models are the concepts to strategy under which firms' operate in product markets. Along the same

²⁷ Generally Accepted Accounting Principles (GAAP).

²⁸ Young and Zeng (2015) propose two dimensions of firm comparability. The first dimension being economic characteristics similarity, and the second representing similarity of firms accounting and reporting decisions.

lines, Badunenko et al. (2021) describe business models as representations of firms' fundamental core logic and strategic choices as an explanation for how firms' create value. These authors, consistent with other scholars (e.g. Mergaerts and Vander Venet, 2016; Dewitte, 2017; Amezcua and Ratinho, 2012), suggest that business models and strategic groups are closely related concepts. In addition, researchers investigating business models agree that selection of business model is a strategic choice (e.g. Badunenko et al., 2021), and that firms with similar business models are following similar strategies (e.g. Lanzolla and Markides, 2021; Morris et al., 2013). It is also suggested that firms' strategies and business models are expected to follow firms' life cycle stages (Drake and Martin, 2020).

Taken together, the relationship between business models and strategic choice implies a *third possible dimension of firm comparability* based on patterns of relatedness in firms' conduct over strategic choices – *strategic similarity* – conceptualised within business models. The literature also seems to suggest that both firms' accounting decisions and strategic choices appear to be examples of firm conduct independent of industrial contexts. This motivates the paper to explore the theoretical support for strategic similarity as dimension for grouping related firms by examining peer selection under a strategic management lens.

Peer selection under the strategic management lens

The structure–conduct–performance (*SCP*) model introduced by Bain following Mason (Mason, 1939; Bain, 1956), and later extended in line with strategic management views by contributions of Porter (1981) and others (see Scherer and Ross, 1990; Carlton and Perloff, 2000) to include public policy and government regulation into an expanded structure–conduct–performance–regulatory model (*SCP-R*)²⁹, provides a theoretical framework helpful to explain and justify why firms' conduct in general, and strategic choices in particular, are likely to play important roles for firm comparability and peer selection.

The application of the extended model in this context also serves as a contribution to the peer literature debate by addressing the limitation in theoretical motivation (see Dittmann and Weiner, 2005; Cooper and Lambertides, 2014; Ding et al., 2019)³⁰ while adding structure to the central position developed in this paper and mapping the concepts of firm similarity.

²⁹ Adding the regulation (government regulation) term to the *SCP* model and forming *SCP-R* in this paper is made to distinguish the traditional IO view from the strategic management perspective.

³⁰ These papers recognise that while applications involving comparable firms are well developed in the literature, there is only limited contributions to theoretical guidance and motivation for *how peer firms should be selected*.

The analysis is based on observations from the literature, and structured around the main elements of the *SCP-R* model adapted for peer selection – *Economic contexts*, *Firm performance* and *Firm behavioural conduct*.

***Economic contexts*³¹(Contextual similarity)**

The traditional *SCP* paradigm takes the view that all firms in the same industrial contexts are largely economically similar with exception of their sizes³². This view relies on assumptions of intra-industry homogeneity that also upholds the conduct-irrelevance argument, wherein firms' actions are ignored as structural economic similarity is expected to determine individual firm conduct and therefore resulting performance (Porter, 1981; Thomas and Pollock, 1999). However, as was uncovered in the peer literature, a large body of research provides evidence to the contrary, and contends that firms within industry contexts are structurally different in other ways than size. For example, firms appear at least to be separable by strategic group membership (*SG*), business model (*BM*) or firm life stage (*FLC*).

The strategic management perspective provides an explanation, suggesting that firms are able of influencing structures and conditions underlying their industries through feedback using strategic actions (Porter, 1981), and more specifically, differentiate themselves within these contexts based on their *strategic choice* as strategic groups (Short et al., 2008) conceptualised through their *business models* (Badunenko et al., 2021). Hence, these categories provide *mid-level* economic contexts suitable for strategic similarity analysis (Porac et al., 2011). Furthermore, studies also link firms' choice of strategy to firm stage of development (Olsen and Kolvereid, 1994; Dickinson, 2011) and argue that firms in the same life cycle stage are economically similar (Vorst and Yohn, 2018). In addition, while industry is a primary a context of competition from a strategic perspective, research also suggests that economic similarity can exist across industry boundaries (Li, 2017). Hence, motivated by prior studies use of inter-industry peer selection (see Alford, 1992; Bhojraj and Lee, 2002; Knudsen et al., 2017) it is justified to include the economy-wide (*EW*) context into a more general perspective of *economic contexts* for peer selection, wherein firms could be economically related by industry membership (*IND*), mid-level market concept (*SG* or *BM*) or life cycle stage (*FLC*). In brief, the above indicates that heterogeneity within economical contexts at least in part should be

³¹ For the purpose of this study “economic contexts” are defined as a general form for economic settings wherein firms are expected to be exposed to similar economic events, e.g. industries. Relatedness in underlying economic events is central to firm economic comparability.

³² The size differentiation under *SCP* also coincides with the findings of Albuquerque (2009).

explained by factors that are related to firms' strategies, and it is therefore reasonable to assume that peers selected within economic contexts (*Contextual peers*) that also control for strategic choice via business models could provide incremental increase in firm comparability.

Firm performance (Performance similarity)

Performance³³ in the peer literature is frequently measured across *fundamental* variables such as *ratios*, *growth* or using *market performance indicators* such as returns, or alternatively combining market and fundamental information via *multiples* (e.g. P/E or P/B) used in peer selection for relative valuation. The traditional IO view treat performance as a deterministic consequence of cross-sectional economic similarity in the industries and markets, where firms' own strategic actions are determined by the structures in these markets and leading to that performance variables when controlled for firm size entirely exogenously decided by basic conditions in the market (e.g. Porter, 1981).

Under the strategic management lens performance is a product of both firms' behavioural conduct and events within their economic contexts, where, as uncovered in the peer literature, conduct-effects due to accounting or strategic differences remain inseparable parts of performance. Hence, to address this issue, one common approach in relative valuation is to anchor peer selection in industries and derive performance multiples from fundamental variables of firms to capture both performance specific characteristics and relatedness of economic contexts (e.g. Bhojraj and Lee, 2002). Even though these approaches have provided more homogenous sets of peers for valuation purposes due to that firms in the same industries are more likely to share economic relatedness (e.g. common growth opportunities), strictly any sample of firms could have been selected across industries provided that these firms share *similar performance characteristics*. In providing peers for applications such as relative valuation, industry or any other economic context, is not a per se a determinant for value on its own, since it is the underlying performance fundamentals (e.g. value drivers) that are priced in stock markets. Consequently, as conduct is inseparable part of performance, controlling for patterns of behaviour linked to strategic choice or business models as suggested in the peer literature (e.g. De Franco et al., 2011) could result in a peer selection approach that either complements or provides an alternative to industry-anchored firm relatedness in economic contexts, or a selection strategy across structural contexts.

³³ Performance in the industrial organisation literature is defined in general terms considering measures such as efficiency, innovation and profitability (Porter, 1981).

Firm behavioural conduct (Behavioural similarity)

Under the IO perspective firm behaviour is considered a deterministic outcome of market effects, providing no additional information, and therefore traditionally perceived as a passive black box (Hoskisson et al., 1999).

From a strategic management view, however, firms are recognised as active entities with *strategic choices* that allow them to influence their economic contexts in response to market or industry shocks (Scherer and Ross, 1990). In addition, firms also are suggested able to influence their performance outcomes through their accounting decisions (e.g. De Franco et al., 2011). Research further report that firms include information from their markets and incorporates learning outcomes from their own and the peer group's performance into their managerial processes (Du and Shen, 2018; Tuo et al., 2020). Moreover, researchers demonstrate that firm strategic conduct not only depends on management ability to form strategies, but that their capability to act on strategic choices is also dependent on differences in their *asset and resource* positions (Barney, 1991) and their levels of *knowledge and competencies* available (Hamel and Prahalad, 1990). Hence, from a peer selection perspective, the above suggests that firm comparability could be seen as a combined effect of accounting decisions and strategic choices that influence in opposite directions in the *SCP-R* model. It also seems likely that firms' abilities to take such actions depend on effects of learning, their information environments, and differences in critical resources such as assets and capabilities. It is therefore reasonable to infer that firms, controlling for variation due to e.g. learning and available resources or capabilities, are able to influence competitive environments through strategic choices, and that both firms' *strategic choices* and *accounting decisions* form parts of the process that translates events in economic contexts into firm performance.

In addition, public institutions and individual firms are expected to have some influence on the *basic conditions*³⁴ (e.g. via new technology), while at the same time public policy and government regulation are likely to impact on firms, markets and performance (e.g. via *GAAP*), with individual firms having some influence (Scherer and Ross, 1990).

The resulting concepts and their relationships are illustrated in Figure 3.1.

³⁴ Basic conditions are supply and demand factors such as materials, technology, seasonality or competitive substitutes that determine the market structures of economic contexts (see Scherer and Ross, 1990, p.5).

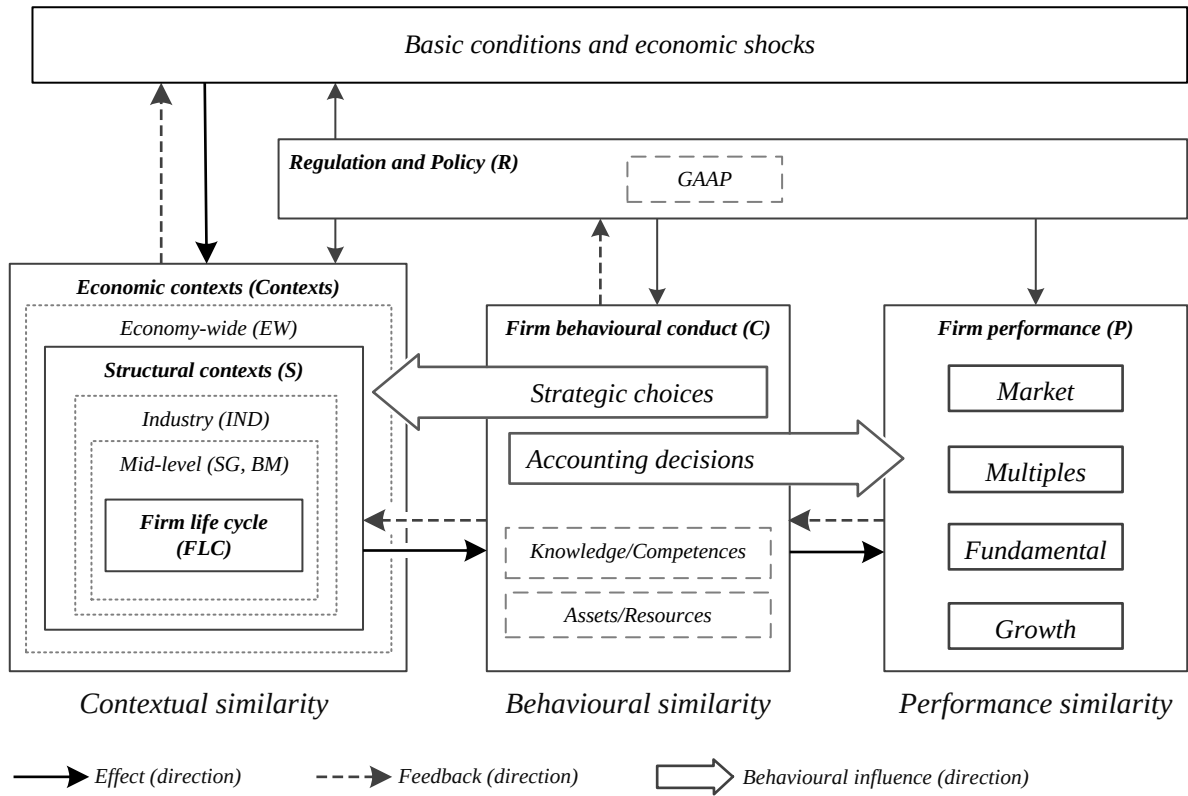


Figure 3.1 – SCP-R map: Peer firm dimensions of similarity and linkages (Source: author adapted from Porter (1981) and further extensions in the literature (see Scherer and Ross, 1990; Carlton and Perloff, 2000)). Central concepts to the purpose of the paper are drawn in heavy black lines, while minor concepts are shown in grey with dashed frames. Note that though firm life-cycle (FLC) is illustrated inside structural contexts, the concept is also considered independently across industries in the economy-wide context.

Towards a strategic management aligned model of fundamental firm comparability

The above taken together, strategic choices made in any period in support of a market position for a firm i , and noting that fundamental performance is related to that financial statement variables are also impacted by the firms' accounting decisions, application of the strategic management lens therefore leads to a generalised model of fundamental firm comparability:

$$Performance_i = f(Accounting\ decisions_i, Strategic\ choices_i, Economic\ events_i) \quad (3.1)$$

In also recognising that business model is a strategic choice, building from equation (3.1) and extending the argument made in De Franco et al. (2008a, 2008b, 2011) by including business model effects, financial statements and resulting fundamental performance of a firm i during the period t , can be expressed as a combined function of its accounting and business processes:

$$Financial\ statements_{i,t} = Acc_{i,t}(BM_{i,t}(Economics\ events_{i,t})), \quad (3.2)$$

where, for firm i in period t , $Acc_{i,t}(\)$ is the accounting system, and $BM_{i,t}(\)$ represents the business model.

The findings from the literatures and discussions in this section leads to the paper position:
All else equal, Comparability between firms' economic performance (performance similarity) do not only depend on similarity in how these firms experience economic shocks (economic similarity)³⁵ or the relatedness of their accounting decisions (accounting similarity), but also on similarity of their strategic choices such as business models (strategic similarity).

Motivated by the opportunity of a new approach to peer selection based on strategic choice, complemented by suggestions that business models and strategic groups might be associated, the paper next examines the business model and strategic group literatures, investigates their relatedness and draws the findings into a general definition of *strategic peers*.

In this process the paper also identifies fundamental proxies for *business model elements* useful to operationalise empirical models of *strategic similarity* under fundamental dimensions of business model comparability for testing the efficacy of the proposed peer selection method.

3.3 Business models and a proxy for Business model leanness

The business model (BM) concept explains the fundamentals of ways firms, by leveraging their asset structures and capabilities through internal and external processes or activities, *translates competitive strategies into value creation* for all stakeholders (i.e. Penman, 2013; Zott et al., 2011; Pinto et al., 2010; Zott and Amit, 2010).

It is a structured approach and system-level perspective that describes how value is generated and appropriated through *interdependencies* among *activities* inside and outside the firm's boundaries (e.g. Lanzolla and Markides, 2021; Velu, 2015; Zott et al., 2011; Teece, 2010; Zott and Amit, 2010)³⁶. Though the concept is mainly theoretical, still debated and emerging (see Bigelow and Barney, 2021; Lanzolla and Markides, 2021), it provides an activity-based perspective of strategy that is useful for drawing together established theories and themes in strategic management and finance, as a purposeful representation of how organisations create value (Arend, 2013).

³⁵ As economic similarity is associated with both economic contexts (e.g. industries) and firm performance variables (e.g. growth or earnings), this paper uses *contextual similarity* or *economic similarity* for economically related firms in economic contexts, and *performance similarity* to signify economic similarity in performance.

³⁶ As example, Zott et al. (2011) reviews how the prior relate business models and strategy concepts, and find that business models are commonly described as reflections or activity-implementations of realized strategy.

A widely agreed definition of what constitutes a business model is still debated and there exist a variety of definitions in the prior literature (Zott et al., 2011)³⁷. A number of contributions across influential textbooks and research papers suggest that the business model and strategy are conceptually interchangeable or at least not different (Penman, 2013; Collins et al., 2011; Casadesus-Masanell and Ricart, 2010; Pinto et al., 2010). Another and larger set of papers take the view that though the concepts are related, they are also distinctly theoretically separable, and argue that the business model conceptually is an operational reflection, or implementation of corporate strategy (e.g. Badunenko et al., 2021; Bigelow and Barney, 2021; Velu, 2015; Klang et al., 2014; Zott et al., 2011; Casadesus-Masanell and Ricart, 2010; Zott and Amit, 2007).

This paper agrees with the view that *a business model is a conceptualisation of strategy*, and more specifically support the recent argument made by Lanzolla and Markides (2021) who provide an important explanation that adds clarity to the debate, by suggesting that business model theory is a separate and complementary perspective on strategy focusing on the *interdependencies* among activities.

Despite the concept of interdependencies being recognised in the resource-based (RBV, e.g. Barney, 1991, 2001) and the market positioning (MPV, e.g. Porter, 1980, 1996) views, it is not considered a point of departure by any of these perspectives. Rather, interdependencies are treated as a higher-level consequence under these lenses that either begin their analysis from the position of external markets and industries, or from state of internal resources and capabilities (Lanzolla and Markides, 2021).

Therefore, the position taken in this paper is that the business model view (BMV) of strategy is distinct from both MPV and RBV, and BMV forms a useful complement being the only perspective that addresses strategy through interdependencies and activities. In addition, the results of search the terms “competitive strategy” and “business model” on Scopus for research papers across the previous 20 years, as shown in Figure 3.2, illustrates that scholars also appear to recognise a distinction, given the difference in popularity between these concepts.

³⁷ For a comprehensive discussion of business model definitions see e.g. Wirtz et al. (2016).

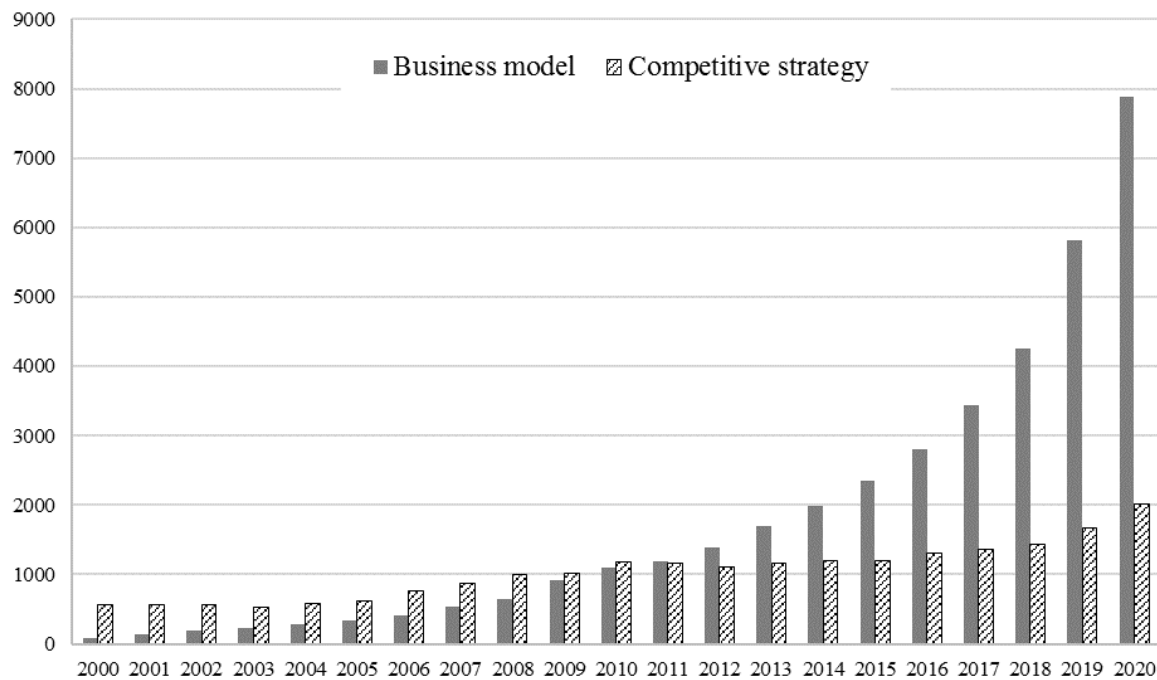


Figure 3.2 – Article search results for keywords “Business model” and “Competitive strategy”, 2000 – 2020 (Source: Scopus, April 2021).

Business model innovation

A related and burgeoning strand of this literature is concerned with business model innovation (BMI)³⁸ as an approach to change or renewal of firms’ business models by providing an organizational-wide strategic flexibility in response to market shocks, competitive changes, or new market opportunities to improve competitive advantages and value creation (see Foss and Saebi, 2017; Kim and Min, 2015; Bock et al., 2012; Teece, 2010). This literature also recognises that renewal of business models as a strategic choice is associated with risk, adoption costs and requirements for new investment into resources or capabilities linked to asset structure changes that need to be considered combined with expected gains from competitive advantages and overall value creation (Hock et al., 2016; Casadesus-Masanell and Zhu, 2013; Teece, 2010; Zott and Amit, 2010).

Economic model, resources, capabilities and activities

Though there is evidence of considerable variation in perspectives among different business model frameworks, there is also evidence of common foundations, such as processes and capabilities, transformations and resource transactions (Ritter and Lettl, 2018). A central

³⁸ Other terms used in place of BMI in these papers are e.g. *business model adaptation* or *business model change* (e.g. Saebi et al., 2017; Landau et al., 2016).

dimension to all business model frameworks is value creation (Zott et al., 2010)³⁹. It describes how resources, capabilities together with activities interact for the firm to create value (e.g. Cortimiglia et al., 2016; Teece, 2010). Integral to this value creation dimension is the *economic model* (also termed profit formula or revenue model) that provides the detailed explanation for how the firm captures value for itself (Zott et al., 2011; Johnson et al., 2008; Linder and Cantrell, 2000). The economic model facilitates the mechanics at the fundamental level that links together revenue and margin models with the underpinning cost and asset structures of the firm's operations (Johnson et al., 2008). In organisational settings resources play a central role for value creation (e.g. Barney, 1991; Wernerfelt, 1984) as well as under the activity perspective of business models that frames value creation in relation to how resources are transformed into value propositions using the system of interdependent activities available within or outside the firm (Zott and Amit, 2010). More specifically, the literature discusses importance of matching the firm's operational assets and working capital with the business model's cost structure, and its implications for profitability and overall model efficiency (e.g. Sohl et al., 2020).

The role of resources and asset structures in relation to value creation is well-established in related literatures. For example, within the strategic management literature, importance of asset combinations (assets and capabilities) and strategic investments in the exploitation of market opportunities and appropriation of value are frequently considered in relation to business execution ability and competitive strategy (e.g. Athanassopoulos, 2003; Cool and Dierickx, 1993; Barney, 1991; Cool and Schendel, 1988; Porter, 1980). Also, in the accounting and financial statement literatures the role of assets (invested tangible and intangible capital) has long been recognised as a base for the firm's ability to generate revenues and through operating margins in the cost structure ultimately profit (e.g. Soliman, 2008; Penman and Zhang, 2004; Fairfield and Yohn, 2001; Nissim and Penman, 2001). These literatures have proposed that both profit margin (PM) and net asset turnover (ATO)⁴⁰ provide important information about the firm's operational efficiency (Soliman, 2008).

³⁹ Various typologies of dimensions have been proposed in the literature (see Zott et al., 2011). A common framework structure of business models recognises five dimensions: (1) value networking, (2) value creation, (3) value proposition, (4) value delivery, and (5) value appropriation (see Cortimiglia et al., 2016; Zott et al., 2011)

⁴⁰ In this paper ATO is defined as net operating asset turnover as in e.g. Soliman (2008), and terms such as asset turnover and net asset turnover (or NATO) are used interchangeably.

A business model leanness proxy based on ATO

The importance of operating assets and growth investments as support underpinning the economic model of business models from the evidence in the prior literature leads to the notion that ATO has potential to represent a measure of resource efficiency in this context, and that there are reasons to assume that levels of ATO could form a useful proxy for levels of business model efficiency (or leanness).

For example, levels of ATO reflecting the efficiency (or utilization) of the resource (asset) base, has been suggested to relate information about the firms operating structure or industry membership (Baik et al., 2013). Specifically, it has been proposed that not only is a firm's level of ATO partially a product of the firm's strategy (Fairfield and Yohn, 2001), but also due to its quantification of use of the firm's fixed assets and working capital, a measure of the resource efficiency of the firm's business model (Soliman, 2008)⁴¹. In addition, these literatures have investigated differences in persistence of ATO across firms and industries. Studies suggest heterogeneity in ATO levels among firms in the same industry and report that firms within the same industry exhibiting differences in persistence also are associated with differences in asset, capital and cost structures (Fairfield et al., 2009). For example, while Fairfield et al. (2009) report differences in cost structures for firms in the same industry, other studies propose that differences in ATO persistence are related to that economic rents from tangible assets are more difficult to expropriate compared to knowledge assets, and that the older physical assets are the more of an artificial barrier to entry they become (Curtis et al., 2015; Soliman, 2008). Zhang (2007) further argues that variation in net operating assets (accruals) that form part of ATO is linked to investment information, and dependent on the firm's business model. Recently, Wannakraijoj and Velu (2021) argue and find that *change in ATO* is an adequate proxy for *change in business models*⁴². Their paper discusses differences in asset structure via inventory levels in a retail sample, and makes the empirical link between firms change in asset levels and efficiency of the business models in total factor productivity. However, their study does not consider or empirically approach levels of ATO as potential proxy for firm-level current business model efficiency as dimension under the economic model of the business model.

⁴¹ For example, Soliman (2008, p.824, footnote 3) discusses the high ATO of Dell, proposing the high turnover and low working capital are directly linked the firm's business model.

⁴² Renewal, change or adaptation of a business model as noted earlier in this paper, is also known in the literature as business model innovation (BMI).

In sum, while the literature has explored variation in ATO in relation to variation in future PM, persistence of ATO and variation in business model as proxy for business model change, it has not yet considered levels of ATO, in terms of asset efficiency in relation to business models, or as a possible proxy for business model *leanness* (or asset efficiency).

Therefore, this paper argues that the literature provides both theoretical and empirical support for a relationship between asset utilisation and business model efficiency, and evidences that firms' abilities to generate profitability is dependent on cost structures that in turn are underpinned by the capital investment and assets in place. More specifically, it is held that ATO provides a size-independent measure of the firm's business model asset efficiency, and that a firms' strategic choice of business model, via the resource dimension, is associated with the level of their ATO. This leads to the following proposition:

Proposition 1: *Firms with higher ATO suggests a leaner and more efficient business model, compared to firms with lower levels of ATO. Therefore, ATO can be applied as a proxy for efficiency of business model resource dimension.*

3.4 Strategic groups – issues and alternative perspectives

Strategic groups are defined as sets of firms in an industry that follows similar strategies (Porter, 1979). The theory of strategic groups emerged from the industrial economics literature via the work of Hunt (1972), was further developed by early contributions from Caves and Porter (1977) and more comprehensive argued in Porter (1979). It adds an intermediate level of analysis between industry and the firm, and provides a valuable tool for practitioners and strategy researchers to improve the understanding of structures within industries through categorisation of firms on strategic choice (e.g. Cattani et al., 2017; Thomas and Venkatraman, 1988; Hatten and Hatten, 1987; McGee and Thomas, 1986).

By introducing strategic groups, it was hoped that sets of firms could be formed to identify differences in capabilities, resources and other dimensions to explain variation in profitability between groups (Porter, 1979). Specifically, Porter (1979, 1980) suggested that firms inside the same groups were similar on strategic dimensions while different from firms in other groups. He also argued that such groups should exhibit stability over time to form long-lived structural parts of industries. This new perspective challenged the traditional structural-conduct-performance (SCP) view by suggesting that *strategic choice of firms* can influence both industry structure and performance (Thomas and Pollock, 1999).

Strategic groups as a concept has received considerable attention by researchers in primarily the industrial organisation and strategic management literatures (Athanasopoulos, 2003). A strong driver for the research efforts is linked to the suggested relationship between group membership and firm performance (e.g. Anand et al., 2013; Dranove et al., 1998; Cool and Schendel, 1987). The strategic groups research has been studied in diverse industries and applications. For example, breweries (Hatten and Hatten, 1987), pharmaceuticals (e.g. Leask and Parker, 2007; Cool and Dierickx, 1993; Cool and Schendel, 1987), banking (Amel and Rhoades, 1988), insurance (Fiegenbaum and Thomas, 1990), airlines (e.g. Gimeno and Woo, 1996; Kling and Smith, 1995; Peteraf, 1993), Entrepreneurship (Amezcuca and Ratinho, 2012), and Retail (Lamberg and Tikkanen, 2006; Athanasopoulos, 2003).

The theory and rationale for strategic groups is underpinned by a few key assumptions. First, it assumes that strategic groups exist in industries under industry market communality. This assumption argues for the possibility of *intra-industry heterogeneity* existence, where firms can make strategic choices to achieve competitive advantages by position themselves in distinctively different groups (Guedri and McGuire, 2011). Second, it is predicted that the performance of firms within groups to a degree is related to group membership (Barney and Hoskisson, 1990). Third, the existence of *mobility barriers* is presumed, preventing firms from entering or exiting groups. It is also expected that such *mobility barriers are asymmetrical* to protect firms within groups (McGee and Thomas, 1986). Fourth, and central to the SCP perspective of strategic groups, is the relationship between strategic similarity and rivalry as formulated by Caves and Porter (1977). This so-called Caves–Porter hypothesis, states that the existence of levels of mobility barriers protect groups of firms by a similar degree of mutual dependence that leads to low level of intra-group rivalry and non-competitive conditions, contributing to an explanation of similarity within and difference across groups in terms of profitability (Guedri and McGuire, 2011).

Although the strategic groups concept is supported by a large body of research, literatures that investigated group membership identification and performance implications of strategic groups have generated mixed outcomes, and important questions remain open (McNamara et al., 2003). For example, while the existence of strategic groups has been supported in prior empirical work (DeSarbo and Grewal, 2008), the link between group membership and performance has not been definitely settled (e.g. Cattani et al., 2017; Thomas and Venkatraman, 1988; McGee and Thomas, 1986). Due to inconsistent results, conceptual issues and an unresolved debate that intersected with the fast-developing interest for research under

the resource-based perspective, the strategic group literature has seen only modest development across the last 20 years (e.g. Cattani et al., 2017; Guedri and McGuire, 2011).

Unresolved issues in strategic group theory

In addition to the above limitations, several open issues remain in the literature. Perhaps one of the most critical white space in the preceding research literature is the deficiency of a predictive theory of requirements for presence or absence of groups in various industry contexts (Mehra and Floyd, 1998; Barney and Hoskisson, 1990). Another issues at the centre of the progress of the research is the inconclusive and partly inconsistent body of empirical support for the theory. The empirical literature appears fragmented with operationalisation of different model specifications, application of varying group forming methods and ad hoc choice of variables, suggested part of the explanation for inconsistencies and non-additivity of the empirical efforts with implication for testing and forwarding the theory (Shanley and Peteraf, 2005; Athanassopoulos, 2003; Mehra and Floyd, 1998). This is further complicated by the commonality of mixed findings in empirical work as for the size of group effects and under what circumstances these effects would exist or be different among groups (e.g. Guedri and McGuire, 2011; Mehra and Floyd, 1998; McGee and Thomas, 1986). For example, while some studies find varying degrees of support for group membership effect (group effect) related to firm performance (Leask and Parker, 2007; Short et al., 2007; e.g. Athanassopoulos, 2003; Fiegenbaum and Thomas, 1990; e.g. Dess and Davis, 1984; Oster, 1982), other papers fail to support the suggested link (Cool and Dierickx, 1993; Cool and Schendel, 1987, 1988). In addition, a number of papers suggests that the group effect on performance is sensitive to the choice of methodology (e.g. Ketchen Jr et al., 1997; Fiegenbaum et al., 1990).

Alternative perspectives to strategic group analysis

The gaps and issues in the strategic group literature illustrates the necessity for additional ideas within interim-level analysis. The theoretical rationale and support for strategic groups as a meaningful approach to investigating and understanding firms on strategic choices is well-established (e.g. Mascarenhas and Mascarenhas, 2019; Cattani et al., 2017; Sonenshein et al., 2017; Anand et al., 2013; McGee and Thomas, 1986), but at the same time, the challenges that remain after decades of industrial economics theory dominance have led to considerations of alternative perspectives of strategy in forwarding strategic group theory (e.g. Anand et al., 2013; Athanassopoulos, 2003; Thomas and Pollock, 1999).

One alternative perspective considered is the resource-based view (RBV) theory (Barney, 1991; e.g. Wernerfelt, 1984) with its focus on explaining strategic implications at the firm-level. However, it has been suggested as a complement to the industrial organisational lens to strategic groups analysis, rather than an alternative frame of analysis (Peteraf and Barney, 2003). In addition, two RBV-related theories at the firm level that has been discussed in this context are isolation mechanism theory (e.g. Rumelt, 1984) and competence based theory (Hamel and Prahalad, 1990). Recent research suggest that these complementary proposals have not received much attention in the strategic group literature (Cattani et al., 2017).

An alternative lens considered in search of explanations for intra-group differences in prior research is the cognitive perspective that takes a behavioural approach to strategic analysis at the industry group level. This cognitive perspective of strategy emerged as a reaction to early criticism of the industrial organisational developments in strategic group research and started to explore definitions of strategic groups from social identity and social learning theory (Peteraf and Shanley, 1997). This new stream of papers focus on managerial perception (mental models) and mapping of competitive categories as structures within industries (Fiegenbaum and Thomas, 1995; Porac and Thomas, 1990) and have spawned a stream of theoretical and empirical contributions (e.g. Peteraf and Shanley, 1997; Fiegenbaum and Thomas, 1990, 1995; Reger and Huff, 1993; Porac and Thomas, 1990; Porac et al., 1989). This literature provides a promising alternative perspective offering new insights into how firms recognise rivals and form groups via cognitive reference maps (Gur and Greckhamer, 2019), into how cognitive identity among members can be used to explain mobility barriers through collective actions (Uzunca and Cassiman, 2023), and produced empirical results to confirm the explanatory power of cognitive strategic groups (Cattani et al., 2017).

In addition to these perspectives, as discussed in the previous section, there exists theoretical support in the strategic management literature for business model theory as an activity-based perspective of strategy (see Lanzolla and Markides, 2021). However, even if the literature appears not yet to have considered the business model perspective for identification or mid-level analysis in the context of strategic groups, as noted in the peer selection discussion, a number of contributions in the literatures appear to suggest that strategic groups and business models might be related concepts (e.g. Badunenko et al., 2021; Marques and Alves, 2021; e.g. Mascarenhas and Mascarenhas, 2019; Mergaerts and Vander Vennet, 2016; Amezcua and Ratinho, 2012; Porac et al., 2011; Athanassopoulos, 2003). For example, Athanassopoulos (2003) proposes that strategic groups can be reflected in the form of business models,

Mergaerts and Vander Venet (2016) suggest that business models as a concept originate from the strategic group literature, and Badunenko et al. (2021) argue that business models are conceptually an improvement of the strategic group theory.

Strategic groups and business models

Starting from the above discussion suggesting that business models and strategic groups might be related concepts under competitive strategy, this section theoretically analyses the question of similarity between the concepts by comparing the fit of the business model concept within central elements of the strategic group theory through the relevant literatures.

Strategic choice and dimensionality

As defined in the previous section, a strategic group is a set of firms in an industry that pursue a similar strategy on several dimensions (Porter, 1980) such as resource commitments, cost structures, distribution choices and level of value chain integration (e.g. Marques and Alves, 2021; Athanassopoulos, 2003) as mobility barriers and sources of competitive advantages in search of opportunities and profitability (e.g. Cool and Schendel, 1988; McGee and Thomas, 1986). Likewise, firms in an industry that implement similar business models are making up a group of firms that also follow similar strategies (e.g. Lanzolla and Markides, 2021; Morris et al., 2013), apply resources, cost structures, and value chain positioning combined with activities as sources of competitive advantages to create and capture value (e.g. Zott et al., 2011). Under the market positioning perspective, strategic dimensions are an important firm-level part of the explanation for strategic similarity. More specifically, strategic dimensions describe elements of how a firm can operationalise its strategy. For example, Porter (1980) proposes a number of dimensions that are suggested to cover the possibilities within a firm's strategic options⁴³. He argues that such firm-level strategic dimensions describe a firm's competitive position within an industry, and by dimensional similarity⁴⁴, the position of the members of the same strategic group. He suggests that these strategic dimensions are linked, and that they make up a stable internal set that characterises every firm (intrinsic characteristics).

⁴³Porter (1980, pp.127–128) provide a list of likely dimensions of competitive strategy including specialization; channel selection; push versus pull; brand identification; product quality; technological leadership; vertical integration; service; price policy; leverage; relationship with parent company; relationship to home and host government.

⁴⁴ Firms in the strategic groups are not expected to be equals on dimensions, and Porter (1980) also recognises that all firms are unique and that if even firms in the same strategic group are likely to be similar, they have intrinsic differences that are likely to generate variation in performance outcomes such as profitability.

From the business model perspective, an internal set of dimensions such as resources, capabilities and activities at the core of each firm, that is similar to the sets of other firms positioned within the same strategic group, are also present broadly in the business model research (e.g. Cortimiglia et al., 2016; Teece, 2010; Zott et al., 2010). Although, strategic groups and groups of business models within this context have different strategic origins, the literature agrees that strategic groups (McGee and Thomas, 1986) and business models (Badunenko et al., 2021) are outcomes from strategic choices. In addition, both strategic groups and business models seem to share for example resource and asset configurations as structural dimensions for strategic execution. Hence, it appears as these concepts are both created from strategic choice, form sets (or groups) of firms on similar strategic dimensions, and could both be generally considered strategic similar.

Level of analysis and industry heterogeneity

The literature also attributes both strategic groups and business models as intermediate level of analysis between industry and firm levels (Amezcuca and Ratinho, 2012). The empirical evidence of industry heterogeneity and existence of strategic groups is established in the literature (e.g. Thomas and Pollock, 1999; McGee and Thomas, 1986). The traditional assumption in the strategic group literature is that separable (core or pure) groups exist within industries as sets of firms based on their common strategies and structures (Cattani et al., 2017; McGee and Thomas, 1986; Caves and Porter, 1977). An example of the more recent literature also finds that within industries there appear to exist not only core groups, but also for example secondary (less consistent, fringe), solitary (single firm) and hybrid groups (overlapping several groups) of firms (DeSarbo and Grewal, 2008). Though the literature has found groups across different industries (Mascarenhas and Mascarenhas, 2019), and earlier studies have pointed to the possibility of cross-industry definitions of strategic groups to overcome issues with industry classifications (Thomas and Venkatraman, 1988), the research appears not yet to have considered an extension of strategic groups outside the intra-industry context. For the purpose of this comparison and to stay within the general definition, the possibility of cross-industry definitions of strategic groups is not considered, even though the literature appears to suggest that it could be a viable proposition.

Due to the activity-based nature of the business model research, where interdependencies are in focus, there are no such limitations within the literature. For example, while there are studies that investigate firms operating different business models within industries (e.g. Sohl et al., 2020; Markides and Oyon, 2010; Sabatier et al., 2010; Willemstein et al., 2007), other studies

have explored variation of business models across industries (e.g. Weill et al., 2011; Enkel and Gassmann, 2010). These insights confirm that both strategic groups and business models are considered interim level of analysis, and reveal patterns of industry heterogeneity via evidence of firms with different business models within same industries in similar way as findings related to strategic groups. In contrast to the strategic group concept, business models appear to offer an extension of a firm group concept on strategic similarity across definitions of industrial classification schemes.

Barriers to mobility and sources of competitive advantages

In strategic group theory, the concept of mobility barriers, defined in the previous section, acts as an augmentation of entry barriers and is central to providing an explanation for inter-group differences through a cost of movement, and as underpinning for competitive advantages that can be sourced due to cost-implications of imitation (e.g. Pattnaik et al., 2018; McGee and Thomas, 1986). Specifically, McGee and Thomas (1986, pp.151–154) outline three categories as sources of mobility barriers that in turn provides group members with competitive advantages under rivalry. These categories are market-related (e.g. user interactions and brands or distribution channels), industry supply characteristics (e.g. R&D or processes) and characteristics of firms (e.g. capabilities or organisational structure). In addition, they link these barrier to strategic choices of market strategies, asset configuration of the firm and scope and organisation of the firm (McGee and Thomas, 1986, p.155). In the strategic group context mobility barriers are linked to irreversible investments to form a structural defence of positions (Porter, 1979), and more generally to required assets or competences in support of a chosen strategy (Cool and Schendel, 1988). The main mechanism for achieving competitive advantages in this context is via cost-based protection against *imitation* (McGee and Thomas, 1986).

At the same time the literature on business models argues that model archetypes provides a basis for competition and a source of competitive advantage (e.g. Lanzolla and Markides, 2021; Casadesus-Masanell and Ricart, 2010; Dahan et al., 2010; Amit and Zott, 2001). In the same way as for strategic groups, business models are dependent on resources and capabilities as part of creation of barriers and as source of competitive advantages, while different from strategic groups, in business models the *interdependencies among activities* also acts as a source of competitive advantage (Lanzolla and Markides, 2021). Teece (2010) argued that despite business models could provide a source of competitive advantage or performance heterogeneity, they would still be susceptible to imitation due to their structural visibility. In

response to this concern, Lanzolla and Markides (2021) provide an explanation for why imitation of business models recipes and resources are neither likely to be easy or successful, and that instead it is the activities that provides barriers to imitation. They show how attempts to imitate activities likely leads to cannibalization conflicts with existing model of the competitor, or to value chain compatibility conflicts with an existing portfolio, and if these conflicts combine to an even stronger protective effect against execution of model imitation. Hence, suggesting that the central protective mechanism for business models is *activity imitation conflict*. The literature suggests that both concepts provide mobility barriers following McGee and Thomas (1986) that rely on e.g. asset-configuration and value chain elements. In addition, to asset-based barriers, business models add the dimension of activity interdependencies. Even though the barriers for models via *activity imitation conflict* calls for further empirical research, the literature supports that both concepts have similarities in sources of mobility barriers and resulting competitive advantages.

Strategic similarity and performance

The relationship between firms' common strategies and performance built on cumulative resources and capabilities as asset endowments, associated mobility barriers and effective execution in the strategic group literature is suggested to in part predict differences in profit potentials associated with group effect (e.g. Thomas and Pollock, 1999; Cool and Schendel, 1988; Porter, 1980). However, even if there exist some empirical support for the effect of groups and performance (e.g. McNamara et al., 2003), the relationship between strategic similarity (group membership) and performance remains debated (Barney and Hoskisson, 1990) and with mixed findings (see Cattani et al., 2017). It also has been suggested that strategic differences can lead to similar performance levels (Slater, 1989).

In the same way, the business model research suggests that the firms' strategies and activity sets in combination with capabilities and resources are drivers of firm performance (e.g. Lanzolla and Markides, 2021; Gambardella and McGahan, 2010; Zott and Amit, 2007). The business model research has also empirically shown that strategic difference through reconfiguring or operating dissimilar business models in an industry can also offer explanations for variation in firm performance (e.g. Sohl et al., 2018; Kim and Min, 2015). Similarly, both concepts argue that performance is associated with the resources, and differently, while studies in strategic groups argue that group effect is the performance differentiator, the papers investigating business models focus on activities and interdependencies as factors for variation in performance. In addition, even though the strategic group concept is empirically more

developed compared to business model theory, there exist for both concepts some evidence of a relationship between strategic similarity and performance, but also in both cases in a weak or inconclusive state.

Stability and strategic change

On one hand the strategic group literature argues that mobility barriers and associated competitive advantages are likely to result in stable groups (e.g. Osborne et al., 2001; Peteraf and Shanley, 1997). On the other hand, this literature also recognise that industry and strategy evolves with changes in technology, new products or arrival of new competitors (e.g. DaSilva and Trkman, 2014; Porter, 1980). For example, Porter (1980) suggests that industry changes can impact on group mobility barriers leading to changes in intra-industry group patterns, where firms need to recognise these shifts and act by reposition themselves into new groups with higher mobility barriers.

In the business model research, the concept of business model innovation plays a central role as changes in the business landscape are treated as an opportunity for firms to renew their business models to explore new or extend existing competitive advantages (e.g. Foss and Saebi, 2017; Wirtz et al., 2016; Amit and Zott, 2012). The focus on activities and interdependencies rather than positions and asset-configurations and product markets is argued to provide approaches to explore new models for an existing customer base (market communality) as well as lead to possibility of creating new markets across industry boundaries (e.g. Loon et al., 2020; Zott et al., 2011). Taken together, both strategic group and business model related literatures recognise from their perspectives that barriers protecting current models or positions are susceptible to changes in the strategic arenas and require firms to consider changes in their positions and models to sustain existing or explore new competitive advantages.

Business model and strategic group relatedness

In sum, the above discussion identifies significant similarities on most of the dimensions and elements that underpins the strategic group concept. Consequently, and as an answer to the question of relatedness, the theoretical analysis above suggests that a sufficient level of similarity exists between business models and strategic groups as concepts. In addition, business models appear to offer an extension to the strategic group theory in providing an interim-level of analysis defined within as well as across industry boundaries. It is therefore argued that groups of firms operating similar business models *within* the same market or industry can be seen as dimensional representatives of strategic groups as suggested in the prior

literature, in the sense that these firms are pursuing similar strategies. This argument is summarised in the below proposition:

Proposition 2: *Firms with similar business models in the same market or industry, form sets of firms that are strategically similar, and each set of such firms can therefore be perceived as a category related to that of a strategic group.*

3.5 Strategic peers

Defining strategic peers

The importance of firm industry membership for peer selection is well established in the prior literature even when alternative peer selection approaches are considered⁴⁵. Following the above discussions, this paper has reasons to consider that the combination of *economic contexts*⁴⁶ such as industry and firm life cycle (FLC) might offer a better peer forming approach. Industries hold important information for explaining firm growth comparability as firms in industrial environments are likely to compete for shared strategic growth options (growth opportunity set) with their peers (see Leiblein et al., 2017; Trigeorgis and Lambertides, 2014; Dalziel, 2009; Miller and Folta, 2002), and the importance of industry to growth forecasting performance is also established in prior work (e.g. Fairfield et al., 2009). Recently, the literature that investigates the importance of FLC confirms that analysis based on combined industry and FLC is expected to increase growth forecast accuracy (Vorst and Yohn, 2018).

Strategic groups form sets of intra-industry firms on the basis of strategic choice (e.g. Cattani et al., 2017; Thomas and Venkatraman, 1988; McGee and Thomas, 1986; Porter, 1979). As such strategic groups capture information at a finer (middle-range) level compared to that of industry classifications that is also related to the firms themselves. Though some research suggests that industry segment data could offer more accurate performance predictions (e.g. Schröder and Yim, 2017), industry (or market) segment information is generally based on product or service commonality that might not adequately reflect the positioning of strategic

⁴⁵ For example, Bhojraj and Lee (2002) find that industry membership explains most of their EV-to-Sales multiple, underlining the relative importance that industry membership can play in peer selection.

⁴⁶ In this paper the terms *economic contexts*, or generally *contexts*, refers to economy-wide or industrial settings, firm life-cycle-stages or combinations of firm life-cycle stage and industry group as a more specific context.

groups, and hence that of strategic similarity (Porter, 1980)⁴⁷. From the discussions and analysis in this paper, business models and strategic groups are suggested as sufficiently related concepts in the sense that it is argued that business models could form a modern approach to strategic groups.

The above and prior literatures motivates this paper to argue that firms that are operating in the same industry, sharing the same growth opportunity set, can also pursue similar strategies forming strategic groups (Porter, 1979; Caves and Porter, 1977), and as demonstrated in the preceding sections, such groups can be represented as similar business models requiring a supportive level of assets in place and investment for future growth. In addition, firms within such groups are likely to approach learning and decision-making differently (Peteraf and Shanley, 1997) leading to that they develop at different rates (Cantrell and Dickinson, 2020) and form peers on life cycle dimensions as demonstrated in previous research (Vorst and Yohn, 2018). Taken together, firms selected on strategic dimensions under fundamental factor similarity are well placed to capture dimensional relatedness of shared growth options, business model specifics and life stage characteristics, in reflection of that firms have different opportunities, follow different strategies and evolve at different rates. Further, given the evidence of existence of business models operated inside as well as across industry boundaries, it is motivated to suggest that firms also can have strategic similarities with business model peers beyond the industry-specific context⁴⁸.

In sum, firms grouped on strategic dimensions, and more specifically on business model dimensions, proxied by firm-fundamental factors, within or across contexts such as industries or life cycle stages, provides a peer selection approach driven by strategic choice, and therefore it is theoretically motivated to suggest that such groups of firms could be defined as *peers on strategic similarity (strategic peers)*. This definition is expressed in the following proposition:

Proposition 3: *Each group of firms within or across similar markets or industrial contexts or in similar life cycle stages that also are related by strategic choices such as operating similar business models can be perceived as peers on strategic similarity – strategic peers.*

⁴⁷ Porter (1980, p.130) argues that market segments and strategic groups are different, and suggests that segments are wider definitions. Also Fairfield et al. (2009) report that segment data appear not to improve firm performance predications.

⁴⁸ The relaxed assumption of strategic similarity within and across industry boundaries also could encompass firms with hybrid or multiple models operating across contexts, given that the foci of the paper is related to capture of strategic similarities on the group-level of firms that could be independent of contextual limitations.

Strategic dimensions and business model elements

The related literatures in strategy and strategic groups have proposed and explored a large number of proxies to capture economic similarity for strategic dimensions (e.g. Ketchen et al., 1993; Fiegenbaum et al., 1990; McGee and Thomas, 1986; Porter, 1979). In addition, the prior peer selection literature commonly identifies performance related value-drivers that also capture risk, size, profitability and future growth that are anchored into industry contexts (e.g. Knudsen et al., 2017; Dittmann and Weiner, 2005; Bhojraj and Lee, 2002; Alford, 1992).

As the focus of this paper is on examining whether strategic dimensions of business models are useful in peer firm selection, the choice of proxies are guided by factors that reflect *structural characteristics* of business models in their economic contexts, rather than by factors that frame attributes of industries or market movements.

Hence, to operationalise the *strategic peers* under fundamental economic similarity and motivate the choice of variables, this paper, specifically turns to the business model and strategic group literatures as they share perspective of firm-similarity in terms of firm-level economic characteristics associated with operational *scope* and *resource deployment activities*. The relatedness between these concepts justifies the use of *strategic dimensions* in the business model context to describe strategic similarity. The suitability of financial and accounting variables as proxies for strategic choice is also consistent with strategy research views such as for example Mintzberg (1978) who argued that fundamental economic measures associated with firms' resource deployment capture elements of realized strategies.

Motivated by these insights, this paper extends from prior work such as Fiegenbaum et al. (1990) and Ketchen et al. (1993) who investigate the mapping of strategic dimensions on organisational structures in terms of scope and resource deployment. More specifically, the paper builds from Grover and Saeed (2004) who identify and propose four structural elements of a firm's strategic orientation (*innovativeness, risk propensity, operating efficiency* and *market intensity*).

The relevance of the Grover and Saeed (2004) study is that it provides an example of how relatedness across dimensions of strategic orientation under the strategic group lens can be operationalised to proxy for factors representing business model similarity. Given the early contribution that predates contemporary business model research in the literature, the authors do not map or analyse how dimensions relate to elements of business models, but instead

explore more generally how such dimensions can be interpreted as reflections of resource deployment with implications for performance under different strategic orientations and their conceptual relationship to business model structures.

Following the argument in Grover and Saeed for *innovativeness*, *risk propensity*, *operating efficiency* and *market intensity* as important determinants of structural strategic similarity and extending by also including *business model leanness* considering the importance of firm-specific assets to strategy in the literature, this paper proposes five strategic dimensions as a justified representation of structural elements related to business model strategic choices: Business model leanness (*BM_lean*), business model innovativeness (*BM_innov*), business model market intensity (*BM_market*), business model efficiency (*BM_eff*) and finally business model risk (*BM_risk*). Each of these dimensions are defined in Appendix 3.A.

Due to that research with business model as a unit of analysis and structural representations of business models remain emergent in the literature, no contemporary study has suggested or empirically examined mappings between strategy and business model concepts. Hence, one objective of this paper is to provide a first attempt to map strategic dimensions into business model elements to derive a testable representation of business model relatedness based on the above five strategic dimensions.

In mapping the five strategic dimensions into an existing business model framework, this study follows the element structure in Johnson et al. (2008). The choice of this model is motivated by its frequent occurrence in the literature (e.g. Bigelow and Barney, 2021; Lanzolla and Markides, 2021; Arend, 2013; Zott et al., 2010) and that it also provides a theoretically accepted and concise four-element representation of firms' realised strategy to explain how interactions of activities among key resources, key processes and the economic model (profit formula) create value in support of delivery of products/services (customer value propositions). Two alternative constructs in the literatures that could have been considered are Morris et al. (2005) that suggest six foundations and the Osterwalder and Pigneur's (2011) nine-element business model canvas that can be viewed as an extension of Johnson et al. Both these models provide similar structures in some more detail, but at the cost of higher complexity.

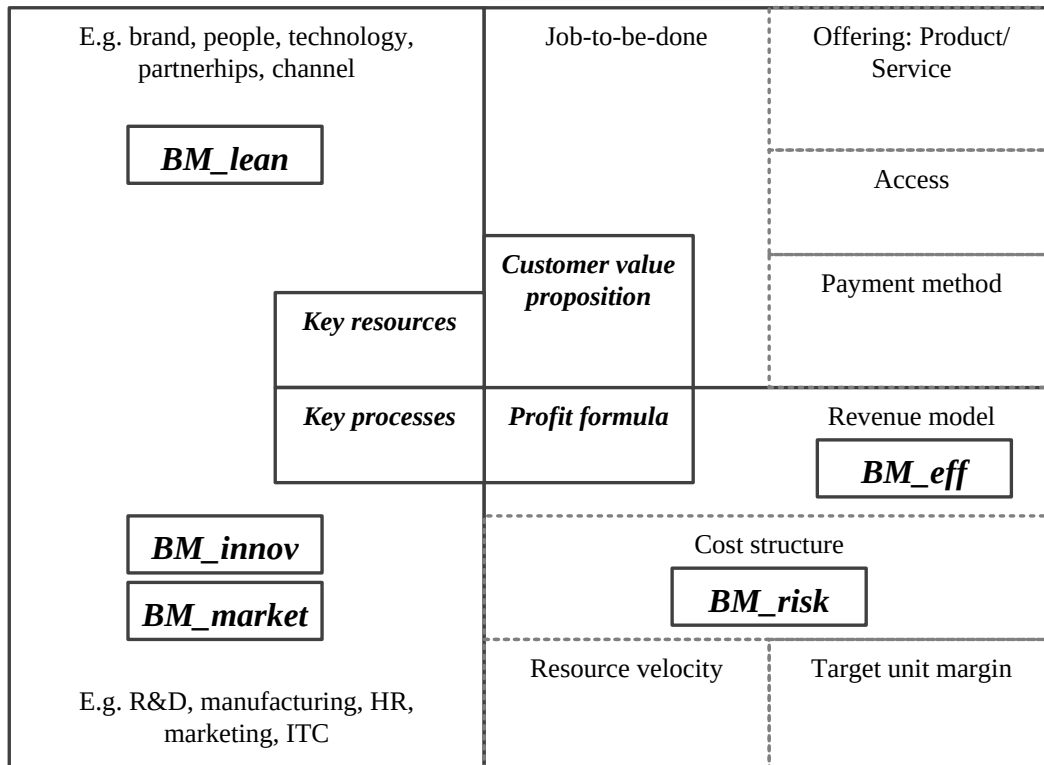


Figure 3.3 – Strategic dimensions mapped into business model elements. Based on Johnson et al. (2008, p.62).

The following paragraphs (also illustrated in Figure 3.3) discuss the viability of the proposed mapping of strategic dimensions that targets the three core structural elements of business models (key processes, key resources and profit formula) in support of the customer value proposition (CVP) delivery.

Business model innovativeness (key process)

The role of technological and process innovation is associated with both the *key activities* and the *value propositions* in the business model context (e.g. Wirtz et al., 2016; Johnson et al., 2008). In this setting the prior literature argues that research and development expenses to sales captures the firm's ability to generate future growth and cash flows, constitutes an indicator of the level of product innovation under the chosen business model (see Dierynck and Verriest, 2020; Visnjic et al., 2016; Guedri and McGuire, 2011).

Under the strategic group paradigm, R&D intensity is an important dimension associated with product innovation strategy (e.g. Ketchen et al., 1993; Fiegenbaum et al., 1990; Hergert, 1987). It is therefore motivated to capture key activities in value proposition renewal as business model innovativeness (*BM_innov*) via research and development expenses to sales.

Business model market intensity (key process)

Also, marketing intensity is an important strategic dimension that is associated with resource deployment (e.g. Oster, 1982) and commonly proxied via advertising expenses to sales (see Ketchen et al., 1993). It is related to business models via the customer relationships dimension and prior literature propose that advertising expenses is a useful proxy to capture efficiency and aggressiveness of customer acquisition as well as aspects of similarity between firms market models and their potential (e.g. Dierynck and Verriest, 2020; Cool and Schendel, 1987; Oster, 1982). Hence, business model market intensity (*BM_market*) is proxied using advertising expenses to sales.

Business model efficiency and Business model risk (economical/profit model)

Turning to the dimension of finance strategy underpinning operations, financial efficiency is a central part of business model constructs embedded into the *cost structure* that have been proxied using general and administrative costs to sales to reflect net margins of the operating activities in the strategic management literature (see Ketchen et al., 1993; Cool and Schendel, 1987; Dess and Davis, 1984).

Following prior studies, profit margin is considered as a proxy for business model efficiency (*BM_eff*). The risk of business models relate to the both short-term operating and long-term structural risks that have been considered in the research context and associated with managerial choices and disposition towards overall business risk and also in the strategic group literature to capture financial risk in resource deployment (e.g. Fiegenbaum and Thomas, 1990; Cool and Schendel, 1987). In this paper risk of operations in terms of business model risk (*BM_risk*) is proxied by leverage (debt to equity ratio).

Business model leanness (key resources)

Beyond the justifications made in this paper, the argument for *business model leanness* as a structural element can also be linked to the strategic group literature in terms of *capital intensity* as a proxy for manufacturing strategy (Hatten and Schendel, 1977), and as a measure of strategic production investment in resource deployment (see Ketchen et al., 1993; Fiegenbaum et al., 1990).

Two models of strategic similarity based on business model dimensions

On the basis of the functional mapping of strategic dimensions into business model elements in this section and arguments in the literature, this paper operationalises and explores strategic peers using fundamental economic similarity via business model dimensions using the following two model specifications:

Multivariate SARD model of business model relatedness (SARD_BM)

Strategic similarity is primarily investigated in a multivariate model setting using all the five identified structural elements that in terms of Fiegenbaum et al. (1990, p.139) cover resource deployment dimensions of *finance* (*BM_eff* and *BM_risk*), *production* (*BM_lean* and *BM_innov*), and *marketing* (*BM_risk*). This model relies on direct relatedness between the five business model dimensions as a combined measure of similarity and is operationalised using the sum of all the absolute rank differences approach recently proposed by Knudsen et al. (2017) to form peer groups on business model SARD closeness (*SARD_BM*).

Univariate quantile model of business model relatedness (BMQ)

In addition, given the importance of firms' resources and asset for value creation in the business model context in the literature and as argued in this paper, the usefulness of a unidimensional model of strategic similarity based solely on the *business model leanness* (*BM_lean*) proxy is explored via peer groups formed as business model leanness quantiles (*BMQ*). This choice can be justified by noticing that though differences in *BM_lean* can be interpreted as variation in asset efficiency, prior studies suggest that since *BM_lean* captures expected size of invested capital required to realise a level of sales revenue, such differences are more likely to be associated with variation in business model structures (e.g. Dickinson, 2011; Fairfield et al., 2009; Soliman, 2004; Nissim and Penman, 2001). In addition, papers also find that levels of *BM_lean* exhibit low variation and long-run persistence indicating it could offer a stable representation for structural relatedness (see Fairfield et al., 2009; Nissim and Penman, 2001).

Operational rationale and details for these models are provided in the research design section.

Importantly, though the choice of strategic dimensions in this paper has strong theoretical support in the literature and across academic disciplines, it is relevant to note that this paper provides an early exploration into the usefulness of strategic peers via business model elements, and that the choice of dimensions is only one of many possible. Any intentions to provide an optimal set of dimensions are therefore left for future research.

3.6 Hypotheses

This section formulates several thematic hypotheses to guide the empirical investigation of the efficacy for the *strategic peer* approach that was defined and operationalised via business model dimensions in the last section. These hypotheses are structured to assess explanatory power via peer group homogeneity in general, and more specifically, explore differences in homogeneity between peer groups selected within and across industry domains.

Power of strategic peers

The first set of hypotheses examine peer selection performance of strategic peers compared to contextually selected peers, and power of business model dimensionality between univariate and multivariate models.

Based on arguments made in the previous section, it is predicted that peers formed on dimensions of business model comparability yields more homogenous sets of peers compared to information captured within economic contexts such as firm life cycle stages or product-markets contained in industrial classifications, or these contexts combined. More specifically, following the theoretical argument in equation (3.2), when economic events in any context are transformed under a business model, they are expected to capture more homogeneity compared to the events in such contexts themselves.

This prediction is expressed in the first hypothesis:

H1: Peers formed on strategic dimensions as business models (strategic peers) generate more homogenous sets of economically comparable firms, compared to any combination of industry or life cycle-based peer selection context.

Following the literature, it is also expected that a higher number of business model dimensions included in the peer selection process leads to that a higher degree of complexity is captured, and therefore also to more homogenous peer firm sets (Knudsen et al., 2017; e.g. Thomas and Venkatraman, 1988).

This is stated as the second hypothesis:

H2: Strategic peers grouped using multi-dimensional approaches (i.e. SARD) have higher explanatory power compared to peers selected via unidimensional approaches as quantiles on a single strategic dimension such as business model leanness (BM_{lean}).

Strategic peers within and across industries

The prior literature suggests both that industry contexts hold important economic information useful to explaining peer firm similarity, and that industries are driven product-markets with shared growth opportunities. On the other hand, it has also been proposed that product-markets can be populated by firms under different strategic choices, implementing different business models, supported by different resource configurations. In addition, firms are also known to compete for example using different business models in the same industry as well as across in multiple industries. As the question whether selecting peer firms on business model dimensions within or across industry contexts is open, the prediction made in the third hypothesis is that relatedness of shared growth opportunities within defined product-markets should increase the economic comparability and peer group homogeneity when compared to more broad selection approaches across industry boundaries. These arguments lead to the third hypothesis:

***H3:** Strategic peers formed within industry domains capture shared growth options as an added dimension of similarity, creating more homogenous sets of peer firms compared to peers formed across industry boundaries.*

It is also predicted following the suggestions in the strategic peer section that strategic peer groups formed within combined industry and firm life cycle contexts provide a higher degree of context specificity resulting in more homogeneous groups, leading to a fourth hypothesis:

***H4:** Strategic peers formed in combined industry and life cycle contexts provide more homogeneous groups than those formed in industry due to growth and life cycle relatedness.*

A related question is how limitations of industry classification compare to direct identification of business model comparability across and within industries. The prior literature suggests that industry classifications could struggle to identify new businesses or be slow to follow changes in existing firms' business operations by correct and timely reclassification. Since the strategic peer approach provide a direct proxy and fundamental measure of firms' business models, it should be able to capture complexities independently from classifications and provide a more stable and higher level of homogeneity within and across industry boundaries (Ding et al., 2019). These arguments lead to the fifth and final hypothesis:

***H5:** Strategic peers formed on business model dimensions capture variations in complexities of firms' operations not fully recognised by industry categories, leading to that strategic peers exhibit a higher and more stable level of homogeneity within and across industry contexts.*

3.7 Research design, methods and data

The usefulness of the novel peer selection approach is primarily investigated through general peer group efficacy relevant to all peer forming applications, and complemented by an additional examination that explores multiple valuation accuracy of the new approach in relation to existing valuation methods.

The main investigation of efficacy is motivated by the issues and limitations associated with peers selected using economic contexts such as industries. It is predicted that firms selected based on strategic relatedness via business model dimensions in these contexts capture a higher degree of similarity, and also that firms selected in this way might also exhibit a higher degree of context independence given evidence of business models being applied across industry boundaries. These predictions were developed into hypotheses in the previous section. The paper tests these hypotheses by means of group homogeneity following the econometric procedure introduced by Bhojraj et al. (2003). In addition, as low variance among members in variables of interest is also a desirable characteristic for peer groups, the intra-group-variance method proposed by Guenther and Rosman (1994) that measure relative group variance between peer groups and industry as benchmark, is used as a complementary method to provide further insights into peer selection performance.

Following the main tests of peer group efficacy across economic contexts, and related to the importance of peer selection in identification of comparable firms for relative valuation using multiples, the paper also explores the usefulness of the new peer selection approach following earlier work in terms of multiple valuation accuracy using absolute percentage error (e.g. Alford, 1992; Knudsen et al., 2017; Bhojraj and Lee, 2002). This examination compares valuation accuracy performance of strategic peers to the warranted multiple approach (WARR; Bhojraj and Lee, 2002) and the recent value-driven SARD method (SARD_KN; Knudsen et al., 2017).

Next this section discusses the peer selection approaches and details the empirical methods, their rationale and fit in the research design. It then describes the data, variables used and present descriptive statistics.

Detailed definitions of all variables used in this paper are provided in Appendix 3.A.

Table 3.1 – Summary of Peer selection approaches

The table lists all variations of approaches to select peers in this paper along with minimum peer group size and a brief description. *IND* denotes GICS6 industry, *FLC* firm life cycle stage following Dickinson (2011) and *IND-FLC* peer selection context that industry and firm life cycle stage.

Peer approach	Peer group size (minimum)	Description
Contextual peers (peers formed within contexts)		
<i>FLC</i>	≥6	Firm life cycle peers (<i>FLC</i> peers) formed within <i>FLC</i> stages
<i>IND</i>	≥6	Industry peers (<i>IND</i> peers) formed within <i>GICS6</i> industries
<i>IND-FLC</i>	≥6	Industry-firm-life cycle peers (<i>IND-FLC</i> peers) formed within combined <i>GICS6</i> industries and <i>FLC</i> stages
Univariate strategic peers (peers for med based on deciles of <i>BM_lean</i>)		
<i>BMQ (EW)</i>	≥6	<i>BMQ</i> peers formed using economy-wide sample
<i>BMQ (FLC)</i>	≥6	<i>BMQ</i> peers formed within <i>FLC</i> stages
<i>BMQ (IND)</i>	≥6	<i>BMQ</i> formed within <i>GICS6</i> industries
<i>BMQ (IND-FLC)</i>	≥6	<i>BMQ</i> formed within combined <i>GICS6</i> industries and <i>FLC</i> stages
Multivariate strategic peers (<i>SARD_BM</i>)		
<i>SARD_BM (EW)</i>	6	<i>SARD_BM</i> peers formed using economy-wide sample
<i>SARD_BM (FLC)</i>	6	<i>SARD_BM</i> peers formed within <i>FLC</i> stages
<i>SARD_BM (IND)</i>	6	<i>SARD_BM</i> formed within <i>GICS6</i> industries
<i>SARD_BM (IND-FLC)</i>	6	<i>SARD_BM</i> formed within combined <i>GICS6</i> industries and <i>FLC</i> stages
Warranted Multiple performance peers (<i>WARR</i>)		
<i>WARR (EW)</i>	6	<i>WARR</i> peers formed using economy-wide sample
<i>WARR (FLC)</i>	6	<i>WARR</i> peers formed within <i>FLC</i> stages
<i>WARR (IND)</i>	6	<i>WARR</i> formed within <i>GICS6</i> industries
<i>WARR (IND-FLC)</i>	6	<i>WARR</i> formed within combined <i>GICS6</i> industries and <i>FLC</i> stages
Value-driven <i>SARD</i> performance peers (<i>SARD_KN</i>)		
<i>SARD_KN (EW)</i>	6	<i>SARD_KN</i> peers formed using economy-wide sample
<i>SARD_KN (FLC)</i>	6	<i>SARD_KN</i> peers formed within <i>FLC</i> stages
<i>SARD_KN (IND)</i>	6	<i>SARD_KN</i> formed within <i>GICS6</i> industries
<i>SARD_KN (IND-FLC)</i>	6	<i>SARD_KN</i> formed within combined <i>GICS6</i> industries and <i>FLC</i> stages

Peer selection approaches

In order to test the efficacy and performance of *strategic peers* under business model dimensions empirically, several alternative peer selection approaches are compared in this paper. They are divided into three categories of similarity following motivation in the theory section and summarised in Table 3.1: Contextual peers (contextual similarity), strategic peers (*behavioural similarity*) and *performance peer approaches*⁴⁹ (*performance similarity*).

⁴⁹ *Performance peers* in this paper refers to firm relatedness in factors of fundamental and market performance.

Contextual peers (economic contextual peers)

An economic context in this paper is defined as either economy-wide (*EW*)⁵⁰, firm life cycle stage (*FLC*), industry (*IND*) or as combined industry-firm-life cycle (*IND-FLC*). In order to capture firm characteristics and explore peer selection performance across economic contexts, this paper forms three contextual peer groups on *IND*, *FLC* and *IND-FLC*. Following prior research, this paper uses *IND* as performance benchmark in tests, and requires each economic context to have more than six members to be included in the study. Further, while some research constrain number of firms in each contextual peer group category such as industry (Lee et al., 2015), this paper uses all available firms in each context to improve fixed effect as in prior studies (e.g. Lee et al., 2016; Bhojraj et al., 2003).

Industry peers (IND peers)

In line with the standard approach in the peer selection literature (see Lee et al., 2015; Chan et al., 2007; Bhojraj et al., 2003) all firms in each year that share the same six-digit Global Industry Classification Standard (GICS) industry with more than six members are considered *industry peers* in this paper. The choice of six-digit GICS follows the rationale in prior research that it is more accurate than alternative industry schemes (see Jennings et al., 2020; Lee et al., 2015).

Firm life cycle peers (FLC peers)

This paper assigns life cycle stages for each firm-year using the fundamental cash flow sign life cycle proxy provided in Dickinson (2011) that classify firms' development into five distinct stages: Introduction (1), growth (2), maturity (3), shakeout (4) and decline (5).⁵¹ Using the life cycle stage as peer context, all firms for each firm-year within the same life cycle stage with more than six contextual members, are considered firm life cycle peers.

Industry-firm-life cycle peers (IND-FLC peers)

In addition, as argued earlier in the paper, firms that belong to the same industry, sharing similar set of growth opportunities, that are also in the same stage of development are also members of a combined and more specific economic context (*IND-FLC*). Therefore, to explore the

⁵⁰ This terminology considers the sample a basic proxy for the economy in terms of firms across industries. The term "Market" has also been used in prior studies (e.g. Dittmann and Weiner, 2005; Alford, 1992).

⁵¹ The Dickinson (2011) scheme applies the signs of SFAS95 cash-flow components (operating, investing and financing) to reflect firm state via similarity in accounting information. It allows firms to move between stages in a non-sequential way that is consistent with perspectives of firm development in the life cycle theory (Miller and Friesen, 1984).

efficacy of a peer approach base on firms that share industry and development stage, all firms in each year that are members of the same firm life cycle stage, belong to the same industry and where there are more than six firms in such as combined peer context, are considered groups of industry firm life cycle peers.

Strategic peer selection approaches

In order to evaluate the strategic peer method of behavioural similarity, this section operationalises the identified strategic dimensions associated with business models from the related literature using the two alternative specifications of methods for selection of *strategic peers* specified in this paper. Though the two approaches take different routes to forming groups of peer firms, and the *BMQ* applies a single strategic dimension while the *SARD_BM* make use of a more comprehensive set of strategic dimensions, both approaches provide representations of *strategic peers*.

Multivariate SARD-based business model peer method (SARD_BM)

The sum of all the absolute rank differences (SARD) approach as proposed in Knudsen et al. (2017) applies a two-stage procedure to identify peer firms in terms of their lowest combined Manhattan distance using cartesian coordinates in n-dimensional space for the sum of pair-wise rank differences for dimensions in variables of similarity in each period. In this paper SARD is selected as primary econometric approach to capture multivariate relatedness between firms for identification of business model-driven *strategic peers* (*SARD_BM*)⁵². In the first step, for every firm i each variable in the set of the five strategic variables V_{BM} identified in this paper as a representation for business model strategic choice, is ranked against all the same variables for all other firms operating in the same peer selection context (e.g. *EW*, *IND*, *FLC*, or *IND-FLC*). Then for each of these ranked variables V_{BM} , the sum of all absolute rank differences between firm i and each firm k on every variable V_{BM} in period t is calculated:

$$SARD_BM_{i,k,t} = \sum_{v \in V_{BM}} |rank_{v,i,t} - rank_{v,k,t}|, \quad (3.3)$$

$$V_{BM} = \{BM_{lean}, BM_{innov}, BM_{market}, BM_{eff}, BM_{risk}\}$$

⁵² The choice of SARD over for example common regression approaches such as the warranted multiple method (Bhojraj and Lee, 2002) is motivated by SARD's focus on similarity between independent dimensions (e.g. business model elements) rather than their relatedness by combined predictive ability into a dependent factor, lower dependence on sample assumptions and reported higher accuracy compared to regression methods.

In the second step, the six firms with the lowest pair-wise *SARD_BM* absolute ranked differences to every firm i are selected as its set of peers. The number of variables is flexible and the approach requires no regression or hold-out sample in the estimation process.

Univariate quantile business model peer method (BMQ)

In addition to the multivariate *SARD_BM* approach, and to test the second hypothesis posed, a simple context-driven quantile approach is also proposed. Each firm i at time t with firms being divided into sample-wide⁵³ deciles q based on their business model leanness (BM_{lean}) dimension that is a member of an economic context J (e.g. *EW*, *IND*, *FLC*, or *IND-FLC*) with more than six members are considered business model quantile peers (*BMQ*):

$$BMQ_{i,j,k,t} = \{firm \in J : Q_{BM_{lean}}[firm] = q\}, J = \{EW, IND, FLC, IND - FLC\} \quad (3.4)$$

Performance peer forming approaches

To examine the relative valuation performance of the *Strategic peer* approaches, two competing alternative peer selection methods based on *performance similarity* and implemented using methods of economic dimensional relatedness are included in the study.

Value-driven SARD peers (SARD_KN peers)

The Knudsen et al. (2017) paper that introduced the SARD method designed to capture dimensional similarity as described above also compose and test a value-driven five-factor SARD-implementation (*SARD_KN*) that is specified on the below V_{KN} set of variables including returns on equity (*roe*), net debt to earnings before interest and taxes (*ndebt/ebit*)⁵⁴, size proxied via market value of equity (*me*), implied growth using leading three-year realised earnings-growth forecast (*ltgrowth*)⁵⁵ and profit-margin (*pm*, or *ebit-margin*):

$$SARD_KN_{i,k,t} = \sum_{v \in V_{KN}} |rank_{v,i,t} - rank_{v,k,t}|, \quad (3.5)$$

$$V_{KN} = \{roe, ndebt/ebit, me, growth, pm\}$$

Similar to the *SARD_BM* procedure, the six firms with the lowest pair-wise *SARD_KN* absolute ranked differences to every firm i are selected as its set of peers.

⁵³ Business model assets are considered available at the economy level, and comparable among firms.

⁵⁴ In this study *ebit* (earnings-before-interest and taxes) is treated as equivalent to operating income (*oi*).

⁵⁵ Knudsen et al. (2017) apply leading one-year analyst earnings-growth forecast with similar results in tests.

As the $SARD_KN$ is compared to the Warranted multiple (Bhojraj and Lee, 2002) using the V_{KN} set of factors in the Knudsen et al. paper and it is reported that $SARD$ outperforms the Warranted multiple on this specification predicting a set of valuation multiples (pe , pb , evs , and $ev/ebit$), this study is motivated to include the $SARD_KN$ and compare it with the Warranted multiple when specified on its original V_{BL} set of factors defined below in addition to testing how the $SARD_KN$ relates to the proposed $SARD_BM$ approach in this paper.

Warranted Multiple peers (WARR peers)

The Warranted multiple (WARR) proposed by Bhojraj and Lee (2002) identify peer firms using a regression approach that capture systematic variation in accounting-based value-drivers as independents, and their mapping on a target dependent multiple in a three-step procedure. In this paper the dependent is one of the valuation multiples, enterprise-value-to-sales (evs), price-to-book (pb), price-to-earnings (pe) or enterprise-value-to-ebit ($ev/ebit$). In a first step, cross-sectional economy-wide regression of the dependent multiple (Dep) is estimated using a X_{BL} set of eight independent variables that are anchored into industry harmonic means and medians: industry harmonic mean of the dependent ($indDep$ being one of $indevs$, $indpb$, $indpe$ or $indevebit$), industry-median-adjusted profit margin ($adjpm$), losses in $adjpm$ ($losspm$), industry-median-adjusted growth forecast ($adjgro$), leverage ($leverage$), returns on net operating assets ($rnoa$), returns on equity (roe) and research and development expenses to sales ($rdint$)⁵⁶:

$$Dep_{i,t-1} = \alpha + \beta X_{BL,i,t-1} + \varepsilon_{i,t-1}, \quad (3.6)$$

$$X_{BL} = \{indDep, adjpm, pmlloss, adjgro, leverage, rnoa, roe, rdint\}$$

In this equation for period $t - 1$, Dep is the predicted dependent for firm i , X_{BL} is the independent set of value-drivers capturing cross-firm variation in the dependent, as introduced above, α is the intercept, β is the estimated vector of coefficients, and ε is the regression residual. In the second step, the coefficients β and intercept α from the regression in the previous period⁵⁷ $t - 1$ are used as model data for the current period t with the X_{BL} set of variables for firm i to estimate a warranted (synthetic) value for the Dep multiple ($wevs$, wpb , wpe or $webebit$). In the final step, the N firms that have are closest warranted multiple to each firm i in terms of smallest absolute deviation error are identified as peers. In addition to the

⁵⁶ The details of the variables are found in Appendix 3.A.

⁵⁷ The rolling regression window in Bhojraj and Lee (2002) that relies on the previous year for training data for each subsequent year is also the approach in this study. Other papers have extended the time window to increase training data using pooled regression over multiple periods. E.g. Knudsen et al. (2017) uses a five-year window.

original approach, this paper also requires firms to share the same strategic context (e.g. *EW*, *IND*, *FLC*, or *IND-FLC*) to be considered *WARR* peers. Different from Bhojraj and Lee (2002) who used two-digit SIC, this paper applies six-digit GICS industry codes in order to achieve comparability between approaches in the study.

Peer group size

For peer groups formed using any of the economic dimensional similarity-based approaches (*WARR*, *SARD_KN* or *SARD_BM*) in this study, the choice of the closest ranked firms as peer group for any base firm is set to six following previous research (e.g. Knudsen et al., 2017; Alford, 1992). The choice of peer group size varies in the literature, and while it has been suggested that peer group stability might be impacted by observed average annual peer firm turnover of 14% (Kaustia and Rantala, 2019), it has also been held that valuation multiples appears to be stable for peer group size between six and 16 (Knudsen et al., 2017). Robustness tests in this study explores stability across peer group sizes and peer selection approaches.

Econometric tests

The empirical strategy applies three tests that are common in the prior literature for comparing different aspects of performance for peer approaches: *peer returns and ratio homogeneity* (Bhojraj et al., 2003), *intra-peer-group variance* (Guenther and Rosman, 1994) and *peer valuation accuracy* (e.g. Knudsen et al., 2017; Alford, 1992). The main tests in the paper consider the efficacy of the proposed *strategic peer* approach compared to peers formed using contextual groups (*FLC*, *IND* and *IND-FLC*), and relies on *peer homogeneity* and *intra-group variance* tests. These tests assess the degree of correlation between base firms and their peers using market returns and fundamental variables, and explore how variance of the peer approaches relate to variance of industry formed (benchmark) peers for market returns and fundamental ratios. In addition, to these two tests, the comparative performance evaluation that benchmark the *strategic peers* with the *WARR* and *SARD_KN* approaches rely on a valuation accuracy test that is also a common method in the literature for assessing comparatively how well peer methods explain valuation metrics such as market or fundamental multiples. This test is applied to compare the absolute valuation error for each peer selection approach in terms of to what degree peers can explain their base firm's outcome for an established set of valuation multiples. Since it was recognised following equation (3.2) that uncontrolled variation in accounting decisions can impact on the validity of performance measures, all methods in this paper assess performance variables in a relative fashion to reduce this influence. In addition,

to control for inconsistencies of industry classification systems and for variation in GAAP, the sample is selected within the same country (USA) and with financial statement data retrieved from a single data provider (COMPUSTAT).

Homogeneity of market returns and fundamentals

The peer group homogeneity test introduced by Bhojraj et al. (2003) provides a systematic regression-based approach to test how well peers are able to explain stock co-movements in monthly returns and annual cross-sectional variation across fundamental ratios, growth indicators and valuation multiples. The rationale of this test is based on the insight that groups of firms that share homogeneity on multiple fundamental factors and performance-related variables, are also likely to provide a higher degree of homogeneity in unobservable variables (Kaustia and Rantala, 2019). The test estimate contemporary cross-sectional regressions in monthly data for market returns and in annual data for a set of valuation multiples and fundamental variables in the form:

$$Var_{i,t} = \alpha_t + \beta_t Var_{peer_{i,t}} + \varepsilon_{i,t} \quad (3.7)$$

where in period t , for base firm i , with means of its set of peers, $Var_{i,t}$ and $Var_{peer_{i,t}}$ are either monthly returns (ret), or one of the valuation multiples such as enterprise-value-to-sales (evs), price-to-earnings (pe), price-to-book (pb), or any of the fundamental ratios profit margin (pm), returns on net operating assets ($rnoa$), return on equity (roe), asset turnover (at), leverage ($leverage$), or one of the growth indicators being long-term growth ($ltgrowth$), year-ahead sales growth ($salesgrowth$) or research and development expenses by net sales ($rdint$). In these regressions α_t is the intercept, β_t is the coefficient and $\varepsilon_{i,t}$ the residual error term. The adjusted R^2 for each monthly (annual) regression is reported for returns (multiples or fundamental variables), and the average adjusted R^2 across the sample time frame is interpreted as a measure of homogeneity in each variable. In addition, the average adjusted R^2 across all variables is used to assess the overall homogeneity of a peer selection approach. All R^2 are exclusive the base firm. In these tests, peer groups are formed into portfolios using all firms in each classification of each of the contexts: firm-life cycle stage (FLC), industry (IND), combined industry- firm-life cycle ($IND-FLC$), where the number of firms in each classification are at more than six. In addition, as described earlier in the section, the same portfolio approach is used for decile-formed business model peers (BMQ), while for SARD-formed business model peers ($SARD_BM$), the six closest ranked firms are selected as peer group members.

Intra-peer-group variance

To complement the homogeneity test, this paper includes an intra-peer-group variance test that was first introduced for comparison of variance in industry classes between CRSP and COMPUSTAT by Guenther and Rosman (1994) based on the assumption that intra-industry variance of financial ratios should be lower in groups of firms that are more similar and homogeneous. Their approach was derived to examine variation between industry classification schemes, but its applicability can be generalised to examine how close-knitted firms behave between any pair of formed groups as applied in more recent work (Yang et al., 2019). Following Guenther and Rosman (1994) composite variances (S) acting as weighted-averages for a set of variables of interest are calculated for each peer selection approach:

$$S = \frac{\sum_{i=1}^G (n_i - 1) V_i}{\sum_{i=1}^G (n_i - 1)} \quad (3.8)$$

where G is the number of subgroups (e.g. industry codes or life cycle stages) within each peer selection approach, n_i is the number of firms in subgroup i and V_i is the variance of a variable of interest in subgroup i . In this paper the test is extended by adopting all the variables used in the peer group homogeneity test on the rationale that this increases the power and usefulness of the test and above all its comparability with the homogeneity test and the overall paper methodology. Then the composite variances (S) of each peer selection approach are tested against that of the GICS6 industry contextual peer approach (IND) by using the ratio of these composite variances as F -statistic:

$$F - statistic = \frac{S_{peers}}{S_{benchmark}} \quad (3.9)$$

where S_{peers} is the composite variance of a peer selection approach, and $S_{benchmark}$ is the composite variance of the GICS6 industry contextual peer approach used as benchmark. The test argues that an F -statistic lower than one suggests a lower intra-peer-group variance compared to industry-formed peers and a comparably more concentrated peer set. This test is informative to assess if a peer selection method (e.g. *strategic peers*) provides more or less tight samples for the observed variables compared to the benchmark. As in the homogeneity test, the performance of each peer selection approach in relation to industry peers is assessed both on the variable level and using the average F -statistic across all the variables.

Valuation accuracy and absolute forecasting errors

The importance of accuracy of peer selection approaches in terms of their ability to predict valuation multiples and the common application of absolute valuation error tests is well-established in the literature (e.g. Knudsen et al., 2017; Young and Zeng, 2015; Bhojraj and Lee, 2002; Kim and Ritter, 1999; Alford, 1992).

To investigate the relative valuation accuracy between peer approaches it is useful to assess how well peers are able to explain contemporary valuation multiples of their base firms using absolute valuation error. A peer approach that generates lower absolute valuation errors in the relationship between its peers and base firms across valuation multiples also provides higher explanatory power and valuation accuracy. The choice of valuation multiples and general test procedure in this paper is largely consistent with that of Knudsen et al. (2017), as their test extends the choice of enterprise-value-to-sales (*evs*), price-to-earnings (*pe*), and price-to-book (*pb*), also featuring in the homogeneity and intra-peer-groups tests, with the enterprise-value-to-ebit (*ev/ebit*) multiple. As in their paper the robust choice of harmonic mean is used in this paper, in estimation of the peer-predicted valuation multiples $\widehat{vm}_i$ in calculation of absolute percentage error (*APE*) in relation to the actual valuation multiple of base firm *i*, vm_i :

$$Absolute\ percentage\ error\ (APE)_i = \left| \frac{\widehat{vm}_i - vm_i}{vm_i} \right| \quad (3.10)$$

The average of the absolute errors across each of the valuation multiples are used to assess the overall valuation accuracy for the *WARR* and *SARD_KN* peer selection methods compared to the economy-wide *SARD_BM* and the industry-life-cycle *BMQ strategic peer* approaches.

Also, consistent with Knudsen et al. (2017), this paper finds that particularly the *enterprise-value-to-ebit* multiple in the study sample is strongly right-skewed using a Shapiro-Wilks normality test, and therefore reports median absolute percentage errors along mean, and interquartile range of absolute percentage errors to locate the typical and representative value of valuation accuracy for each of the tested peer selection approaches.

Data and descriptive statistics

The hypotheses in this paper are examined using a large sample comprised of all US firms listed on the AMEX, NYSE and NASDAQ exchanges⁵⁸ with available annual financial statements on COMPUSTAT⁵⁹ and monthly stock market data in the CRSP database over the study sample period 2006 – 2020⁶⁰.

As the main analysis in this paper follows and extends from Bhojraj et al. (2003), variables are defined as in their paper, and all firms are required to have available values for six-digit Global Industry Classification Standard (GICS) schemes in each year to be considered in the sample. The Warranted multiple calculation in this paper follows Bhojraj and Lee (2002) by applying a one-year rolling regression window, and therefore firms in the hold-out sample starting in 2007 having less than one year of financial statement history are dropped. Both active and inactive firms are included⁶¹, and in extending the peer firm requirements in Bhojraj et al. (2003) this paper requires each GICS6 industry to have more than six members⁶² to be included in the sample to facilitate analysis. Firm-periods with share price [*prcc*] below 3 USD or net sales [*sale*] under 100 million USD are excluded to reduce effects due to small denominator sizes, and total shareholder equity [*seq*], as well as total common (book value) of equity [*ceq*] are required to have positive values to be included (Lee et al., 2015). For estimation of firm life cycle stages in line with Dickinson (2011) all firms are required to have available data in each year for net cash flows from operating [*oancf*], investing [*ivncf*] and financing [*fincf*] activities along with period change in cash flow [*chech*]. In addition, non-missing values for property, plant, and equipment [*ppent*], current assets [*aco*] and current liabilities [*lco*] are required for calculation of returns on net operating assets (*rnoa*), operating income after depreciation [*oiadp*] is required to have non-missing positive values for calculation of *ebit* (Knudsen et al., 2017), and cash and short-term investments [*che*] is required for estimation of net debt-to-*ebit* (*ndebt/ebit*). Missing values for research and development [*xrd*] or advertising expenses [*xad*] are replaced by zero. Firm-periods are also required to have non-missing values for shares outstanding [*csho*], net income before extraordinary items [*ib*], total assets [*at*], long-term debt [*dltt*], and debt in current liabilities [*dlc*].

⁵⁸ Firms are selected within these markets using CRSP share codes 10 or 11 (ordinary common shares).

⁵⁹ COMPUSTAT data items are provided in square brackets.

⁶⁰ The sample start was restricted to 2006 due to limits in processing of the extensive number of peer selection calculations and to obtain a ten-year window (2007-2016) for analysis following filtering.

⁶¹ Prior studies reports that inclusion of inactive firms yields similar outcome (Bhojraj et al., 2003).

⁶² With a peer group size (*N*) of six plus one base firm, the minimum industry membership size is $N + 1$ ($>N$).

Table 3.2 – Descriptive statistics

The table provides descriptive statistics for the study sample that covers the period 2007 – 2016 and consists of 3 437 firms with 21 107 firm-year observations derived from all US firms listed on the AMEX, NYSE and NASDAQ exchanges with available data following requirements in this paper. Stock prices are from CRSP and financial statement data from COMPUSTAT. All variables are winzorised at the 1st and 99th percentile. See Appendix 3.A for detailed variable definitions and the data and sample selection section for data selection criteria. It reports summary statistics including mean, standard deviation (*Std. Dev.*), inter-quartile range (*IQR*) and 25th (*Q1*), 50th (*Median*) and 75th (*Q3*) percentiles.

		<i>Mean</i>	<i>Std. Dev.</i>	<i>Q1</i>	<i>Median</i>	<i>Q3</i>	<i>IQR</i>
<i>me</i>	<i>MUSD</i>	4 830	10 400	445	1 250	3 830	3 390
<i>mv</i>	<i>MUSD</i>	11 800	49 800	639	1 800	5 930	5 290
<i>ret</i>		0.01	0.11	-0.05	0.01	0.06	0.11
<i>evs</i>		2.76	3.09	0.95	1.83	3.57	2.62
<i>pb</i>		3.00	3.28	1.33	2.04	3.41	2.08
<i>pe</i>		28.01	37.55	13.46	18.61	27.41	13.95
<i>ev/ebit</i>		21.13	25.94	11.12	14.75	20.74	9.62
<i>rnoa</i>		0.20	0.46	0.06	0.16	0.31	0.25
<i>roe</i>		0.08	0.26	0.04	0.10	0.16	0.13
<i>at</i>		3.36	5.66	0.78	1.30	2.48	1.70
<i>pm (ebit)</i>		0.12	0.20	0.05	0.10	0.19	0.14
<i>leverage</i>		0.71	1.15	0.06	0.37	0.86	0.80
<i>ltgrowth</i>		0.32	0.69	-0.03	0.19	0.49	0.53
<i>salesgrowth</i>		0.08	0.23	-0.02	0.06	0.15	0.17
<i>rdint</i>		0.03	0.10	0.00	0.00	0.02	0.02
<i>indevs</i>		1.55	1.23	0.76	1.15	1.93	1.17
<i>indpb</i>		1.49	0.64	1.10	1.43	1.81	0.71
<i>indep</i>		15.26	5.57	11.84	14.73	18.37	6.53
<i>indevebit</i>		13.92	4.02	11.04	13.30	15.94	4.89
<i>adjpm</i>		0.04	0.21	-0.03	0.02	0.08	0.11
<i>pmloss</i>		-0.03	0.13	-0.02	0.00	0.00	0.02
<i>adjgro</i>		0.12	0.66	-0.19	0.00	0.26	0.45
<i>ndebt/ebit</i>		2.61	7.47	-0.34	1.66	4.86	5.20
<i>bm_lean</i>		0.92	0.70	0.40	0.77	1.27	0.87
<i>bm_innov</i>		0.03	0.10	0.00	0.00	0.02	0.02
<i>bm_market</i>		0.01	0.02	0.00	0.00	0.01	0.01
<i>bm_eff</i>		0.12	0.20	0.05	0.10	0.19	0.14
<i>bm_risk</i>		0.71	1.15	0.06	0.37	0.86	0.80

CRSP monthly raw stock buy-and-hold returns (*ret*) are required for the past 12 months. The forward three-year (years $t+1$ to $t+4$) cumulative percentage sales growth used to capture long-term growth (*ltgrowth*) in the study limits the total sample length by four years, resulting in a ten-year effective sample period 2007 – 2016. Finally, all included variables are winzorised at the 1st and 99th percentile. The final sample consists of 3 437 firms with 21 107 firm-year observations.

Table 3.2 presents descriptive statistics for each variable in the study across the sample. The cross-sectional variation in firm size, proxied via market equity (*me*), ranges from \$445 in Q1 to \$3 830 in Q3 with a median of \$1 250 and mean \$4 830. This indicates that the sample to a degree is biased towards fewer larger firms with higher market values. Observing the data,

and consistent with earlier work (Knudsen et al., 2017) multiples such as *evs* and other variables as *me*, *mv*, *bm_risk* (leverage), *ltgrowth*, *bm_innov* (*rdint*), *pmloss*, and *bm_market* exhibit some skewness in the cross section. Specifically, *bm_innov* (*rdint*) and *bm_market*. due to that along with common practice in the literature, missing values are replaced by zero, also leading to medians of zero due to that only ca. 38.9% of the firms in the sample report research and development expenses, and ca. 45% non-zero advertising costs.

3.8 Results

General efficacy of strategic peers within and across economic contexts

This subsection presents the main paper results and hypothesis tests of peer method efficacy based on homogeneity in monthly returns and annual fundamental factors following the Bhojraj et al. (2003) procedure described in the method section. These tests investigate efficacy for *BMQ* and *SARD_BM* strategic peers when compared to *Contextual peers* (*FLC*⁶³, *IND*⁶⁴ and *IND-FLC*).

Table 3.3 presents the result of the analysis. The peer group homogeneity outcomes show variation on independent variable levels between returns, valuation multiples, ratios and growth factors. As this paper assess peer approach efficacy based on average adjusted R^2 as in earlier work to test the posed hypotheses (e.g. Kaustia and Rantala, 2019), the results will be focused on the overall outcome⁶⁵, and with a few detailed observations at the variable level to keep the presentation brief.

For monthly returns (*ret*) the results suggest that while contextual peers offer the highest power for industry selected peers (25.7%), *SARD_BM* peers provide lower explanatory power than any contextually selected peers with 22.5% in the combined industry-life cycle context. *BMQ* formed peers on the other hand offer the highest power for returns in the combined industry-firm-life cycle context (30.1%). This suggests that growth options in markets are more related to industries. Moreover, since the *SARD_BM* approach is driven by structural fundamental factors defined at the economy level, it is also less likely to be able of explaining market-related performance.

⁶³ As described in methods, for *FLC* and *IND-FLC*, firm life cycle peers are defined as in Dickinson (2011).

⁶⁴ Following previous empirical studies, this paper applies the *GICS6* industrial scheme as reference benchmark due to its reported dominance over alternative industry classifications (e.g. Lee et al., 2015; Bhojraj et al., 2003).

⁶⁵ In untabulated tests based on medians, while absolute levels in returns, valuation multiples, ratios and growth factors are generally lower, the overall relative differences used in tests between peer methods remain similar.

Table 3.3 – Peer group homogeneity

The table reports comparison of peer group homogeneity via average adjusted R^2 for valuation multiples, ratios and fundamentals extending from Bhojraj et al. (2003) via cross-sectional regressions for each period t of base firms (i) and peer group means ($peer\ i$) in the form $Var_{i,t} = \alpha_i + \beta_i Var_{peer\ i,t} + \epsilon_{i,t}$ using annual financial statement data from COMPUSTAT and monthly market returns from CRSP between 2007 and 2016. Peer groups are formed in contexts on firm life cycle stages (FLC) following Dickinson (2011), GICS6 industries (IND) as in Bhojraj et al. (2003), and combined GICS6 industries and firm life cycle stage (IND-FLC). In each prior context (FLC, IND, and IND-FLC) and economy-wide (EW), peer groups for each firm are also formed using business model leanness deciles calculated sample-wide (BMQ), and using the SARD (SARD_BM) as in Knudsen et al. (2017) via five business model factors: Business model leanness (BM_Leam), Business model innovativeness (BM_innov), Business model market intensity (BM_eff) and Business model risk (BM_risk). In order to be included into contextually formed peers (FLC, IND and IND-FLC), as well as for BMQ and SARD_BM formed peers each context must hold more than six members. In the regressions, the dependent base firm and independent peer average variable is one of monthly returns (ret), or annual values of the multiples price-to-book (pb), enterprise-value-to-sales (evs), or price-to-earnings (pe), or one of the ratios return on net operating assets ($rnoa$), asset-turnover (at), profit-margin (pm), or leverage ($leverage$), or one of the growth indicators year-ahead realised sales growth ($salesgrowth$), long-term realised sales growth ($ltgrowth$) or research and development expenses-to-sales ($rdint$) as defined in Appendix 3.A. Following Lee et al. (2015) observations with negative net income before extraordinary items are excluded for regressions involving pe , and also for missing values of current assets, current liabilities and property, plant and equipment for $rnoa$. Two-tailed t-tests are performed on reported average adjusted R^2 . Adjusted R^2 rank vs. IND context per variable is in square brackets. The average annual cross-sectional regression size for each variable is represented by n . As in prior work, the highest adjusted R^2 in each variable is in boldface. Significance levels are indicated using *, **, and *** for 10%, 5%, and 1% levels.

	Context peers				BMQ peers			SARD_BM peers			
	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC
Returns											
<i>ret</i> ($n=18637$)	0.193*** [-0.064***]	0.257***	0.254*** [-0.003]	0.209*** [-0.048***]	0.196*** [-0.061***]	0.254*** [-0.003]	0.301*** [0.044***]	0.167*** [-0.090***]	0.161*** [-0.096***]	0.220*** [-0.037***]	0.225*** [-0.032***]
Valuation multiples											
<i>pb</i> ($n=1716$)	0.002 [-0.087***]	0.088***	0.094*** [0.006]	0.034*** [-0.055***]	0.028*** [-0.060***]	0.095*** [0.007]	0.156*** [0.068***]	0.273*** [0.185***]	0.209*** [0.121***]	0.162*** [0.074***]	0.152*** [0.064***]
<i>evs</i> ($n=1719$)	0.046*** [-0.220***]	0.266***	0.329*** [0.063***]	0.296*** [0.030***]	0.294*** [0.029***]	0.451*** [0.185***]	0.510*** [0.244***]	0.471*** [0.206***]	0.423*** [0.157***]	0.459*** [0.193***]	0.479*** [0.213***]
<i>pe</i> ($n=1184$)	0.004* [-0.037***]	0.041***	0.053*** [0.013***]	0.010*** [-0.031***]	0.014*** [-0.027***]	0.033*** [-0.008]	0.043*** [0.002]	0.042*** [0.001]	0.033*** [-0.007]	0.051*** [0.010]	0.044*** [0.004]
Fundamental ratios											
<i>rnoa</i> ($n=1690$)	0.032*** [-0.041***]	0.073***	0.092*** [0.019***]	0.038*** [-0.035***]	0.051*** [-0.022***]	0.073*** [0.000]	0.091*** [0.017]	0.157*** [0.084***]	0.133*** [0.060***]	0.147*** [0.073***]	0.132*** [0.059***]
<i>roe</i> ($n=1718$)	0.052*** [0.019***]	0.033***	0.049*** [0.016***]	0.010*** [-0.022***]	0.037*** [0.004]	0.044*** [0.011***]	0.070*** [0.037***]	0.300*** [0.267***]	0.251*** [0.218***]	0.160*** [0.127***]	0.125*** [0.092***]
<i>at</i> ($n=1728$)	0.089*** [-0.676***]	0.765***	0.825*** [0.060***]	0.903*** [0.139***]	0.905*** [0.140***]	0.913*** [0.148***]	0.934*** [0.170***]	0.874*** [0.109***]	0.831*** [0.066***]	0.913*** [0.148***]	0.896*** [0.131***]
<i>pm</i> ($n=1724$)	0.036*** [-0.173***]	0.209***	0.278*** [0.069***]	0.152*** [-0.057***]	0.186*** [-0.023***]	0.312*** [0.103***]	0.425*** [0.216***]	0.666*** [0.457***]	0.634*** [0.425***]	0.569*** [0.360***]	0.564*** [0.355***]
<i>leverage</i> ($n=1723$)	0.003 [-0.063***]	0.066***	0.070*** [0.004]	0.024*** [-0.042***]	0.026*** [-0.040***]	0.083*** [0.017]	0.084*** [0.018]	0.720*** [0.654***]	0.597*** [0.531***]	0.358*** [0.292***]	0.258*** [0.192***]
Growth indicators											
<i>salesgrowth</i> ($n=1717$)	0.032*** [-0.078***]	0.109***	0.154*** [0.044***]	0.020*** [-0.090***]	0.052*** [-0.057***]	0.122*** [0.013]	0.216*** [0.107***]	0.033*** [-0.077***]	0.058*** [-0.051***]	0.122*** [0.012]	0.157*** [0.048***]
<i>ltgrowth</i> ($n=1323$)	0.022*** [-0.037***]	0.059***	0.081*** [0.021***]	0.010*** [-0.050***]	0.024*** [-0.036***]	0.058*** [-0.002]	0.089*** [0.029***]	0.032*** [-0.027***]	0.043*** [-0.016]	0.053*** [-0.006]	0.072*** [0.013]
<i>rdint</i> ($n=1734$)	0.027*** [-0.482***]	0.508***	0.619*** [0.111***]	0.074*** [-0.434***]	0.092*** [-0.416***]	0.635*** [0.126***]	0.754*** [0.246***]	0.651*** [0.143***]	0.587*** [0.079***]	0.731*** [0.223***]	0.739*** [0.230***]
Average adj. R^2	0.045	0.206	0.242	0.148	0.159	0.256	0.306	0.366	0.330	0.329	0.320
Avg. diff. vs. SARD_BM (EW)	-0.321***	-0.159***	-0.124***	-0.217***	-0.207***	-0.109***	-0.059***	-0.035***	-0.037***	-0.037***	-0.045***

Turning to valuation multiples, while the combined industry-firm-life cycle peers provide the highest *pe* multiple with 5.3%, the economy-wide *SARD_BM* explains 27.3% of peer variation in *pb*, and *BMQ* in the combined industry-life context yields the highest value for *evs* (51%).

In terms of fundamental ratios, the economy-wide *SARD_BM*, given that its underlying variables are included in the homogeneity test (except *BM_market*) is biased, and hence offers the highest power with the exception of *at*, where *BMQ* in the combined industry-firm-life context at 93.4% remains higher for the same reason. Interestingly, firm life cycle peers appear to capture more variation in the *roe* than any other contextual peer at 5.2%, hinting to that capital structure and dividend policies could be related to firm development.

Generally, for all peer approaches, growth increases monotonically with higher specificity of industry-related context. This result is consistent with prior studies holding that growth is related to industry and studies arguing that growth is life cycle specific (e.g. Vorst and Yohn, 2018). The highest power in growth indicators is achieved for *BMQ* peers in the industry-firm-life cycle context, and *SARD_BM* peers appear to capture growth drivers slightly above contextually formed peers.

Power of strategic peers (H1 and H2)

The overall results from the homogeneity test points to that strategic peers formed using industry-firm-life cycle *BMQ* (adj. R^2 ca. 31%) and economy-wide *SARD_BM* (adj. R^2 ca. 37%) have on average higher explanatory power across included factors compared to any other contextual combination of peers as predicted. In part, and specific to this test, it is owed to that the operationalised models are based on ratios that are also included in the test. With these observations, the results are consistent with the first hypothesis (**H1**), supporting that at an overall level, strategic peers provide a higher general homogeneity over any of the contextually formed peers.

In respect to hypothesis **H2**, as predicted, univariately formed *strategic peers* capture less firm-specific variation of homogeneity compared to multivariate formed peers. An exception to this is that *BMQ* peers in the combined industry-firm-life cycle context appears to improve on *SARD_BM* peers in capturing fundamental and market-reflected growth. This can be explained by noting that the *BM_lean* factor (*at*) used to proxy for *BMQ peers* seems to provide a significant link to growth and it is likely that the equal-weighting of factors in the *SARD*-approach compromises the model's predictive performance.

Taken together, though the results suggest that *SARD_BM* is less associated with growth and stock returns, it provides an overall performance that exceeds any contextual formed peers, and capture more variation than *BMQ* peers that given the method's simplicity, offers a high performance across contexts provided by a single factor. In addition, firm life cycle as an independent peer selection approach seems to fall short with an overall performance of 4.5%, which is lower than industry context peers capturing 20.6% of the variation on average in returns and fundamentals, or in the combined industry and firm life cycle that accounts for 24.2% of the variation in the sample.

Peers within and across industry boundaries (H3 and H4)

The question whether strategic peers formed on business model dimensions within industry contexts can explain more homogeneity compared to strategic peers formed across industries in the economy is unanswered in the literature. The prediction made in hypothesis **H3** suggests that a higher degree of homogeneity should result by forming *BMQ* or *SARD_BM* peer groups within either industry or combined industry-firm-life cycle contexts compared to homogeneity when formed in the economy-wide or firm life cycle peer contexts independently. The results fail to support hypothesis **H3** for *SARD_BM* peers, while it holds for *BMQ* peers. Hence, in absolute terms it is not supported. It is also anticipated in hypothesis **H4** that strategic peers on business model dimensions in combined industry-firm-life cycle contexts, having a higher context specificity, provide higher degrees of homogeneity compared to groups formed on industry contexts alone. The outcome of this test is similar to that of hypothesis **H3**. One explanation for these results is that while homogeneity in all test variables for *BMQ* peers are monotonically increasing in industry-related contexts, and even more amplified in the more specific industry-firm-life cycle context suggesting that operating asset structures are linked to both industry and development stage, the *SARD_BM* approach while exhibiting the predicted relationships for growth indicators and market returns, provides reverse and mixed outcomes for ratios and valuation multiples. This is related to that the dimensions used to form firm-level relatedness in the *SARD_BM* approach are anchored in economy-wide similarity and hence exhibit a higher degree of context independence.

In sum, though these results suggest that both industries and combined industry-firm-life cycle contexts provide incremental ability to capture relatedness, and that forming peers on strategic (business model) dimensions can provide more homogenous formed peers, they also reveal the underlying challenge involved in providing a peer approach or homogeneity test that is able to capture universal firm- homogeneity among returns, multiples, ratios and growth variables.

Table 3.4 – Peer approach contextual stability

The table reports results for stability of peer approach homogeneity calculated using the results reported in Table 3.3 as variance of each variable and average adjusted R^2 for returns, valuation multiples, ratios, growth indicators and overall total across the economic contexts (*EW*, *FLC*, *IND*, *IND-FLC*) for *SARD_BM* peers, *BMQ* peers and *Context* peers (*FLC*, *IND*, *IND-FLC*). F-statistics for *BMQ* peer and *SARD_BM* peer variances compared to *Context* peer variance are reported for each variable and averages of returns, valuation multiples, ratios, growth indicators and overall total. Due to non-normality Kruskal-Wallis H tests were performed for adjusted R^2 in each variable and all average measures across economic contexts to establish significance of difference between the two pairs of peer groups. As in prior work, the lowest across context variance of average adjusted R^2 for homogeneity for each variable and overall is in boldface. Significance levels are indicated using *, **, and *** for 10%, 5%, and 1% levels.

	<i>Context peers</i>	<i>BMQ peers</i>		<i>SARD_BM peers</i>	
	<i>Var</i>	<i>Var</i>	<i>F-Statistic</i>	<i>Var</i>	<i>F-Statistic</i>
Returns					
<i>ret</i>	0.0147	0.0023	0.155	0.0011	0.077
Valuation multiples					
<i>pb</i>	0.0027	0.0036	1.322	0.0031	1.144
<i>evs</i>	0.0261	0.0121	0.462	0.0006	0.023
<i>pe</i>	0.0007	0.0002	0.339	0.0001	0.071
<i>Avg. multiples Var.adj. R²</i>	0.0064	0.0038	0.591	0.0004	0.060
Fundamental ratios					
<i>rnoa</i>	0.0017	0.0005	0.315	0.0001	0.082
<i>roe</i>	0.0006	0.0006	1.056	0.0065	11.582
<i>at</i>	0.1897	0.0002	0.001	0.0012	0.006
<i>pm</i>	0.0180	0.0156	0.867	0.0025	0.139
<i>leverage</i>	0.0015	0.0011	0.770	0.0451	30.584
<i>Avg. ratios Var.adj. R²</i>	0.0173	0.0019	0.107	0.0043	0.247
Growth indicators					
<i>salesgrowth</i>	0.0049	0.0076	1.527	0.0033	0.657
<i>ltgrowth</i>	0.0013	0.0013	0.959	0.0003	0.216
<i>rdint</i>	0.1031	0.1271	1.232	0.0052	0.050
<i>Avg. growth Var.adj. R²</i>	0.0201	0.0250	1.239	0.0021	0.105
<i>Avg. total Var.adj. R²</i>	0.0156	0.0059	0.375	0.0005	0.033
<i>Diff. Var.adj. R² vs. Context peers</i>		-0.0097***		-0.0151***	

Peer group stability across economic contexts (H5)

In line with that business model related peers should be less dependent on changes of industry classifications that might not be updated sufficiently, hypothesis **H5** argued that homogeneity for strategic peers should be both higher and robustly more stable across economy-wide (*EW*) and industry contexts (*IND*). To investigate this prediction the variance in homogeneity across the economic contexts (*EW*, *FLC*, *IND*, *IND-FLC*) is calculated using the data in Table 3.3 for *Contextual* peers, *BMQ* peers and *SARD_BM* peers for each variable in the homogeneity test summarised as averages of monthly returns as well as of annual valuation multiples, ratios, and growth indicators. F-statistics are calculated to establish relative indicative measure of the pair-wise differences between *BMQ* peers respective *SARD_BM* peers and *Contextual* peers. Kruskal-Wallis H tests are performed and significance reported for the pair-wise differences between the *BMQ* peers and *SARD_BM* compared to the *Contextual* peers. The Kruskal-Wallis test is selected as the underlying data is non-normal.

The results from the test is reported in Table 3.4. Following the test strategy, the question of peer group stability is assessed on an overall level across returns, ratios, multiples and growth variables, following some observations. The *SARD_BM* and *BMQ* formed peers have the lowest variation in each variable across economic contexts with the exception for *pb* and *roe*. Furthermore, *BMQ* peers exhibits lower variation compared to *SARD_BM* peers for ratio variables with the exception of *rnoa*.

Overall and consistent with the prediction underlying hypothesis **H5**, each of the strategic peers operated on business model dimensions have a considerably lower variation across the economic contexts, with *BMQ* peers exhibiting only 37.5% and *SARD_BM* peers 3.3% of the variation compared to peers formed directly in the contexts.

Intra-peer-group variance

Next, as low group variation in peer groups are desired, an intra-peer-group variance test is applied to explore how tight-knitted *strategic peers* are compared to GICS6 industry peers as benchmark across the same sets of peers as in the homogeneity tests.

In the intra-group variation test, this paper extends the original Guenther and Rosman (1994) approach to capture variation in each of the monthly returns and annual fundamental variables used in the homogeneity test, following the rationale that it increases the comparability across the tests and its precision. In addition, given that the sample appears right-skewed, this test relies on medians of F-statistics for the ratio between peer group variation and industry variation. The test argues that a F-statistic less than one signifies a more close-knitted group compared to that of industry peers.

The results from the intra-peer-group variance test are reported in Table 3.5. With the average pooled F-statistic results across returns, multiples, ratios and growth drivers, it is shown that *SARD_BM* selected strategic peers provide groups of firms with group variance as low as 53.5% compared to those based on *BMQ* peers with 63.9%, relative to industry peers. It also evident that combining industry and firm life cycle to form peer groups results in an average of 80.9% compare to industry formed peers. However, firms selected solely on firm life cycle stage underperforms industry, with a variance on average 33.8% higher than that of industry peers. These results also reveal that multivariate formed *SARD_BM* captures more similarity and achieves a more coherent peer group on average across the test variables compared to the univariate *BMQ* peers.

Table 3.5 – Intra-peer-group variance

This table reports pooled F-statistics for the main intra-peer-group variance test following Guenther and Rosman (1994) applying the same set of returns, valuation multiples, ratios and growth fundamentals used in Bhojraj et al. (2003) in Table 3.3 and using annual financial statement data from COMPUSTAT and monthly market returns from CRSP between 2007 and 2016. Peer groups in the main intra-peer-group variance test are formed in contexts on firm life cycle stage (*FLC*) following Dickinson (2011), GICSE industries (*IND*) as in Bhojraj et al. (2003), and combined GICSE industries and firm life cycle stage (*IND-FLC*). In each context (*FLC*, *IND*, and *IND-FLC*) and economy-wide (*EW*), peer groups for each firm are also formed using business model leanness deciles calculated sample-wide (*BMQ*), and using the SARD (*SARD_BM*) as in Knudsen et al. (2017) via five business model factors: Business model leanness (*BM_leann*), Business model innovativeness (*BM_innov*), Business model market intensity (*BM_market*), Business model efficiency (*BM_eff*) and Business model risk (*BM_risk*). In order to be included into contextually formed peers (*FLC*, *IND* and *IND-FLC*), as well as for *BMQ* and *SARD_BM* formed peers each context must hold more than six members. Pooled F-statistics for each valuation multiple, ratio and fundamental variable is tabulated together with average F-statistic used to assessment overall performance for each peer selection approach. Two-tailed t-tests are performed on the pooled averages of F-statistics. Degrees of freedom are given in square brackets. The lowest F-statistic representing the most collected peer group for each variable and overall is in boldface. Significance levels are indicated using *, **, and *** for 10%, 5%, and 1% levels.

	Context peers				BMQ peers				SARD_BM peers			
	<i>FLC</i>	<i>IND</i>	<i>IND (benchmark)</i>	<i>IND-FLC</i>	<i>EW</i>	<i>FLC</i>	<i>IND</i>	<i>IND-FLC</i>	<i>EW</i>	<i>FLC</i>	<i>IND</i>	<i>IND-FLC</i>
Returns												
<i>ret</i>	1.149*** [228403]	1.000 [242655]		0.886*** [181019]	1.168*** [245638]	1.089*** [220478]	0.746*** [144321]	0.631*** [63720]	0.856*** [196609]	0.865*** [181939]	0.787*** [195436]	0.760*** [149927]
Valuation multiples												
<i>pb</i>	1.339*** [19696]	1.000 [20981]		0.852*** [15678]	1.354*** [21165]	1.233*** [19030]	0.387*** [12623]	0.234*** [5489]	0.570*** [20442]	0.592*** [18820]	0.678*** [19979]	0.636*** [14940]
<i>evs</i>	1.269*** [19658]	1.000 [20909]		0.763*** [15639]	1.200*** [21237]	0.993*** [19094]	0.699*** [12727]	0.609*** [5530]	0.520*** [20497]	0.547*** [18843]	0.527*** [20057]	0.440*** [14959]
<i>pe</i>	1.147*** [16017]	1.000 [16934]		0.774*** [12668]	1.213*** [17266]	1.026*** [15448]	0.736*** [9230]	0.551*** [4280]	0.388*** [11568]	0.454*** [10141]	0.455*** [9388]	0.395*** [7318]
Fundamental ratios												
<i>rnoa</i>	0.829*** [19405]	1.000 [20684]		1.095*** [15392]	0.864*** [20859]	0.824*** [18735]	1.539*** [12325]	1.842*** [5210]	0.527*** [18692]	0.524*** [17147]	0.527*** [18509]	0.535*** [13622]
<i>roe</i>	0.957*** [19615]	1.000 [20881]		0.741*** [15622]	1.168*** [21064]	0.911*** [18953]	0.576*** [12565]	0.424*** [5483]	0.494*** [20205]	0.504*** [18602]	0.540*** [19651]	0.494*** [14762]
<i>at</i>	3.040*** [19594]	1.000 [20849]		0.726*** [15584]	0.371*** [21290]	0.353*** [19145]	0.858*** [12775]	0.853*** [5557]	0.375*** [20774]	0.558*** [19093]	0.266*** [20319]	0.367*** [15169]
<i>pm</i>	1.023* [19628]	1.000 [20915]		0.953*** [15632]	1.154*** [21106]	0.780*** [18964]	0.796*** [12628]	0.707*** [5441]	0.338*** [20774]	0.358*** [19093]	0.373*** [20319]	0.382*** [15169]
<i>leverage</i>	1.357*** [19621]	1.000 [20895]		0.911*** [15589]	1.347*** [21085]	1.295*** [18956]	0.607*** [12558]	0.527*** [5469]	0.355*** [20774]	0.449*** [19093]	0.665*** [20319]	0.697*** [15169]
Growth indicators												
<i>salesgrowth</i>	1.024** [19736]	1.000 [21030]		0.765*** [15704]	1.216*** [21212]	1.015*** [19071]	0.699*** [12736]	0.574*** [5539]	0.855*** [20339]	0.825*** [18673]	0.752*** [19912]	0.665*** [14918]
<i>ltgrowth</i>	1.022* [16261]	1.000 [17231]		0.813*** [12468]	1.176*** [17531]	0.983*** [19352]	0.810*** [9356]	0.646*** [4087]	0.674*** [6560]	0.626*** [5815]	0.668*** [6644]	0.586*** [4962]
<i>rdint</i>	1.905*** [19810]	1.000 [21106]		0.432*** [15780]	3.025*** [21290]	1.617*** [19145]	0.289*** [12775]	0.071*** [5557]	0.979*** [20774]	1.116*** [19093]	0.697*** [20319]	0.460*** [15169]
<i>Pooled F-statistic</i>	1.338	1.000		0.809	1.271	1.010	0.729	0.639	0.578	0.618	0.578	0.535

Discussion of main results

Taken together, these results suggest that peer firms selected on strategic dimensions as in the paper business model dimensions, have explanatory power in the cross-section of monthly returns and annual fundamental factors over industry, firm life cycle or combined industry-firm life cycle selected peers. Specifically, the outcome of both the intra-variance and homogeneity tests indicates that firm life cycle stages, while seemingly effective in interaction with fundamental and strategic factors, appears not to be a suitable approach for peer forming on their own. Moreover, consistent with earlier studies on accounting-similarity, the *SARD_BM* approach offers a peer selection approach that provides both a higher degree of homogeneity in cross-section and lower group variation on most fundamental factors in the tests. The reliance on economy-anchored structural dimensions in the *SARD_BM* also provides a degree of context-independence.

Valuation accuracy of strategic peers

Given the importance of peer selection to multiples-based comparative valuation, this section consistently with previous work, and to help answer the second paper question, explores how strategic peers perform when compared to established relative valuation approaches in the literature in terms of valuation accuracy. Hence, the highest performing strategic peers from the main test, industry-firm-life cycle *BMQ*, economy-wide and industry-firm-life cycle *SARD_BM* strategic peer⁶⁶ approaches are benchmarked with two multivariate methods modelled on valuation theory and developed specifically for the purpose of comparable valuation that are reported to provide high performance: the recently proposed value-driven *SARD* approach (Knudsen et al., 2017) – *SARD_KN* – and the Warranted Multiple regression method (Bhojraj and Lee, 2002) – *WARR*. Following prior work and as described in the method section, valuation accuracy is examined using absolute percentage error (*APE*) in mean, along with median and interquartile range of absolute percentage valuation errors for the four commonly featured valuation multiples enterprise-value-to-sales (*evs*), price-to-earnings (*pe*), and price-to-book (*pb*) and enterprise-value-to-ebit (*ev/ebit*) following the procedure in Knudsen et al. (2017). In this examination, the assessment of overall valuation accuracy performance is focused on mean of the absolute errors (*MAPE*) across each of the selected valuation multiples.

⁶⁶ The life-cycle only context was eliminated from tabulated and reported results in further tests as life-cycle information in line with outcome from the first homogeneity and intra-group tests shows consistently lower cross-sectional adjusted R^2 and higher intra-group variation compared to industry formed peers.

Table 3.6 – Absolute percentage valuation errors (valuation accuracy)

The table reports median, mean and interquartile range of absolute percentage valuation errors for selected peer forming approaches between base firm and peer-predicted values across common valuation multiples for each multiple and as average over all multiples to assess overall performance of each peer selection approach following prior research (e.g. Knudsen et al., 2017). The peer selection approaches are the economy-wide and industry-firm-life cycle *SARD_BM*, industry-firm-life cycle *BMQ*, the warranted multiple regression approach (*WARR*) by Bhojraj and Lee (2002) and the value-driven *SARD* (*SARD_KN*) introduced by Knudsen et al. (2017). *WARR* and *SARD_KN* peer groups are formed in economy-wide (*EW*), industry-specific (*IND*) and combined industry-firm-life cycle (*IND-FLC*) contexts. The firm life cycle (*FLC*) context was excluded in these tests due to low performance in untabulated tests. Peer groups for industry-firm-life cycle *BMQ* peers are formed using business model leanness sample-wide deciles, and *SARD_BM* peers via five business model factors: Business model leanness (*BM_lean*), Business model innovativeness (*BM_innov*), Business model market intensity (*BM_market*), Business model efficiency (*BM_eff*) and Business model risk (*BM_risk*) and applying the *SARD* approach in Knudsen et al. (2017). Warranted Multiple peers (*WARR*) are regressed annually following procedure in Bhojraj and Lee (2002) using GICS6 industry instead of SIC2. Value-driven *SARD* peers (*SARD_KN*) are formed using variables and general procedure as in Knudsen et al. (2017). In order to be included in the sample, each context (*EW*, *IND*, *IND-FLC*) must contain more than six firms for each of the *SARD_BM*, *SARD_KN* and *WARR* approaches. For *BMQ* deciles more than six members are required in the industry-life-cycle context. The multiples are calculated using annual financial statement data from COMPUSTAT between 2007 and 2016 with winsorizing at 1% and 99%. The enterprise-value-to-sales (*evs*), price-to-earnings (*pe*), price-to-book (*pb*), and enterprise-value-to-ebit (*ev/ebit*) multiples are defined in Appendix 3.A. **Panel A** reports median absolute percentage errors, **Panel B** reports mean absolute percentage errors with W-statistic (and t-test significance) from Shapiro-Wilks normality tests in square brackets, and finally, **Panel C** reports interquartile range absolute percentage errors. The lowest valuation errors are shown in boldface for each multiple and for lowest average to assess overall performance for each peer selection approach. Significance is calculated using the Wilcoxon signed-rank test and significance levels are indicated using *, **, and *** for 10%, 5%, and 1%.

	<i>BMQ peers</i>	<i>SARD_BM peers</i>		<i>WARR peers</i>			<i>SARD_KN peers</i>		
	<i>IND-FLC</i>	<i>EW</i>	<i>IND-FLC</i>	<i>EW</i>	<i>IND</i>	<i>IND-FLC</i>	<i>EW</i>	<i>IND</i>	<i>IND-FLC</i>
Panel A - Median absolute percentage error (Median APE)									
<i>pb</i>	0.312***	0.316***	0.335***	0.352***	0.317***	0.313***	0.388***	0.341***	0.329***
<i>evs</i>	0.291***	0.244***	0.295***	0.400***	0.365***	0.368***	0.538***	0.367***	0.360***
<i>pe</i>	0.263***	0.291***	0.262***	0.325***	0.283***	0.273***	0.328***	0.265***	0.264***
<i>ev/ebit</i>	0.231***	0.224***	0.223***	0.278***	0.241***	0.238***	0.255***	0.217***	0.216***
Average median APE	0.274	0.269	0.279	0.339	0.302	0.298	0.377	0.298	0.292
Panel B - Mean absolute percentage error (MAPE)									
<i>pb</i>	0.413*** [0.687***]	0.413*** [0.695***]	0.434*** [0.709***]	0.457*** [0.690***]	0.414*** [0.662***]	0.403*** [0.690***]	0.493*** [0.702***]	0.443*** [0.697***]	0.431*** [0.732***]
<i>evs</i>	0.361*** [0.736***]	0.324*** [0.674***]	0.394*** [0.537***]	0.562*** [0.430***]	0.505*** [0.452***]	0.511*** [0.412***]	0.729*** [0.516***]	0.506*** [0.438***]	0.518*** [0.409***]
<i>pe</i>	0.365*** [0.635***]	0.405*** [0.582***]	0.364*** [0.600***]	0.440*** [0.637***]	0.391*** [0.668***]	0.377*** [0.653***]	0.429*** [0.675***]	0.370*** [0.632***]	0.370*** [0.647***]
<i>ev/ebit</i>	0.312*** [0.780***]	0.291*** [0.787***]	0.301*** [0.758***]	0.369*** [0.795***]	0.329*** [0.733***]	0.321*** [0.778***]	0.325*** [0.836***]	0.293*** [0.806***]	0.297*** [0.762***]
Average mean APE	0.363	0.358	0.373	0.457	0.410	0.403	0.494	0.403	0.404
Panel C – Interquartile (IQR) absolute percentage error (IQR APE)									
<i>pb</i>	0.394***	0.394***	0.409***	0.401***	0.382***	0.375***	0.452***	0.419***	0.408***
<i>evs</i>	0.353***	0.319***	0.370***	0.434***	0.417***	0.425***	0.491***	0.446***	0.445***
<i>pe</i>	0.376***	0.381***	0.354***	0.401***	0.372***	0.364***	0.413***	0.366***	0.366***
<i>ev/ebit</i>	0.316***	0.292***	0.302***	0.358***	0.327***	0.325***	0.337***	0.311***	0.311***
Average IQR APE	0.360	0.347	0.359	0.399	0.375	0.372	0.423	0.386	0.383

Table 3.6 presents the results, with panel B reporting the outcome for mean absolute percentage errors (*MAPE*). Overall, the economy-wide *SARD_BM* peer approach ranks first and offers the lowest average of the average *MAPE* across the four valuation multiples with 35.8%, and industry-firm-life cycle *BMQ* ranking closely second with an average *MAPE* of 36.3%. In these

tests *SARD_KN* only outperforms *WARR* in the industry context, while being reasonably on par in the combined industry-firm-life cycle context, and exhibiting a 3.7% higher error in the overall economy. Generally, as can be seen, *SARD_KN* seems to perform better than *WARR* for *ev/ebit* and *pe*, while the opposite is true for *pb* and *evs*. In fact, the only variable where *WARR* has the lowest *MAPE* compared to a strategically formed peer is *pb* (40.3%). The valuation performance is dominated by the economy-wide *SARD_BM*, that provides the lowest *MAPE* in both *evs* and *ev/ebit*, while *pe* yields a lower *MAPE* in the industry-firm-life cycle *SARD_BM* context.

In sum, these results indicate that *strategic peers* offer a marginally higher valuation accuracy in *MAPE* compared to both *WARR* and *SARD_KN* at ca. 40%, with the unidimensional industry-firm-life cycle *BMQ* offering an overall lower valuation error at ca. 37.3% closely compared to the economy-wide *SARD_BM* approach at ca. 35.8%. Though the economic benefits of *strategic peers* in absolute terms appear relatively small (4.0 – 4.6%), an interesting observation is that *BMQ*, despite the simplicity of the approach appears to provide a valuation accuracy on par with more complex methods such as *WARR* and *SARD_KN*. The median and interquartile *APE* measures in panels A and C provide similar results, with median (typical) *APE* values providing the lowest errors.

3.9 Additional analyses

In this section additional tests are reported that assess how variation in size of peer groups and choice of peer selection estimation method impact on the results of the proposed method.

Peer group size (*N*)

Following earlier studies (e.g. Knudsen et al., 2017) the effect resulting from different peer group size is examined in a more extensive scenario, by not only varying the peer group size between six and sixteen firms in increments of two extending from Knudsen et al. (2017)⁶⁷, but also by providing this variation across four economic contexts (*EW*, *FLC*, *IND*, and *IND-FLC*).

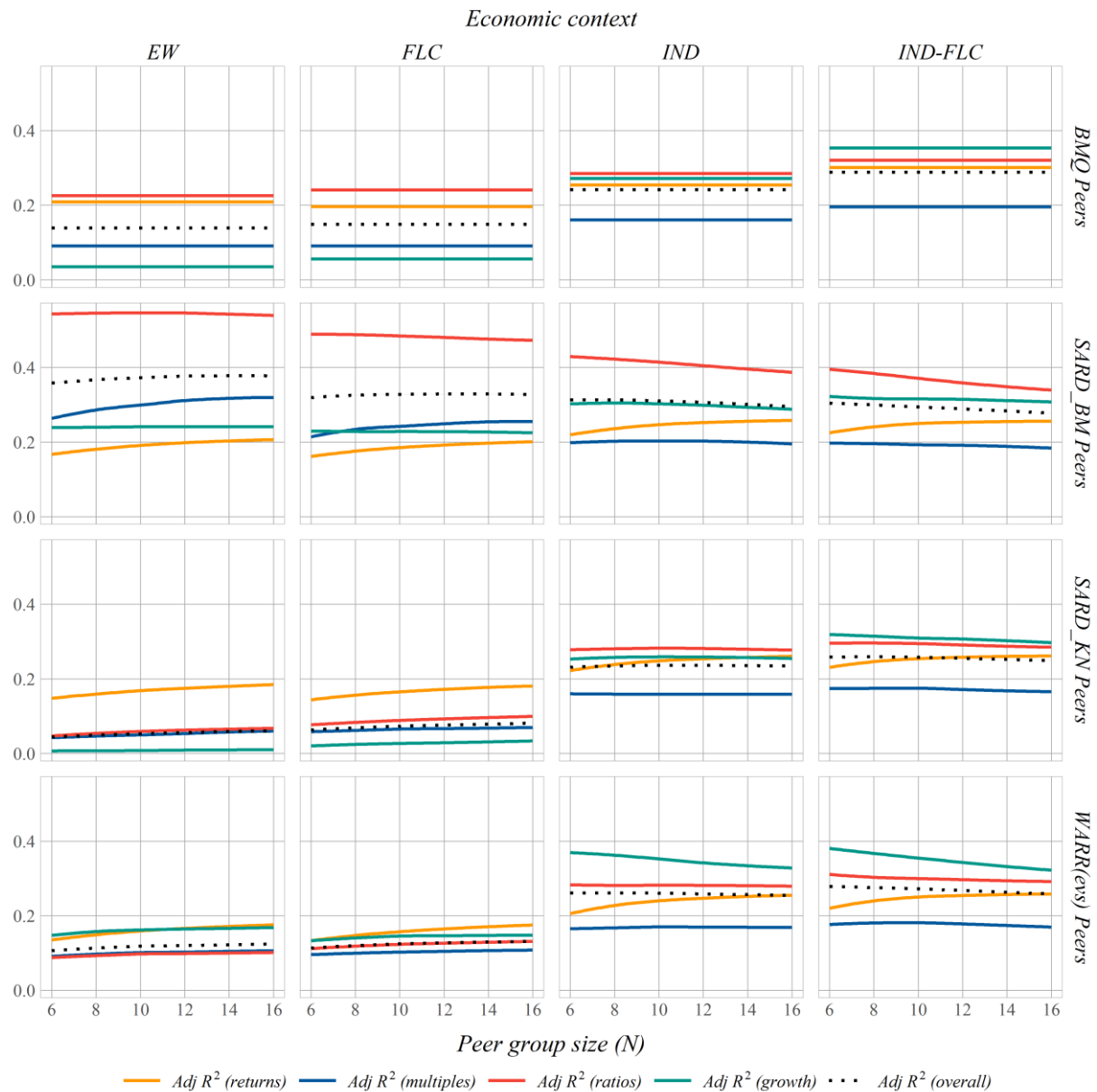
In order to provide an overview of robustness, the 12 variables in the peer group homogeneity tests following Bhojraj et al. (2003) are reduced into averages based on the four performance categories returns, multiples, ratios and growth. In addition, the overall average of these performance categories is calculated.

⁶⁷ Knudsen et al. (2017) provide up to peer group size up to 22, however, note also stability from sixteen.

As contextual peers use all available firms they are excluded from this test (no variation) that examines peer group size effects in *BMQ* peers, *SARD_BM* peers and the two performance-driven peer approaches in the valuation accuracy comparison – *SARD_KN* and *WARR*. As the *WARR* approach is predictive on a dependent variable (e.g. *evs*, *pe*, *pb* or *ev/ebit*), only the *WARR(evs)* is included motivated by the need to keep the presentation brief and also by that *evs* is commonly featured in the literature.

Peer group homogeneity in the four performance categories (returns, multiples, ratios, growth) for the selected peer approaches across economic contexts and peer group sizes are provided in Figure 3.4 with detailed data available in Appendix 3.B (Table 3.B.1).

Figure 3.4 – Homogeneity (*average adj. R²*) across strategic contexts and different peer group sizes



In this examination while treating *BMQ* as a reference⁶⁸, the sensitivity of *SARD_BM*-formed peers not only depends on the performance category, but also on the economic context. For example, ratios are showing low variation in the economy-wide context with increasing variation with peer group size and more specific context. On the contrary, both multiples and returns becomes less sensitive as the contexts becomes more specific consistent with findings in the literature. Growth is reasonably stable across groups size for economy and firm life cycle contexts, but exhibits a decreasing tendency with increasing peer group size in industry and combined industry-firm-life cycle contexts. The patterns are similar for *WARR(evs)* and *SARD_KN* approaches, and consistent with Knudsen et al. (2017), *SARD_KN* appears fairly robust, while *WARR(evs)* seems to be less stable in the industry and industry-firm-life cycle contexts. Overall, while the results seem to indicate a level of robustness, it is also evident that peer context, choice of variables and peer approach are trade-offs and sensitive to group size.

SARD_KN* compared to *SARD_BM

As an additional exploration, the *SARD_KN* and *SARD_BM* approaches are compared to investigate if the performance of *SARD_BM* in this paper is to a convincing part due to that the strategic variables used to proxy for business model dimensions are capturing firm-level relatedness, or if the performance is mostly due to the choice of the *SARD* method itself.

In order to answer this question, the paper compares peer group homogeneity and intra-peer-group variance across the 12 variables within their four performance categories similar to the previous peer group size test. The explorative results are illustrated in two pair-wise figures across economic contexts with peer group homogeneity shown in Figure 3.5 and intra-peer-group variance in Figure 3.6. The differences in homogeneity are clearly visible. While the *SARD_KN* seems to exhibit lower economy-wide homogeneity that increases with industry and industry-firm-life cycle contexts, the factors driving the *SARD_BM* model appear highly stable across contexts with the notable exception of ratios that due to the nature of the fundamental dimensions used in the approach provide the highest homogeneity in the economy-wide context. Turning to intra-peer-group variance reveals that there are even larger differences between the two methods. Not only does *SARD_BM* seem to provide higher stability across the contexts, but also comparably lower internal variation. This suggests that while the factors used in the *SARD_KN* approach require an industry (or industry-firm-life cycle) context to provide

⁶⁸ Strictly, *BMQ* formed peers are defined as deciles and also using all firms in the group forming context as described in the methods section. They are included to provide a comparability of overall performance.

tightly knitted peer groups, the *SARD_BM* approach, provides tighter peer groups already in the economy-wide context that further improves in the industry setting. Notable, the results suggest that multiples and ratios provide the smallest intra-group variation when selected in the economy, while growth and market returns improve with industry context specificity. Taken together, there appears to exist distinct differences between the two approaches other than the application of SARD alone.

Figure 3.5 – Homogeneity (*avg. adj. R²*) variation across economic contexts: *SARD_KN* and *SARD_BM*

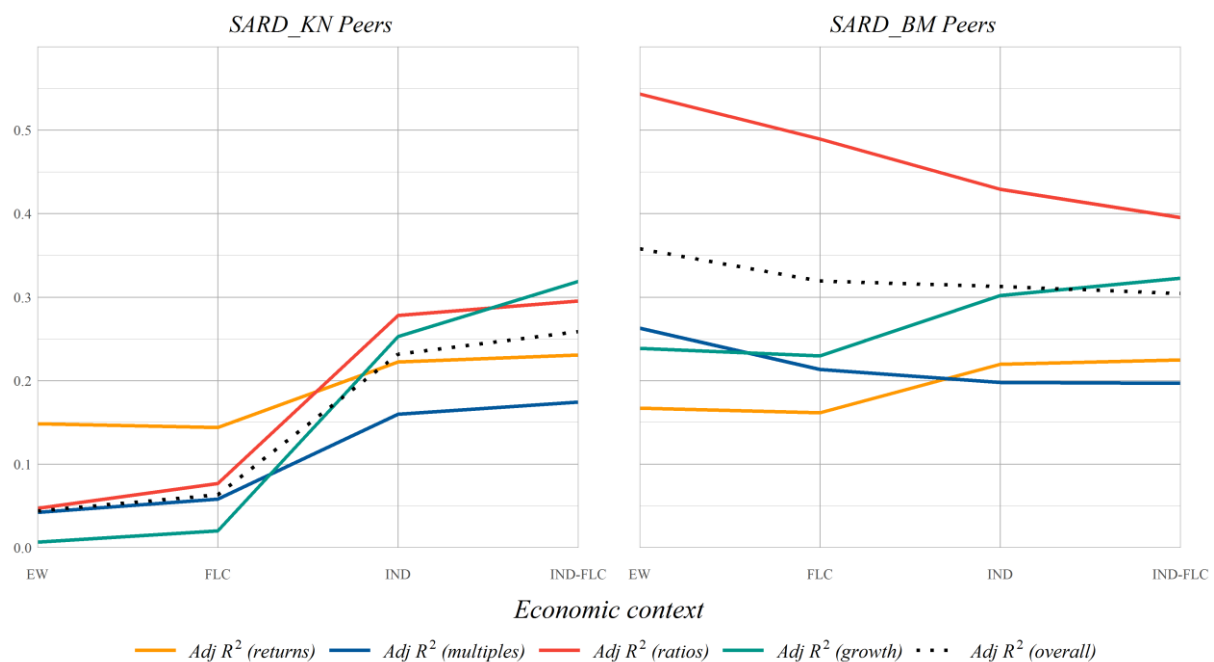
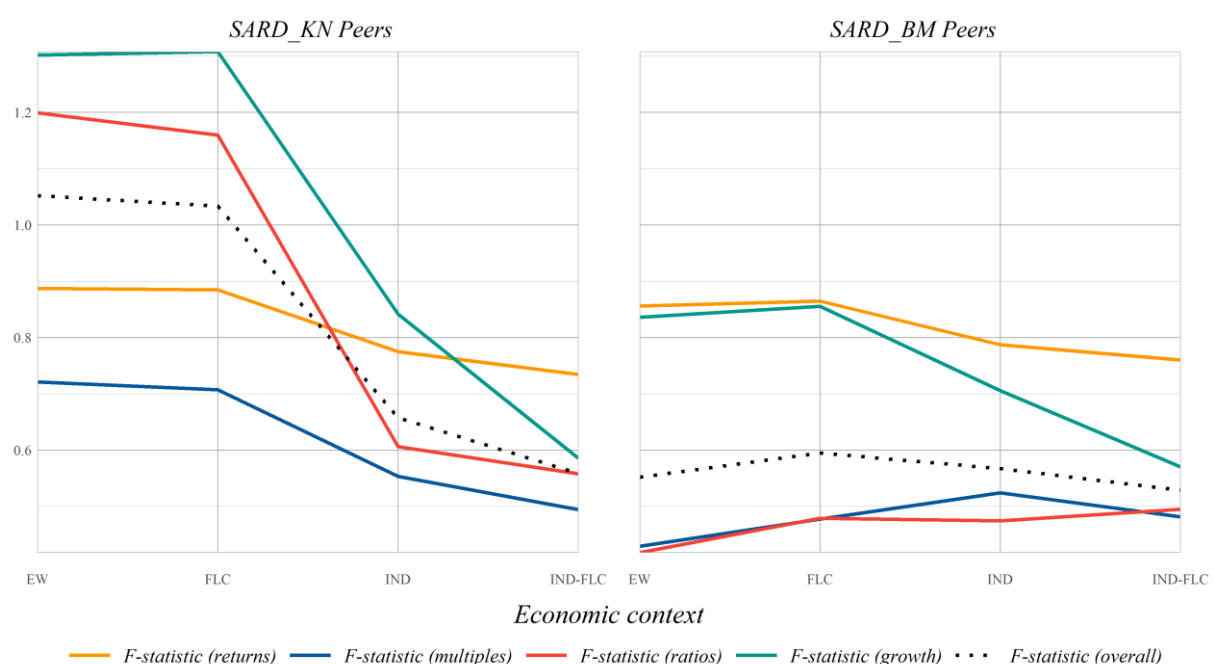


Figure 3.6 – Intra-group-variation (*avg. F-statistic*) variation across economic contexts: *SARD_KN* and *SARD_BM*



3.10 Conclusions

The inconsistencies and importance of peer selection to identification of comparable firms due to their relevance for relative valuation motives this paper to propose and examine a novel method of firm relatedness based on strategic similarity operationalised through business model dimensions – *strategic peers*.

In extending from the current development in the accounting similarity literature, and taking a strategic management perspective, the paper argues that comparability of firm performance can be perceived as a function of relatedness of economic events (*economic similarity*) in markets or industry contexts, resemblance of the accounting decisions (*accounting similarity*) and similarity of strategic choices (*strategic similarity*). More specifically, it claims that business models are outcomes of strategic choice, and suggests that forming peer groups within and across industry boundaries or firm life cycle contexts based on strategic dimensions that capture structural relatedness associated with business models in the literature can provide a *third dimension of firm similarity* that complements economic and accounting dimensions of relatedness in the peer selection context.

In addition, the paper contributes to the current debate in the strategic management literature by investigation the alluded relationship between strategic groups and business models. The theoretical analysis supports the suggested relatedness, and moreover, shows that the business model concept could provide a useful level of analysis that is not only, in line with the traditional view of strategic groups, limited to intra-industry analysis, but also given the evidence in the literature, could offer a group concept across industry boundaries.

The empirical results presented in this paper provide consistent evidence in support of the argument that peers formed on strategic dimensions related to business models appear to be able to capture a large share of the overall variation across the explanatory variables representing market returns, multiples, ratios and growth. In light of the results, a potential application for the proposed peer selection approach would be as alternative or complementary procedure for valuation of new firms where traditional methods are less effective due to lack of financial history, but where business model dimensions and for example industry sectors can be effectively identified.

Though the results are promising and present researchers, practitioners and analyst with an additional approach to identifying and generate groups of economically similar firms, the paper

comprise an early contribution to application of strategic choice and business model relatedness in the selection of comparable firms, and a number of limitations are in order. For example, even though peers seem stable in variation of peer groups, the standard use of same size peer groups in this and in other studies such as a fixed number of closest ranked peers (e.g. in SARD or WARR) or a whole economic context (e.g. industry), is a limitation that at worst could introduce degrees of inconsistency and low representative value of the peers comparability in e.g. valuation multiples. Moreover, though both intra-variance and valuation accuracy tests confirm the relevance of the proposed peer approach, since the strategic dimensions are based on economy-anchored ratios, they become biased in the homogeneity test that includes four out of five of the ratios, suggesting future consideration of alternative factors and tests. Another limitation due to the early nature of the tests of the peer method is that there has been no control in the sample for firms that either operate within multiple industries or are active with multiple business models. This limitation is due to challenges to access this information in a large sample. Lastly, as the sample is based on listed firms following earlier studies, it also inherently limits the understanding of how strategic dimensions in privately held firms can be operationalised for peer selection.

Looking ahead, there are a number of directions that could provide for future research. First, as noted in the paper, the choice and number of strategic dimensions used in the models to represent business model elements, though consistently grounded in and justified through prior work, has not been explored for optimal fit or explanatory performance. This limitation leaves the possibility for a more suitable model leading to improvements in for example valuation accuracy that could be addressed in future work. Second, as the results suggest that the multivariate *SARD_BM* model appears less sensitive to growth in fundamental factors and market returns compared to the univariate *BMQ* model, it could provide for future research to explore a weighted strategy in order to obtain a more balanced impact from the strategic dimensions applied. Third, and a question that remains for future research from this study is whether the peers selected on strategic dimensions are also true representations of strategic groups. As this paper has only concerned itself with strategic similarity as a means to for representative business model groups, future research could explore if the variables tested in this paper can be extended to contribute to the strategic group literature via e.g. adding firm variables from empirical studies to control for actual business models in samples of firms.

Appendix 3.A – Variable definitions

Table 3.A.1 – Variable definitions. This table reports all variables used in the paper. Market data is from the CRSP monthly set. Financial statement information is from the COMPUSTAT North America daily updates set, collected annually at the end of December of each year. COMPUSTAT data items are provided in square brackets. Variable definitions unless noted are defined as in Bhojraj et al. (2003) with exception of all industry variables that are estimated using six-digit GICS codes.

Label (alt. label)	Description	Measurement definition
<i>me (size)</i>	Market value of equity (Market capitalization)	Share price [<i>prcc</i>] x Shares outstanding [<i>csho</i>] (e.g. Knudsen et al., 2017)
<i>mv (ev)</i>	Enterprise value (Firm market value)	Market value of equity (<i>me</i>) plus long-term debt [<i>dltt</i>] and debt in current liabilities [<i>dlc</i>] (Bhojraj and Lee, 2002)
<i>ret</i>	Monthly returns	Monthly buy-and-hold return using CRSP monthly files, <i>ret</i>
<i>evs</i>	Enterprise-value-to-sales	Enterprise value (<i>mv</i>) / net sales [<i>sale</i>]
<i>pb</i>	Price-to-book value	Market value of equity (<i>me</i>) / total common equity [<i>ceq</i>]
<i>pe</i>	Price-to-earnings	Market value of equity (<i>me</i>) / net income before extraordinary items [<i>ib</i>]
<i>ev/ebit</i>	Enterprise-value-to-ebit	Enterprise value (<i>mv</i>) / operating Income after depreciation [<i>oiadp</i>], *
<i>rnoa</i>	Return on net operating assets	Operating Income after depreciation [<i>oiadp</i>] / (property, plant, and equipment [<i>ppent</i>] plus current assets [<i>aco</i>] minus current liabilities [<i>lco</i>])
<i>roe</i>	Return on equity	Net income before extraordinary items [<i>ib</i>] / total common equity [<i>ceq</i>]
<i>at</i>	Asset turnover	Total assets [<i>at</i>] / net sales [<i>sale</i>], **
<i>pm (ebit)</i>	Profit margin	Operating Income after depreciation [<i>oiadp</i>] / net sales [<i>sale</i>]
<i>leverage</i>	Leverage	Long-term debt [<i>dltt</i>] / total shareholder equity [<i>seq</i>]
<i>ltgrowth</i>	Long-term growth (<i>cum. realised</i>)	Year-ahead three-year cumulative percentage sales growth (between <i>year t+1</i> and <i>year t+4</i>), adapted from Grullon et al. (2012), ***
<i>salesgrowth</i>	Percentage year-ahead sales growth	Net sales [<i>sale</i>] (<i>year t+2</i>) / net sales [<i>sale</i>] (<i>year t+1</i>) less one
<i>rdint</i>	R&D intensity	Research and development expenses [<i>xrd</i>] / net sales [<i>sale</i>]
<i>indevs</i> <i>indpb</i> <i>indpe</i> <i>indevebit</i>	Harmonic mean of industry <i>evs</i> , <i>pb</i> , <i>pe</i> and <i>ev/ebit</i>	Industry harmonic means of enterprise-value-to-sales, price-to-book, price-to-earnings and enterprise-value-to-ebit (Bhojraj and Lee, 2002)
<i>adjpm</i>	Industry-adjusted profit-margin	Difference in Profit margin (<i>pm</i>) between base firm <i>i</i> and industry median (Bhojraj and Lee, 2002)
<i>pmloss</i>	Loss indicator for <i>adjpm</i>	Calculated equal to <i>adjpm</i> if <i>adjpm</i> is zero or negative, else zero (Bhojraj and Lee, 2002)
<i>adjgro</i>	Industry-adjusted long-term growth	Difference in Long-term growth (<i>ltgrowth</i>) between base firm <i>i</i> and industry median (Bhojraj and Lee, 2002)
<i>ndebt/ebit</i>	Net debt-to-ebit	Net debt (Long-term debt [<i>dltt</i>] plus debt in current liabilities [<i>dlc</i>] less cash and short-term investments [<i>che</i>]) / profit margin (<i>pm</i>), *
<i>bm_lean</i>	Business model leanness	Proxied by <i>at</i> ⁻¹ (consistent with Ketchen et al., 1993)
<i>bm_innov</i>	Business model innovativeness	Proxied by <i>rdint</i> (i.e. Fiegenbaum et al., 1990; Hergert, 1987)
<i>bm_market</i>	Business model market intensity	Proxied by advertising expenses [<i>xad</i>] / net sales [<i>sale</i>] (e.g. Oster, 1982)
<i>bm_eff</i>	Business model efficiency	Proxied by <i>pm</i> (e.g. Ketchen et al., 1993; Dess and Davis, 1984)
<i>bm_risk</i>	Business model risk	Proxied by <i>leverage</i> (e.g. Fiegenbaum and Thomas, 1990; Cool and Schendel, 1987).

* Adapted from Knudsen et al. (2017), ** inverse of asset-turnover as in Bhojraj et al. (2003), *** Different from prior work e.g. Bhojraj et al. (2003), this paper applies year-ahead long-term (three-year) realised sales growth instead of summary five year forecasts from IBES as these have lower frequency in the sample and provides decreased significance in more specific peer contexts such as industry-life-cycle.

Appendix 3.B – Additional data

Table 3.B.1 – Peer group homogeneity across peer group sizes (N)

The table reports Peer group homogeneity across peer group sizes (N). Two-tailed t-tests are performed on reported average adjusted R^2 . The average periodical cross-sectional regression size for each variable is represented by n . As in prior work, the highest adjusted R^2 in each variable is in boldface. Significance levels are indicated using *, **, and *** for 10%, 5%, and 1%.

	BMQ peers				SARD_BM peers				SARD_KV peers				WARR (vs) peers			
	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC
Average adj. R2 Returns (n=73961)																
6	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.167 ***	0.161 ***	0.220 ***	0.225 ***	0.148 ***	0.144 ***	0.222 ***	0.231 ***	0.135 ***	0.133 ***	0.206 ***	0.220 ***
8	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.181 ***	0.176 ***	0.236 ***	0.241 ***	0.159 ***	0.157 ***	0.239 ***	0.247 ***	0.149 ***	0.147 ***	0.228 ***	0.240 ***
10	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.191 ***	0.185 ***	0.247 ***	0.250 ***	0.168 ***	0.165 ***	0.248 ***	0.254 ***	0.159 ***	0.157 ***	0.240 ***	0.250 ***
12	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.198 ***	0.192 ***	0.252 ***	0.253 ***	0.175 ***	0.172 ***	0.254 ***	0.258 ***	0.166 ***	0.164 ***	0.247 ***	0.254 ***
14	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.203 ***	0.197 ***	0.255 ***	0.255 ***	0.180 ***	0.177 ***	0.257 ***	0.260 ***	0.171 ***	0.170 ***	0.252 ***	0.257 ***
16	0.209 ***	0.196 ***	0.254 ***	0.301 ***	0.206 ***	0.201 ***	0.258 ***	0.256 ***	0.185 ***	0.181 ***	0.261 ***	0.261 ***	0.175 ***	0.175 ***	0.255 ***	0.258 ***
Average adj. R2 Multiples (n=6522)																
6	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.263 ***	0.213 ***	0.198 ***	0.197 ***	0.042 ***	0.058 ***	0.160 ***	0.174 ***	0.091 ***	0.095 ***	0.165 ***	0.176 ***
8	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.288 ***	0.236 ***	0.203 ***	0.196 ***	0.047 ***	0.061 ***	0.159 ***	0.173 ***	0.097 ***	0.099 ***	0.167 ***	0.180 ***
10	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.299 ***	0.242 ***	0.202 ***	0.193 ***	0.050 ***	0.065 ***	0.159 ***	0.175 ***	0.101 ***	0.102 ***	0.170 ***	0.181 ***
12	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.311 ***	0.249 ***	0.202 ***	0.191 ***	0.053 ***	0.066 ***	0.158 ***	0.171 ***	0.102 ***	0.104 ***	0.169 ***	0.178 ***
14	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.317 ***	0.255 ***	0.200 ***	0.188 ***	0.058 ***	0.068 ***	0.159 ***	0.168 ***	0.104 ***	0.106 ***	0.169 ***	0.174 ***
16	0.090 ***	0.091 ***	0.161 ***	0.196 ***	0.320 ***	0.255 ***	0.195 ***	0.184 ***	0.060 ***	0.070 ***	0.159 ***	0.166 ***	0.106 ***	0.107 ***	0.168 ***	0.169 ***
Average adj. R2 Ratios (n=6415)																
6	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.543 ***	0.489 ***	0.429 ***	0.395 ***	0.047 ***	0.077 ***	0.278 ***	0.295 ***	0.088 *	0.112 **	0.283 ***	0.311 ***
8	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.546 ***	0.488 ***	0.422 ***	0.385 ***	0.054 ***	0.083 ***	0.280 ***	0.296 ***	0.092 *	0.118 **	0.281 ***	0.302 ***
10	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.546 ***	0.485 ***	0.414 ***	0.371 ***	0.059 ***	0.089 ***	0.282 ***	0.294 ***	0.097 *	0.123 ***	0.282 ***	0.299 ***
12	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.546 ***	0.481 ***	0.405 ***	0.359 ***	0.063 ***	0.093 ***	0.281 ***	0.291 ***	0.098 *	0.126 ***	0.281 ***	0.297 ***
14	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.542 ***	0.476 ***	0.396 ***	0.348 ***	0.065 ***	0.096 ***	0.279 ***	0.287 ***	0.100 *	0.129 ***	0.280 ***	0.293 ***
16	0.226 ***	0.241 ***	0.285 ***	0.321 ***	0.540 ***	0.473 ***	0.387 ***	0.339 ***	0.067 ***	0.099 ***	0.277 ***	0.285 ***	0.101 *	0.131 ***	0.279 ***	0.292 ***

Table 3.B.1 (Continued) – Peer group homogeneity across peer group sizes (N)

The table reports Peer group homogeneity across peer group sizes (N). Two-tailed t-tests are performed on reported average adjusted R^2 . The average periodical cross-sectional regression size for each variable is represented by n . As in prior work, the highest adjusted R^2 in each variable is in boldface. Significance levels are indicated using *, **, and *** for 10%, 5%, and 1%.

BMQ peers				SARD_BM peers				SARD_KN peers				WARR(evs) peers			
EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC	EW	FLC	IND	IND-FLC
Average adj. R^2 Growth ($n=5405$)															
6	0.035 *	0.056 **	0.272 ***	0.353 **	0.239 **	0.230 **	0.302 **	0.323 **	0.007 *	0.020 ***	0.253 ***	0.319 ***	0.133 ***	0.369 ***	0.381 ***
8	0.035 *	0.056 **	0.272 ***	0.353 **	0.239 ***	0.228 ***	0.305 ***	0.316 ***	0.007 *	0.024 ***	0.258 ***	0.315 ***	0.140 ***	0.363 ***	0.367 ***
10	0.035 *	0.056 **	0.272 ***	0.353 **	0.241 ***	0.228 ***	0.302 ***	0.316 ***	0.008 *	0.027 ***	0.259 ***	0.309 ***	0.145 ***	0.352 ***	0.355 ***
12	0.035 *	0.056 **	0.272 ***	0.353 **	0.241 ***	0.228 ***	0.299 ***	0.314 ***	0.009 *	0.029 ***	0.258 ***	0.307 ***	0.146 ***	0.342 ***	0.343 ***
14	0.035 *	0.056 **	0.272 ***	0.353 **	0.241 ***	0.227 ***	0.293 ***	0.311 ***	0.009 **	0.031 ***	0.257 ***	0.302 ***	0.147 ***	0.334 ***	0.332 ***
16	0.035 *	0.056 **	0.272 ***	0.353 **	0.241 ***	0.225 ***	0.288 ***	0.308 ***	0.010 **	0.033 ***	0.255 ***	0.297 ***	0.147 ***	0.328 ***	0.322 ***
Average adj. R^2 Overall ($n=73961$)															
6	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.358 ***	0.319 ***	0.313 ***	0.304 ***	0.044 ***	0.063 ***	0.232 ***	0.259 ***	0.113 ***	0.261 ***	0.279 ***
8	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.368 ***	0.327 ***	0.313 ***	0.300 ***	0.049 ***	0.068 ***	0.235 ***	0.259 ***	0.120 ***	0.260 ***	0.275 ***
10	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.372 ***	0.328 ***	0.310 ***	0.294 ***	0.053 ***	0.073 ***	0.236 ***	0.258 ***	0.124 ***	0.260 ***	0.272 ***
12	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.377 ***	0.329 ***	0.306 ***	0.289 ***	0.056 ***	0.076 ***	0.236 ***	0.255 ***	0.120 ***	0.258 ***	0.267 ***
14	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.377 ***	0.329 ***	0.301 ***	0.283 ***	0.059 ***	0.079 ***	0.235 ***	0.252 ***	0.122 ***	0.256 ***	0.263 ***
16	0.139 ***	0.149 ***	0.241 ***	0.288 ***	0.377 ***	0.328 ***	0.295 ***	0.278 ***	0.061 ***	0.081 ***	0.234 ***	0.249 ***	0.131 ***	0.254 ***	0.258 ***

4. Strategic Intensity:

A real options measure of strategic flexibility

Abstract

This paper proposes *strategic intensity* as a proxy for capturing effects associated with strategic flexibility at the firm-level. The measure is aligned with fundamental value creation theory and the real options view of the firm. It avoids the problems associated with the mainly qualitative proxies for strategic flexibility applied in the strategic management literature by providing an unbiased and preference free econometric real options approach to systematically capture the effects of firm-level decision-flexibility via fundamental skewness in (low-frequency) financial statement data. The paper applies the proxy to explore value creation across the firm life cycle and to investigate and answer questions about outcomes of strategic flexibility raised in the related literatures. The findings in the study are mainly consistent with the posed hypotheses and demonstrate that the novel proxy is able to contribute explanations for variation in value creation, growth and survival across levels of implied strategic flexibility. Specifically, the paper contributes not only by showing that firms with higher positive levels of strategic flexibility exhibit less mean reversion, but also by the novel finding that such persistence across levels of achieved strategic flexibility is linked to relationships between current levels of strategic flexibility, future levels of profitability and market value has implications for valuation of both established and new firms. In addition, the paper provides evidence arguing that also the longer-term strategic choice of business model contributes to strategic flexibility.

4.1 Introduction

This study develops and applies a new fundamental proxy for effects of strategic flexibility.

Strategic flexibility in the form of a firm's ability to apply active decision-making based on learning to adapt strategies to changes in its dynamic environment has long been recognized a crucial source of competitive advantage and important determinant for firm value creation, growth and ultimately survival in the strategic management literature (e.g. Brinckmann et al., 2019; Dai et al., 2018; Lieberman et al., 2018; Kunisch et al., 2017; Klingebiel, 2012; Sanchez, 1995, 1997; Geroski, 1995; Olsen and Kolvereid, 1994).

In this literature, strategic flexibility is invariably associated with positive outcomes such as competitive positioning; creation of new markets; enabling of innovation; resilience towards environmental turbulence; risk reduction; and higher financial performance (e.g. Nadkarni and Herrmann, 2010; Zahra et al., 2008; Grewal and Tansuhaj, 2001; Hitt et al., 1998; Sanchez, 1995). Yet, despite its importance and wide academic interest, contributions to the strategic management literature on dynamic capabilities and strategic flexibility remains mostly theoretical (e.g. Combe et al., 2012; Grewal and Tansuhaj, 2001) with unresolved debates over conceptual models and features (Nadkarni and Narayanan, 2007; Johnson et al., 2003). These studies also uncover that strategic flexibility as a concept is polymorphous in terms of attributes, capabilities, and perspectives as well as exhibits variation in definitions (e.g. Upton, 1995; Evans, 1991) and expose a lack of unified and comparable approaches to measure to what extent firms are able to exercise strategic flexibility (Brozovic, 2018). Under the lens of real options theory, strategic flexibility implies the firm's active decision-making over resource-investment choices under uncertain demand where strategy is treated as an unfolding emergent process (e.g. Bowman and Hurry, 1993; Sanchez, 1993). The active decision-making over the firm's operating assets introduces asymmetries in form of higher moments (e.g. skewness) in the firm's earnings and stock returns (see Del Viva et al., 2017; Trigeorgis and Lambertides, 2014; Zhang, 2013; Grullon et al., 2012). Recent research within financial statement and asset pricing literatures confirm empirically that higher moments in stock returns and pricing information linked to firm level decision-making are also evident in fundamental financial statement variables (e.g. Jia and Yan, 2017; Konstantinidi and Pope, 2016; Givoly and Hayn, 2000; Basu, 1997; Chang et al., 2021). By combining the perspectives on strategy under real options and strategic management with the empirical findings in asset pricing and financial statement literatures, an opportunity for addressing the gap relating to a comparable measure of strategic flexibility via higher moments emerges.

Hence, this paper's main purpose is to propose *strategic intensity* as a measure that captures effects of strategic flexibility via asymmetry (skewness) in firm-level fundamental earnings processes under the real options view of the firm as proposed in Bowman and Hurry (1993) to narrow the long-standing gap in the literature by providing a practical and preference free measure of strategic flexibility.⁶⁹

⁶⁹ The majority of studies in the literature are based on market returns that are composed of among other factors information related to investor preferences and market mood. In stark contrast an intrinsic measure based on fundamentals such as accounting variables is not directly related to such preferences. Notably in most prior studies

In addition, there still remains substantial gaps in the understanding of how strategic flexibility⁷⁰ is related to outcomes at the firm-level.

First, a growing number of papers find life cycle information useful in explaining firm-level performance (e.g. Anderson et al., 2017; Vorst and Yohn, 2018) and others suggest that firms' strategic choices and decisions are linked to life cycle stages (Olsen and Kolvereid, 1994; McDowell et al., 2016). Also, the real options theory predicts that growth option value should normalise from initial higher to lower future levels as firms transcend across life cycle stages. However, the distribution of growth options and their relationship with the firms' ability to achieve strategic flexibility across life cycle stages are open empirical questions. More, the literature remains unresolved in terms of whether small or large firms are more or less strategically flexible in this context (e.g. Ebben and Johnson, 2005) and how value creation relates to firm development and strategic flexibility over the firm life cycle is another open theme in the literature, specifically for the case of growth oriented firms in technology (high-clockspeed) industries.

Second, the importance of strategic flexibility for firm survival is highlighted in the literature (e.g. Brinckmann et al., 2019), yet the question of the role played by strategic flexibility in new and growth-oriented firms remain empirically unclear.

Third, strategic flexibility in the general literature has a strong focus on implications and effects of flexibility for the organisation, its growth and performance in the current and short-term setting. At the same time it is suggested that also firms' business models could offer flexibility through the process of business model innovation in the longer term (see Bock et al., 2012; Teece, 2010). To what degree business models can provide a source of strategic flexibility for firms has not been fully empirically investigated.

The second purpose of the paper is to explore these spaces in the literatures through the lens of the proposed strategic flexibility proxy guided by the question: *What are the implications of strategic flexibility for firm value creation and survival?*

The first part of the paper proposes *strategic intensity (SI)* as a novel proxy for strategic flexibility that different from earlier work provides a measure designed to capture asymmetry

the higher moments relate to higher moments in market information based on price. In this study such variation in higher moments relates to firm fundamentals. See e.g. Zhang (2013) or Jia and Yan (2017).

⁷⁰ In this paper, the term flexibility in its general form, refers to *strategic flexibility* under the real options view.

(skewness) resulting from past decision-flexibility over future options using the conditional time-series approach suggested by Gu and Wu (2003) to explain effects in fundamental accounting variables instead of in stock prices. Though prior work has shown that asymmetry in asset prices can be explained by future options and that higher order variation in fundamentals can explain asset price asymmetry, no work has produced a fundamental proxy explicitly to capture and study effects of strategic flexibility for assessment of decision-driven variation in low-frequency firm-level accounting data.

The second part of the paper addresses the open questions in the literatures using a large sample of US listed firms over the 1989 – 2020 period with available quarterly financial statement data from COMPUSTAT and monthly stock market data in the CRSP database. The methods in the paper rely mainly on sorts using firm-level characteristics (e.g. firm life cycle stage, firm size or strategic intensity), Fama-Macbeth (1973) style regressions, complementary loglog regressions for survival analysis and standard statistical approaches to test posed hypotheses.

Applying the firm life cycle as a lens, the findings reveal significant patterns in normalisation of growth options across life cycle stages consistent with theoretical expectations as firms evolve from introduction to maturity, and that firms' levels of strategic intensity also appear to increase and peak in the growth stage in reflection of option exercise activity over the same stages. In relation to the size–flexibility puzzle in the literature, the findings suggest that there are significant differences in patterns and levels of achieved strategic flexibility between small and large firms. While medium-sized and large firms appear to have more growth options and enjoy higher levels of achieved flexibility, the results suggest that small firms are less likely to achieve positive outcomes of flexibility consistent with implications of financial constraints.

The paper further provide evidence that not only are higher levels of achieved strategic flexibility related to higher performance outcomes in market share, growth and value creation, but that firms with higher levels of strategic intensity are also associated with increased creation of new options. The findings also imply that for new firms in the introduction stage, achieved strategic flexibility has more impact for both value and growth than at any other stage. This outcome is consistent with the argument that strategic flexibility is importance for new firms. The results further suggest that while firms in high-clockspeed (technology-driven) markets are more strategically flexible than firms in slower markets, new firms in both high- and low-clockspeed markets seem less able to achieve strategically flexibility due to lower levels of financial flexibility compared to their more mature and established incumbents. The data also

indicates that in high-clockspeed contexts established firms experience more competition than new firms. Moreover, the results imply a consistent significant and positive relationship between strategic flexibility and survival persistence (via hazard rate) at all levels of analysis. These results also suggest that new firms in low-clockspeed industries in particular have the highest mean-difference in decreasing hazard rate between firms with positive and negative outcomes of strategic flexibility. This difference is practically important, as improved understanding of strategic flexibility for these firm is also likely to help new firms overcome the issues related to newness. Finally, the findings show that while firms are likely to derive most of their flexibility from organisational sources, a smaller but significant part of flexibility appears related to the business model. This supports the argument that firm-level flexibility arrives both via the current organisational setting in the short-term and via structural changes due to longer-term strategic choice. In addition, the study contributes to financial statement analysis by demonstrating that *SI* not only is mean-reverting, but also by showing that applying current levels of *SI* in forecasting results in significant relationships with future levels of profitability and market value over a five-year horizon. Taken, together these findings provided under the lens of strategic intensity, offer further incremental insights to the implications of strategic flexibility at the firm-level.

This paper contributes in several ways to the debates in the strategic management and real options literatures: First, it argues and provides a novel proxy for assessment of strategic flexibility in a methodical contribution to narrow the measurement gap in strategic management and as a complement to the debate on real options and dynamic capabilities (e.g. Teece and Pisano, 1994; Teece, 2007) by offering a fundamental value-based measure of the strength of strategic decision-making that is currently not available within the strategic management literature. Secondly, it applies the proxy to provide answers to important open questions in this both literatures. Third, it adds to the real options and the financial statement analysis literatures, by extending research into the relationships between firm-level fundamental asymmetry, investment, growth options, value creation and firm survival.

The remainder of the paper is organised as follows: Section 4.2 outlines the rationale for a proxy of strategic flexibility under the real options lens. Section 4.3 introduces the proxy. Section 4.4 develops hypotheses in thematic subsections. Section 4.5 describes the sample, descriptive statistics, methods and measures. In section 4.6 the main empirical results are presented. Section 4.7 provides some robustness and post hoc tests, and section 4.8 concludes.

4.2 Perspectives on strategic flexibility

The concept of *flexibility in the strategy context* can be traced back to at least Stigler (1939). It has given rise to an array of interpretations and attracted attention in a wide range of academic disciplines such as economics, marketing, decision science, competitive strategy, organisation theory, finance and strategic management (see Johnson et al., 2003; Upton, 1995; Evans, 1991). Strategic flexibility provides firms with a capability to operationalise strategic intension via actions, including changes to the underlying strategies themselves (Evans, 1991). It plays an important role for firm survival and performance (Zahra et al., 2008) by taking into account that firms are able to adapt their business models, internal processes, or reverse earlier decisions in order to achieve a better strategic fit to external changes such as demand or regulations that is particularly critical under dynamic, resource scarce or uncertain conditions (Brinckmann et al., 2019). Thereby the effect of flexibility in terms of *competitive advantage* or *value creation* is achieved via choices and actions that are dependent on active managerial decision-making (Grewal and Tansuhaj, 2001; Sanchez, 1995; Bowman and Hurry, 1993).

Strategic flexibility is commonly defined as the firm's ability to identify unanticipated changes in the environment, and its ability to swiftly respond using its capabilities and resources to effectively reposition its fit, reconfigure its resources and processes or exercise its options to minimise negative impacts in order to maximise performance and value creation (Brinckmann et al., 2019; Kurt and Hülland, 2013; Bock et al., 2012; Nadkarni and Herrmann, 2010; Bowman and Hurry, 1993; Evans, 1991).

Strategic management perspectives on strategic flexibility

Studies within strategic management approach strategic flexibility via the *external* products and markets perspective and the *internal* resources and capabilities perspective. The objective within both these strands is to *maximize competitive advantage*. The products and markets view has produced two influential theoretical strands in explaining competitive advantage that are dominating the mainstream debate in the literature, the *competitive forces view* (Porter, 1980) and *strategic conflict theory* (Shapiro, 1989).

As this paper is aimed at understanding of strategic flexibility within the firm, the analysis of the literature is purposefully limited to the *internal* resources and capabilities perspective. Under this perspective, the resource-based view (RBV) that originated from work within strategy and economics such as Penrose (1959) takes an endogenous perspective of the firm by

suggesting that competitive advantage can be explained in terms of the resources and capabilities of the firm (Barney, 1991; Rumelt, 1984; Wernerfelt, 1984). RBV has a specific focus and dependency on scarce resources as barriers to competition that are both valuable, rare, inimitable, and non-substitutable (VRIN) and forms the core capabilities of the firm (Sanchez, 1995). In order to overcome the static and retrospective nature of RBV and to address modern dynamic firms, new theoretical approaches such the dynamic capability view (DCV) emerged (Teece and Pisano, 1994). The original version of DCV that added dynamic capabilities as a higher order action-oriented capability, defined as the ability to build, integrate, and reconfigure resources, processes, and capabilities, addressed some of the dynamic issues in RBV (Kortmann et al., 2014). As DCV attracted criticism for lacking micro foundations and for failure to explain entrepreneurship decision-making (Prashantham and Floyd, 2012), a second version of the dynamic capability was proposed by Teece (2007). Flexibility in the dynamic capabilities framework stems from the firm's underlying resources and managerial practices (Zhou and Wu, 2010; Hitt et al., 1998). Under this perspective strategic flexibility is considered as an *important dynamic capability* that provides the firm with an ability for *action* to find, create and recombine resources in unique responses to both anticipated and unanticipated events (Johnson et al., 2003).

Although the resource-based and the dynamic capability perspectives have drawn considerable academic interests resulting in significant theoretical contributions to conceptualise strategic flexibility, this literature also reveals that the framework appears emergent with important gaps to be addressed: First, the contributions to the dynamic capability literature are mainly *theoretical* in exploring the concept, nature and role of dynamic capabilities, and empirical studies are lacking (see Combe et al., 2012; Grewal and Tansuhaj, 2001). Second, the prior literature finds and highlights the importance of strategic flexibility for new firms that are exposed to incumbent competition in fast-moving markets under high levels of environmental uncertainty (e.g. Brinckmann et al., 2019; Dai et al., 2018). However, most of the contributions in these literatures have focused on larger and established firms leaving a gap in the understanding if and how small or new firm with growth-orientation are able to achieve strategic flexibility (Brinckmann et al., 2019; Brozovic, 2018; Dai et al., 2018). The debate in the literature appears unresolved and some scholar suggests that small firms are more structurally agile than larger firms (Ebben and Johnson, 2005), while others argue that larger firms have more opportunities and stronger financial positions compared to smaller firms that are considered more likely to be resource constrained (Carter and Aukun, 2005).

Third, the concept of dynamic capabilities also suffers a *lack of consensus* in terms of important features and conceptual models (Nadkarni and Narayanan, 2007; Johnson et al., 2003). Fourth, shortfall of measurement comparability for estimation of strategic flexibility appear considerable in this literature, resulting in studies applying a variety of approaches including proxies for capital intensity, slack, financial constraints, or via likert scales or composite indices (Brozovic, 2018).

Strategic flexibility and value creation under the real options lens

The real options perspective that originated from the idea of financial options (Black and Scholes, 1973), rests on the insights of Myers (1977) that were influenced by the seminal theories of the firm provided through the work of Miller and Modigliani (1961). It holds that firms with operating assets in place as going concerns, where future investments into growth and operational decisions depend on uncertain demand and opportunities are considered rights, but not obligations. These decisions give rise to strategic, managerial and financial flexibility⁷¹. The objective of real options in the firm context is to optimise the firm's available decisions under uncertainty to minimise risk and maximise *value creation*.

This literature has provided extensive contributions to both academic research (e.g. Trigeorgis and Tsekrekos, 2018; Driouchi and Bennett, 2012; Kogut and Kulatilaka, 2004) and practical literatures (e.g. Copeland and Antikarov, 2003; Amram and Kulatilaka, 1999; Trigeorgis, 1996). In relation to the field of strategic management, real options has made several extensions to theory. For example, it has been studied as a conceptual approach to strategic investment and decision-making under uncertainty (see Bernardo and Chowdhry, 2002; Amram and Kulatilaka, 2000; Luehrman, 1998), option analysis of strategic games (c.f. Smit and Trigeorgis, 2017; Grenadier and Malenko, 2011) and as a theoretical approach to strategic flexibility (Tamayo-Torres et al., 2010; Amram and Kulatilaka, 2000; Luehrman, 1998; McGrath, 1997; Bowman and Hurry, 1993).

Real options theory extends the traditional firm value perspective following Miller and Modigliani's (1961) contention recognizing value as composed of existing operating assets-in-place (*AIP*) and future growth opportunities (*GO*). Value from existing assets flows proportionally from the operating activities in the firm under no-growth and *passive*

⁷¹ In this paper the focus is on the operating assets of the firm and managerial or firm-level flexibility are therefore considered *combined* as elements of strategic flexibility. When flexibility around the firm's financial (non-operating) real options is concerned such as investor funding, financial flexibility is used.

management assumptions reconciling with standard linear net-present valuation models such as the residual income or discounted cash flow models (see Penman, 2013). The future growth opportunities represent a non-linear value effect due to *active* management that is able to rationally improve e.g. internal efficiencies or operationalise growth options such as new product technologies to capture demand upsides, or limit market downsides by e.g. reducing internal operations or divesting operating assets.

Strategy under the options lens can be described as an unfolding sequence of decisions linked by organizational learning (Bowman and Hurry, 1993), in a process where the firm *actively* senses, creates or reconfigure its bundle of resources and capabilities (Teece, 2007) generating different forms of *real options* in the form of dynamic capabilities over real assets that are associated with strategic choice giving rise to strategic flexibility (Sanchez, 1995). Thus, the value of the *active flexible firm* (Krijnen, 1979) under the real options lens can be expressed as the linear value of the *passive* firm with the addition of the sum of non-linear value due to strategic flexibility (*SF*) under uncertainty about resources and core capabilities that forms a firm's current portfolio of call and put options over its tangible and intangible operating assets.

The *active* decision-making over the firm's life path under competition and uncertain demand where the firm's decisions are dependent on learning, management cognition and limitations such as bounded rationality or attention constraints, is known to introduce non-linearity in the underlying demand function that translates into higher moments (e.g. skewness) in the firm's earnings distribution⁷². For example, active management can take advantage of positive expected demand by either early strategic (growth) investments, or via operational changes to the current value creation processes (e.g. scaling up or switching resources) as expansion *call* options on the firm. In the same way should anticipated demand weaken, active management has the flexibility to operationally scale back present activities or even close down current strategic or operational projects as protective *put* options on the firm. If the firm is successful in achieving competitive advantages, capturing market options and minimising downsides, the sum of *calls* and *puts* is adding positively to firm value (positive *SF* effect) through convexity in the earnings function resulting in right-shifted asymmetry in the earnings distribution.

⁷² Previous studies have concluded that strategic flexibility in actively managed firms over real options that arise due to uncertainty introduces *non-linearities* into the underlying earnings processes that drives *non-normality* in the resulting earnings-distributions (e.g. Grullon et al., 2012; Del Viva et al., 2013; Sick and Gamba, 2005). Jensen's inequality (Jensen, 1906) provides a theoretical explanation for why convex (concave) functions of normally distributed stochastic variables results in non-normal right-skewed (left-skewed) outcome distributions.

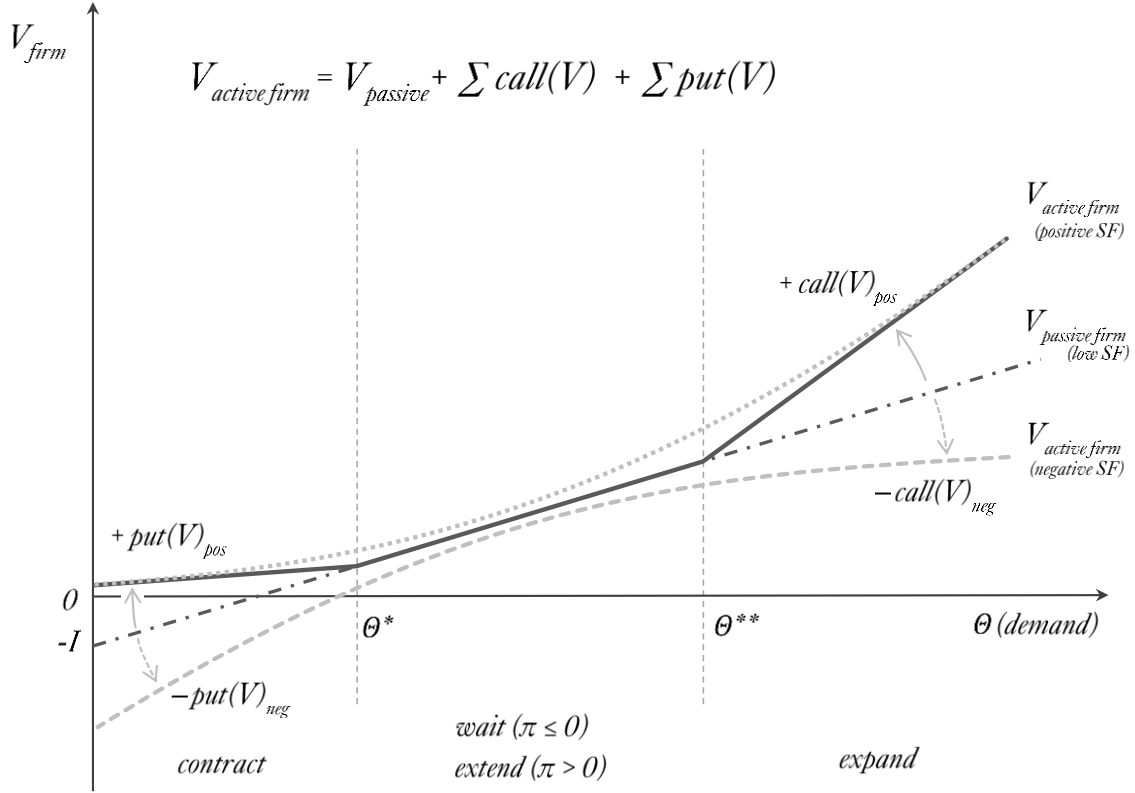


Figure 4.1 – Value of passive and active firms with strategic flexibility effects, based on Del Viva et al. (2017).

For a firm that is unable to operationalise strategic flexibility effectively due to e.g. severe financial constraints, the returns will be close to the *passive* firm (low SF effect). If the active firm is making decisions that result in *calls* or *puts* having a negative value contribution (negative SF effect), the earnings function becomes concave and the distribution negatively skewed (left-shifted) resulting in a lower firm value compared to the *passive* firm⁷³.

The non-linear effects of strategic flexibility driven by the firm's decision-making under uncertainty and taking into account decision hysteresis effects⁷⁴ is illustrated in Figure 4.1 that shows intuitively how the firm's strategic investment policy can be explained under uncertain demand over expectations of future growth opportunities, and how the sum of options-related decisions for the passive or active firm is related to value creation (destruction) via the effects of higher moments such as skewness.

⁷³ Firms that are not able to exercise options or benefit from flexibility due to organisational limitations could see value being destroyed rather than created (e.g. Kogut and Kulatilaka, 1994; Driouchi and Bennett, 2012).

⁷⁴ The general theoretical expectation contains upper and lower thresholds in expected demand that must be exceeded for the firm to invest or divest in the sense of a minimum profitability against maximum loss (see Del Viva et al., 2015; Pindyck, 1990) in what is described as the firm's optimal inertia (Bowman and Hurry, 1993).

Empirical studies in the asset pricing literature on return asymmetry have concluded that that real options are the most significant source of convexity in earnings as well as firm-level fundamental skewness⁷⁵, and that these higher moments in returns are valued in the market, commanding a risk discount (Del Viva et al., 2017; Trigeorgis and Lambertides, 2014; Zhang, 2013; Grullon et al., 2012). Particularly, they find that the effect is stronger in firms in high volatility industries (e.g. technology), financially constrained (and distressed) or small firms, and firms with low return on assets or low book-to-market values (e.g. Del Viva et al., 2017). As this stream mainly have examined return-asymmetries of listed firms, some of the determinants of skewness that are related to asset price movements (e.g. investor heterogeneity, leverage and volatility feedback mechanisms, bubbles, or information ambiguity) are not directly applicable in fundamental or unlisted return contexts. Moreover, as studies in this strand have mainly contributed to understanding of asymmetry via co-skewness or idiosyncratic skewness in the asset pricing setting, these results are dependent on market implied value of future growth opportunities that would be unavailable for analysis of unlisted firms. This literature has suggested that while market effects such as mood amplify value asymmetries, fundamental skewness should also be a measurable property in firm-level variables (e.g. Trigeorgis and Lambertides, 2014).

Fundamental higher moments, firm-level decision-making and value creation

In response to such suggestions in the market-oriented asymmetry studies, an emergent strand with contributions from a variety of literatures in asset pricing, financial statement analysis and real options theory has started to empirically address value creation implications and measures of *fundamental* second and higher moment effects that goes beyond moments in stock returns. These studies have found empirical evidence that higher moments such as skewness in accounting variables are both significant and linked to firm-level decision-making (e.g. Jia and Yan, 2017; Konstantinidi and Pope, 2016; Givoly and Hayn, 2000; Basu, 1997; Chang et al., 2021). For example, in a recent review Jia et al. (2020) report that studies investigating fundamental higher moments in firm profitability, earnings and cash flows also are able to explain cross-sectional stock returns. In addition, papers in this line have analysed earnings, cash flows and accruals and their relationships to accounting conservatism and earnings management (Givoly and Hayn, 2000; Basu, 1997). These articles have identified and

⁷⁵ In addition to active decision-making, extant research has shown that fundamental skewness also can result from demand uncertainty and from leverage changes due to financial flexibility (see Grullon et al., 2012).

estimated skewness with significant results using fundamental measures based on higher moments in time-series (Jia and Yan, 2017; Gu and Wu, 2003; Basu, 1997), via quantile regression methods (Konstantinidi and Pope, 2016; Chang et al., 2021) and in the cross-section of firms (Givoly and Hayn, 2000). Moreover, these studies reach attainable empirical results using low frequency quarterly (e.g. Gu and Wu, 2003) or annual accounting data (e.g. Chang et al., 2021) and find that analysis at both the industry- and firm-level can provide significant measures of fundamental skewness (Givoly and Hayn, 2000).

The studies in this strand on fundamental higher moments complements the market-oriented research on return asymmetry in a number of ways: First, they provide evidence consistent with theory that higher moments due to decisions over real assets can be measured in accounting variables. Second, the empirical evidence also suggests that higher moments are detectable in cross-section of firms with similar features, such as industry peers. Third, several of the methods applied to capture e.g. skewness allow for low-frequency information such as quarterly or annual data that makes them suitable for analysis of higher moments in samples of unlisted or smaller firms with limited financial statement information.

Reconciling the views – towards a real options measure of strategic flexibility

Taken together, the theoretical approach to strategic flexibility under the real options lens provides an empirical validated firm-level dynamic real options-based explanation for the relationship between *active* management decision-making and fundamental higher moments in the return distribution due to asymmetry under uncertain demand and value creation. In addition, the empirical findings in the literature indicate that higher moments contain important information about committed decision-related flexibility that could form the basis of a fundamental measure of strategic flexibility. The ability to capture such strategic flexibility effects in low frequency (e.g. quarterly) data indicates opportunities for new contributions for study of emergent or unlisted firms.

More specifically, by reconciling the dynamic capability and real options perspectives, it can be argued that strategic flexibility under the strategic management regime of dynamic capabilities and the *competitive advantage maxim* has its counterpoint in the real options perspective of *value maximisation*, in the flexibility provided by active management decision-making. For this reason, the literature agrees that the concept of a *dynamic capability* coincides theoretically with *strategic flexibility provided by real options* in the firm context.

As firms' not only can optimise their operations based on competitive advantage or strategic positioning, but also have to satisfy rational objectives under expected value maximisation, there is arguably a trade-off under which competitive advantages have to align with the investors expected growth and value objectives. Therefore, on the firm-level, strategic flexibility should be the result of decision-making based on resources and capabilities at management level or below, where competitive advantages are not maximised, but made to fit the value creation objectives expected by the shareholders.⁷⁶

In sum, it is therefore motivated to propose that strategic flexibility under the option lens that focuses on *value creation*, not only moderates and aligns the theoretical contributions of *strategic positioning* under the dynamic capability perspective with shareholder objectives, but more importantly that it offers a comparable and unbiased measure of *exercised* strategic flexibility via fundamental skewness that captures value effects of strategic decision-making.

4.3 Strategic intensity: a measure of realised strategic flexibility

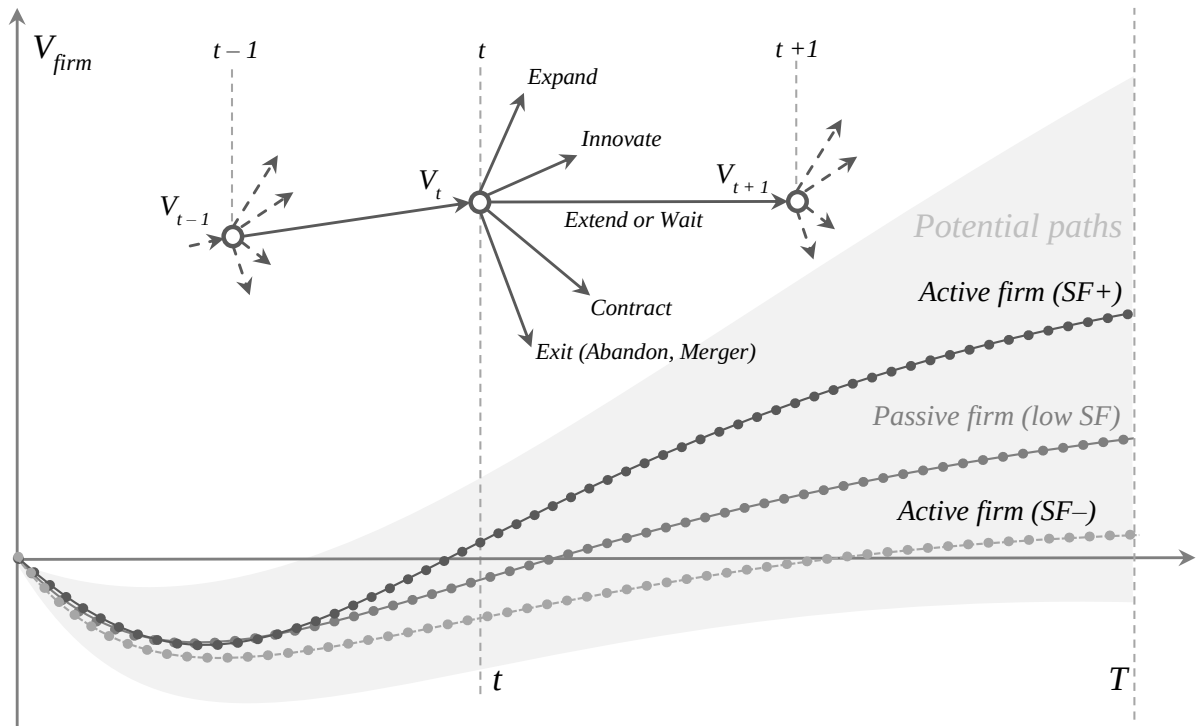
Building on the theoretical work and empirical findings in prior research, this section addresses the measurement gap in the strategic management literature, through proposing a fundamental proxy under the logic of the real options perspective of the firm to capture the level of a firm's realised (past exercised) strategic flexibility – *strategic intensity*.

Strategic flexibility in the emergent value creation process

Value creation through the real options perspective on the firm's sequential choice over its resources and related options under uncertain demand, has led to that strategy has been defined as an unfolding pattern of decisions (Mintzberg, 1978). Under this sequential strategy formation theory, a firm's future *performance* and its *value* under uncertainty is dependent on decisions over its strategic options and their interaction with organizational resources (e.g. capabilities and assets). Firm value creation in this emergent process that is exemplified in Figure 4.2, is hence conditional on whether the firm takes a passive or active role faced with opportunities, and if the strategic flexibility (SF) it is endowed with due to its options at any time *t* results in active destruction of value (active firm: SF–), active creation of value (active firm: SF+) or in a passive linear value effect (passive firm: low SF).

⁷⁶ Moreover, extant studies suggest that firms have a degree of separation in control and ownership agency costs (Jensen and Meckling, 1976) indicating a link to a possible irrational explanation in terms of the gap between strategy and management in terms of management preference for competitive position over shareholder wealth.

Figure 4.2 – Strategy as unfolding value creation process for passive and active firms under the real options lens

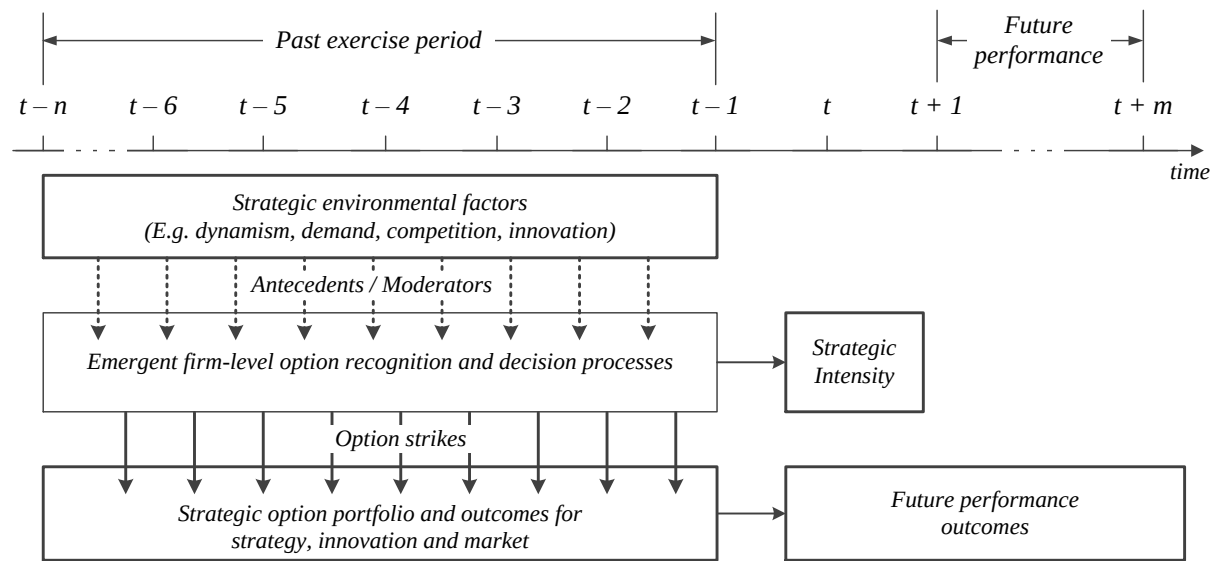


Within the strands of the strategic management literature that focus on strategic flexibility, recent research developments have provided conceptual reviews and multidimensional models to help explain how outcomes, antecedents and moderators are related to firm-level decision-making in an emergent value creation process (Brozovic, 2018; Combe, 2012)⁷⁷. For example, Herhausen et al. (2021) tests the structural and dimensional aspects of strategic flexibility in relation to environmental factors and outcomes of flexibility. Their empirical findings suggest not only that strategic flexibility at the firm-level appears to be a path-dependent process consistent with internal perspectives on strategy (e.g. Barney, 1991), but also that resources and strategic options, as dynamic capabilities developed over time in response to environmental dynamism factors such as demand uncertainty, competition intensity and innovation at the industry levels, results in a *chain of effects* on outcomes.

The logic of the argument related to *chain effect* implies that firms first, either in response to environmental change, or proactively in anticipation of future market opportunities, generate *new options* and *innovation outcomes* that have an impact on *market outcomes* and finally, results in *performance outcomes*.

⁷⁷ A table of identified concepts and their reported relationships with strategic flexibility from these reviews is provided in Appendix 4.C.

Figure 4.3 – Value creation process under the real options lens: past exercise and future performance.



Following this theory it is motivated to suggest that as strategic decisions unfold over time as a *chain of effects* over outcomes following Herhausen et al. (2021), these decisions are the result of strategic flexibility and give rise to asymmetry (skewness) in firm-level fundamental earnings processes consistent with prediction of *the option chain* framework under the real options lens proposed by Bowman and Hurry (1993) and with the real options theory.

Taking a more detailed view of strategic flexibility in the *chain of effect* setting as an emergent process, as illustrated in Figure 4.3, strategic flexibility of a firm observed in a *past exercise period* ($t-n$), within which the firm creates new options (e.g. strategic options and innovation outcomes) that give rise to interaction effects with anticipated opportunities, demand and environmental factors, drive outcomes (e.g. market share growth and profitability) in the *current period* (t) and ultimately performance outcomes (e.g. further growth and competitive advantages) in future periods ($t+m$). As this process is complex due to that a firm is faced with multiple options that also are likely to be in different phases of development, then consistent with real options theory, interaction effects among options held by a firm at any time where options influence for example value or resources available are also likely, making observation of individual options and their effect in the implied chain challenging (Audretsch and Link, 2012; Trigeorgis and Ioulianos, 2013). However, instead of a focus on individual options, it is suggested that a measure that captures the combined effect associated with the past decisions at the firm-level via fundamental skewness of a firm's earnings processes, can provide a practical ex post estimator that represents the overall level of *exercised* strategic flexibility related to the real options portfolio during a *past exercise period*.

Defining strategic intensity

Against this theoretical background, in this study *strategic intensity (SI)* is defined as the *signed degree of exercised strategic flexibility* that a firm is exhibiting on the aggregate level. It represents the resulting asymmetry of all underlying processes within the firm context over a *past exercise period*. The *size of the effect* measured as total fundamental asymmetry in the sense of departure from normal distribution in firm-level variables, suggests a more (less) radical change in the firm's operating activities or business model due to activation of options under the real options perspective. A positive *sign* in the measure holds that the firm's decision-making overall is aligned with value creation outcome in the *past exercise period*, while a negative value represents a counter-intuitive outcome that also has a negative impact on value creation in the short-term. For the purpose of the analysis in this paper following the theoretical arguments above, firms in each past exercise period are separated into three categories as economy-wide quarterly quintiles of *SI*, as active firms with a positive level (*q5, SI+*) or a negative level (*q1, SI-*) of strategic intensity, and as firms with a low level of strategic intensity signifying more passive behaviour (*q3, Passive*)⁷⁸.

The strategic intensity measure (conditional time-series skewness)

To operationalise *strategic intensity (SI)* by capturing asymmetry (*skewness*) resulting from past decision-flexibility in low frequency quarterly financial statement data, the conditional time-series approach applied by Jia and Yan (2015, 2016, 2017) and originally suggested in this context by Gu and Wu (2003)⁷⁹, provides a suitable econometric method for estimation of skewness (*SK*) in a rolling time window for an earnings variable *X* over a *past exercise period*:

$$SI_t \equiv SK_{X,t} = \frac{n}{(n-1)(n-2)} \sum_{\tau=t-n}^{t-1} \mathbf{W} \left(\frac{x_{\tau} - \mu_x}{\sigma_x} \right)^3, \quad (4.1)$$

where μ_x and σ_x are, respectively, the sample average and standard deviation of X ⁸⁰ across the time window of length *n* quarters, and **W** is a *n*-dimensional vector of weights that either treats each quarter equal (equal-weighted) or put more weight on quarters close to the end of the window (end-weighted) to prioritise new information. The reasons for weighting are discussed

⁷⁸ In the paper, the terms high positive or positive are used interchangeably as well as negative or high negative to signify *q5* or *q1* of strategic intensity (*SI*). Also, *passive* behaviour or *low SI* are equally used for *q3*.

⁷⁹ Jia and Yan (2015) show empirically that fundamental time-series skewness following the Gu and Wu (2003) approach captures effects consistent with option flexibility using samples of realized quarterly data.

⁸⁰ In case $\sigma_x = 0$ (time window stationarity in *X*) $SK_{X,t}$ is undefined in Eq. 4.1 and instead defined as $SK_{X,t} = 0$.

below and is different from earlier implementations. Following Jia and Yan (2017) the value of X_t for quarter t is not used in estimation of $SK_{X,t}$ to avoid hindsight bias.

Alternative operating earnings measures

The primary skewness variable X used to capture operating earnings selected for this paper is operating profitability (OP) proposed in Ball et al. (2015), and thus $SI_t \equiv SK_{OP,t}$. This earnings measure has drawn attention as a high-quality indicator for firm-level earnings-based return. The choice of OP is motivated by its alignment with real options theory, in treating research and development expenses (RD) as an investment, and in that it provides a clean measure of profitability that both captures the income flowing through the organisational cost margin structures ($COGS$ and SGA) while being free from bias due to accrual adjustments that are associated with issues common in cash flow-based measures. Different from Ball et al. (2015) that divides their measure by contemporary total assets, this paper uses lagged total assets as deflator, as it represents past investment made to support the current period's outcome. Applying current assets would bias the earnings measure by inclusion of real investments and growth options in the period under assessment⁸¹. Other possible earnings measures commonly applied in the literature are gross profit (GP , Novy-Marx, 2013), earnings per share (EPS , e.g. Lee et al., 2015). These will be used as controls and their relative strength to predict profitability assessed in the robustness tests. This is important as other scholars have suggested that GP is the dominant fundamental measure of economic profitability (Jia and Yan, 2017).

Length of past exercise period and weighting of events in the window

The length of the past exercise window n is eight quarters following earlier work⁸² that is also motivated by findings of evidence that firms are likely to progress across life cycle stages on average every 1.8 years⁸³ and that a longer window would be less representative in terms of life cycle stage stability. As skewness resulting from decisions over options in previous windows are likely to impact on the current window, there are reasons to consider weighting of quarterly third moments. For example, if option strike events take place in the last quarter

⁸¹ For example, Zhang (2017) notes that deflating by current assets includes a forward-looking “hidden investment effect” and finds that gross profitability (Novy-Marx, 2013) loses power once it is deflated by lagged total assets.

⁸² Prior studies such as Gu and Wu (2003) and Jia and Yan (2017) mainly apply the time-series skewness measure on eight quarters ($n=8$), and note that while choice of window size affects accuracy, they also report that fundamental skewness can be effectively captured up to window sizes of at least 20 quarters.

⁸³ Drobotz et al. (2015) find that on average firms remain in the same life cycle stage 1.8 years, with longer expected tenures for growth (1.86 years) and mature (1.98 years) firms, while firms in the introduction stage are likely to progress within 1.65 years.

of a window (e.g. an investment into lower-cost production capacity) the asymmetry effect of such decision events will earliest have an impact on earnings in the next or later quarters, and therefore generate a spill-over effect into the next window.

Hence, in order to limit such serial correlation in the underlying processes from earlier periods for analyses where the measure of skewness as strategic intensity is related to change or variation in variables within the same window, or when future predictions are regressed⁸⁴, this paper applies an *end-weighted* representation that offers more weight for events closer to the end of the exercise period (e.g. Cao et al., 2008). In more general assessment of overall strategic intensity, equal-weighted representation is used to capture all skewness effects within the exercise period window independently of in what period these effects were triggered. Consequently, the n -dimensional vector $\mathbf{W}$ is a vector of ones $(1,1,1,1,1,1,1,1)$ for *equal-weighted* representation of events in each quarter, and for an *end-weighted* representation for $n=8$, $\mathbf{W}$ is the vector of quarterly weights $(0.03, 0.06, 0.08, 0.11, 0.14, 0.17, 0.19, 0.22)$ ⁸⁵.

The proposed proxy for realised strategic flexibility under the real options lens extends from prior research that has empirically concluded that the main source of skewness in firm-level earnings is real options flexibility driven by active management decisions (e.g. Del Viva et al., 2017; Grullon et al., 2012; Trigeorgis and Lambertides, 2014). Research has also empirically validated the ability of the fundamental time-series skewness measure used for the proxy (Gu and Wu, 2003) to capture real options flexibility in past periods of quarterly earnings (Jia and Yan, 2015). Hence, no additional validation tests were considered in this paper.

4.4 Hypotheses on outcomes of strategic flexibility

A central purpose of this study is to evaluate to what extent the real options related measure of *strategic intensity* is able to *explain past* observations that are suggested in the strategic flexibility and strategic management literatures. This section develops hypotheses in thematic subsections to addresses questions raised in the literatures related to value creation and *strategic flexibility across the firm life cycle*; to *firm survival and strategic flexibility* and finally implications of *strategic flexibility over the short and long-term*.

⁸⁴ Applying the skewness measure in regressions of future dependents (e.g. and market returns) events at the end of a window have more power compared to events earlier in the window, and therefore it is motivated to use end-weighted skewness for regression analysis of future windows.

⁸⁵ The choice of weights is extended for $n=8$ from Cao et al. (2008) who applied a similar pattern for $n=4$.

Strategic flexibility and value creation across the firm life cycle

The first subsection makes predictions to address gaps in the understanding of how value creation and strategic flexibility are related through firms' development stages based on findings and debates in the literature. It applies the life cycle lens provided by Dickinson (2011) to investigate the sample across the firm life cycle (FLC)⁸⁶. Aside from offering insights into how firm-level components of enterprise value are distributed across stages; this lens also provides an opportunity for extracting more detailed information related to the specific setting of every stage of development⁸⁷. The importance of life cycle information in relation to strategic flexibility and value creation has been highlighted in the literature. For example, papers suggest that strategies and decision-making are different between life cycle stages (Olsen and Kolvereid, 1994; McDowell et al., 2016; Cantrell and Dickinson, 2020), and other studies argue that firms in the same development stage experience similar exogenous shocks (Vorst and Yohn, 2018; Drake and Martin, 2020). Since it is well-established that operational conditions of firms are a product of their economic contexts, relatedness under a life cycle lens is likely to provide more specific information about decision-making over growth options and value creation at the firm level⁸⁸.

Normalisation of growth options and strategic flexibility over the life cycle

The real options literature predicts that value of firms with growth prospects in their early stages should consist mostly of future growth options compared to value of assets-in-place (e.g. Trigeorgis, 1996). As the firm evolves through the life cycle stages into maturity and decline, the share of firm value consisting of future growth should decrease as growth options are converted into an increasing value share sourced from assets-in-place (Alonso et al., 2005).

Though the theoretical and empirical foundation for conversion of growth value into assets is accepted in the extant literature, the process and the assumed share redistribution of value components (assets-in-place and growth options) has not been comprehensively explored in the life cycle stage context.

⁸⁶ The details of the Dickinson (2011) FLC model is described in the method section.

⁸⁷ The life cycle model provides a method for identifying and investigating firms in a specific stage, such as new firms (FLC stage 1, introduction).

⁸⁸ Further implications not addressed in this paper, is that not only firm stage of development or age are expected to influence availability of growth opportunities. The literature posits that firm growth rates are also varying across industries, and with industry age, as a lower level of growth opportunities can be expected in mature industries (e.g. Coad, 2007).

The Dickinson (2011) life cycle model allows firms to change life cycle stage in a non-monotonic fashion, guided by the argument that firms' transitions as well as their rates of progression between stages is driven by a combination of internal determinants (e.g. strategic choice or resource availability) and external factors (e.g. competition or demand). This non-linear progression also suggests that both distressed (or failing) young and older declining firms could enter shake-out or decline stages (Faff et al., 2016). This indicates that there is a possibility that the cross-sectional distribution of firm value perhaps is not in sequence with firm age across all of the life cycle stages. However, the distribution of firms across the introduction, growth and maturity stages seems to offer a higher consistency with age in prior studies, and should be representative of a normalising process from growth option value into value from assets-in-place. It is therefore hypothesised that:

H1a: *Growth options share of firm value is decreasing and value from assets-in-place is increasing across introduction to maturity life cycle stages.*

In addition, this leads to a related, yet unexplored expectation that profitability asymmetry and therefore implied strategic flexibility also should normalise with firm development (Schwartz and Moon, 2001). The literature holds that older firms are likely to become less strategically agile (Nordal and Næs, 2012) as they derive an increasing share of value from their assets-in-place (e.g. Trigeorgis, 1996). In addition, real options in the growing portfolios of these firms are anticipated to interact with higher intensity, leading to more normalised distribution of firm-level returns and profitability (Trigeorgis and Lambertides, 2014). In the same way as growth option value is anticipated to normalise across life cycle stages, it also follows from the theory that a decreasing share of options in the firm value should be associated with higher levels of strategic commitment, and an increasing level of *strategic intensity* due to increased options exercise activity. To what degree firm's option exercise and *strategic intensity* increases in sequence with normalisation of real options portfolios over the firm life cycle is an open question that appears not to have been addressed in the literature. Exercised strategic flexibility proxied via *strategic intensity* should increase across introduction, growth and maturity stages as more options are committed. It is therefore hypothesised that:

H1b: *Strategic intensity increases across life cycle stages from introduction to maturity in reflection of that firms exercise and convert more of their growth options into assets-in-place.*

Firm size and strategic flexibility

There also appears to exist a gap in the understanding of how firm size is related to firms' ability to achieve strategic flexibility. The debate seems inconclusive on whether or not smaller firms are able to operationalise strategic flexibility effectively, and some studies even suggest that excessive levels of flexibility that is commonly associated with early stage and smaller firms could have negative outcomes (Brozovic, 2018).

The literature appears largely divided on the size-flexibility relationship. For example, some studies argue that small firms are more likely to be financially constrained than larger firms with more slack resources, leading to fewer opportunities for smaller firms to exercise flexibility over their options (Carter and Auken, 2005). Other papers suggest that smaller firms have higher levels of resource adaptability (e.g. Ebben and Johnson, 2005) providing them with approaches to mitigate constraints and act timelier on opportunities in contrast to larger firms that are associated with a higher degree of structural inertia (Brinckmann et al., 2019).

Another relationship that is discussed in this context is the duality between organisational complexity and organisational behavioural aspects of option recognition and decisions-making. In this setting, while small firms' commonly have less complex organisations affecting their abilities to benefit from options, large firms are often hampered by complexities of both their organisational structures and behavioural decision-making processes, affecting their ability to exert flexibility over their real options portfolios (Barnett, 2008; Adner and Levinthal, 2004).

In addition, a recent meta-analysis suggests that there appears to be no significant size-flexibility relationship or moderating effect on firm performance in the flexibility and size setting (Herhausen et al., 2021). Since it is probable that smaller firms are also younger firms in their earlier stages of development, these firms are also likely to be dependent on external funding such as venture capital or debt finance to exercise their growth options. The literature seems to agree on that frictions in the valuation and funding processes combined with issues in assessment of the ventures due to lack of historical financial data are common contributing factors to costly funding that is associated with under-capitalisation and financial constraints (e.g. Ge et al., 2005; Fazzari et al., 1988; Davila et al., 2012). It is therefore predicted that:

H2a: Larger firms are more likely to be in position to exercise strategic flexible compared to smaller firms.

Value creation and levels of strategic flexibility across the life cycle

How value creation relates to firm development across life cycle stages is a research white space, and to what degree levels of strategic flexibility are related to value creation in this setting also an open question. An expectation related to increased levels of enacted strategic flexibility during a past exercise period and captured in *strategic intensity*, is an increase in conversion of real opportunities into assets-in-place. However, firms are not only expected to exercise options via commitment into shared or proprietary options followed by investments into e.g. market activities or operating assets, but are also likely to generate new options via for example product or process innovation that is likely to lead to an increase in growth options value of firm. In addition, as the processes at the firm-level during any past exercise window are complex and associated with for example, interaction among resources and available options at any given time, as well as learning and decision-making activities, makes separation of value creation into options and assets-in-place challenging. However, for value creation at the firm-level, the real options theory predicts that firms with higher levels of positive (negative) strategic flexibility over their options, should be associated with a positive (negative) change in overall firm value through the combined value of its assets-in-place and implied growth options. Such a positive (negative) change as value is created (destroyed) should be linked to a higher (lower) positive present value of the firm or in the case of loss firms, to a lower (higher) negative value. Ultimately, as discussed earlier in this paper, the difference between firms that are able to exercise flexibility leading to positive levels of *strategic intensity* (SI+) should have a higher positive effect on firm value compare to firms that are taking decisions leading to a negative level of *strategic intensity* (SI-). This leads to a first hypothesis on the relationship between strategic intensity and value creation at any life cycle stage:

H3a: Firms with positive strategic intensity (SI+) create more value (less losses) than firms with negative strategic intensity (SI-).

The importance of strategic flexibility for new firm survival, growth and value creation is highlighted in the literature. However, to what extent new firms are able to achieve positive (negative) effects for value creation at the firm-level due to higher (lower) levels of strategic intensity is also unknown. Against the evidence of new firm activities around resource and financial constraints in the literature and the probability that only some firms are able to achieve flexibility, particularly in early stages of development, it is suggested that the effect on firm value for the firms that are able to exercise active decision-making will be positive compared

to firms that are either unable to achieve flexibility or take actions with detrimental effect. This hypothesis is stated as follows:

H3b: *New firms with positive strategic intensity (SI+) are more profitable compared to new firms with a negative strategic intensity (SI-).*

Strategic flexibility of firms within and across high-technology industries

Technology intense industries characterised by rapid technological change are described as being more uncertain (Dess and Beard, 1984) and associated with intense levels of product-market competition (Volberda, 1996). The literature has highlighted the importance for firms in innovative intense markets to adapt in order to survive (Basu and Wadhwa, 2011), and to maintain strategic flexibility (Claussen et al., 2018). It has been suggested that in highly dynamic environments as competition becomes more aggressive, firms' performance is to a higher degree dependent on management's ability and decision-making to respond to the changes in the strategic environment (Mitchell et al., 2011). Particularly, under such dynamics, firms need to develop a portfolio of strategic options in order to have dynamic capability in face of threats of disruption and competition (Basu and Wadhwa, 2011; Volberda, 1996; Bowman and Hurry, 1993). In addition, as real options held by firms in such competitive markets are also likely to be shared among competitors that could act pre-emptively and erode value of opportunities for their incumbents (Trigeorgis and Reuer, 2017), it is predicted that firms in industries with high degree of technology (high-clockspeed) are more strategically flexible than firms in industries with lower levels of technology (low-clockspeed). This leads to the following prediction:

H4a: *All else equal, Firms in high-clockspeed (technology-driven) industries are more strategically flexible than firms within lower clockspeer industries.*

As the literature has emphasized the importance of strategic flexibility for growth-oriented firms that are new entrants and in early stages of their development in fast-moving markets (e.g. Brinckmann et al., 2019; Dai et al., 2018), an open question is whether new growth firms are able to mobilise strategic flexibility. The literature appears inconclusive, with some studies reporting that strategic flexibility increases with age (Herhausen et al., 2021), while others argue that firms in their early stages are more flexible than older firms (Nadkarni and Herrmann, 2010). It is suggested in the literature that new entrants in fast-moving markets are likely to engage in innovation and technologies in order to build an option portfolio to fit these markets by providing competitive and comparative advantages over existing products in order

to survive and grow (Sahaym et al., 2010). Though, the literature suggests that new growth firms appear more strategically flexible than their mature and established incumbents, activities such as proactive adjustment of their resource bases to overcome constraints and fit their markets as new entrants are likely to help these firms cope with survival, but at the same time they are also likely to be at risk of resource constraints as high-clockspeed industries require high levels of investment into innovation to compete. Hence, it is hypothesized that:

H4b: New entrants in high-clockspeed (technology-driven) industries are more constrained and less flexible than their mature incumbents.

Firm survival and strategic flexibility

Past studies in the strategic management literature have suggested firms' approach strategic choices differently depending on their stage of development, and that strategic flexibility combined with learning effects from resource availability and competitive position informing decision-making are critical to firm performance, growth and survival (see McDowell et al., 2016; Verreynne and Meyer, 2010; Geroski, 1995; Olsen and Kolvereid, 1994; Cooper, 1981). The literature has hypothesised that the propensity of firms' to grow and therefore survive is linked to their rates of learning about the environment and their ability to convert this learning into strategic changes to effectively reconfigure their positions (e.g. Geroski, 1995). The theoretical proposition implies that the rate of the process of learning and strategic change should explain why some firms make it while others fail. Particularly this argument has been held relevant to the combination of speed of learning process and market turbulence, where some firms learn in the process by adapting their strategy (active learners) and others learn from failure pursuing fixed strategies (passive learners). Therefore, it is predicted that firms that are more strategically flexible are also less likely to exit, in the sense that for firms exiting with a negative outcome (e.g. failure), strategic flexibility is a significantly related factor in explaining survival.

H5a: Firms with higher levels of achieved strategic flexibility are less likely to exit.

Previous studies have investigated the link between new ventures' options, decisions and survival (e.g. Wennberg et al., 2016). However, the question of how the risk of exit for new compared to that of established ventures in the sample is related to their levels of strategic flexibility appears novel. The ability of firms in earlier stages of their development to learn and provide flexibility in response to exogenous changes is known to be related to both growth and

survival (Suvas, 1996). In contrast, established and more developed firms are expected to be increasingly rigid from a strategic change perspective (Nordal and Næs, 2012). However, new firms are also likely to be more financially constrained compared to established firms (e.g. Davila et al., 2012). Following real options theory, firms that are financially constrained should be able to exert a degree of protective measures, even if they are not financially able of invest in order to capture growth opportunities (e.g. Del Viva et al., 2017). Hence, in terms of difference for firms with strategic intensity, this reasoning leads to the following hypothesis:

H5b: *Independently of level of achieved strategic intensity, constraints for new firms are expected to leave them at a higher risk of exit compared to established firms.*

The literature suggests that firms in high clock-speed industries are required to be more strategically flexible compared to firms in less competitive industries (Claussen et al., 2018). It is also predicted that firms in high-clockspeed industries that are able to be more strategically flexible, are also less likely to exit in the sense that for firms that exits markets, strategic flexibility is significantly related to survival probability (see Brinckmann et al., 2019). Hence, it is predicted as follows:

H5c: *Firms in high-clockspeed (technology) industries have a lower risk of exit (higher survival odds) compared to firms in lower-clockspeed industries.*

Strategic flexibility over the short and long term

This section takes a more detailed view of firm-level strategic flexibility by deconstructing the main firm flexibility proxy (*strategic intensity*) into its underlying elements to investigate the impact that the sources of strategic flexibility have on overall firm-level flexibility.

It adds an argument to the debate by suggesting that firm flexibility can be viewed, consistent with the real options firm model (e.g. Bowman and Hurry, 1993), as having a short-term part concerned with strategic flexibility over options in the organisational context and a long-term part, related to the strategic choices that underpins the adaptation to and the flexibility derived from the business model.

The section first briefly introduces business model change as a source of long-term firm flexibility and then turns to analysis of strategic flexibility via its underlying elements.

Business model adaptation⁸⁹ as a source of long-term strategic flexibility

The literature that is exploring business model innovation (BMI) is concerned with change in the firm's current model in response to competitive changes and in order to improve both competitive advantages and enhance value creation (see Foss and Saebi, 2017; Kim and Min, 2015; Bock et al., 2012). Another term used for BMI in the academic literature, *business model adaptation* (e.g. Saebi et al., 2017; Landau et al., 2016) suggests consistently with the strategic management view that firms and research concerned with adaptation of business models are also concerned with application of strategic flexibility on an overall-organisational level (Bock et al., 2012). More specifically, the literature holds that BMI can be seen as an important mechanism for long-term organizational-wide strategic flexibility that is activated in order to renew business models as a means to improved competitive advantages and to approach new opportunity portfolios (Teece, 2010).

Elements of strategic flexibility in the short and long-term

As detailed and argued in the previous section, this paper utilises skewness in operating profitability to operationalise strategic intensity. The decomposing of operating profitability allows for a more detailed investigation into what factors drives strategic flexibility within firms. Strategic flexibility is sourced in the short term via growth options on its operating activities based on assets-in-place (AIP), and through strategic investment mainly related to the firm's business model (BM) in the long term. This paper suggests that viewed through the real options lens, and aligned with the debate in the strategic management literature, the present value dimensions of the firm could be expressed with separation of flexibility sources in the *strategic present value (PV)* framework:

$$PV_{firm} = PVAIP + \underbrace{PV \text{ Strategic flexibility}_{organisation} + PV \text{ Strategic flexibility}_{business model}}_{PVGO} \quad (4.2)$$

As discussed in the theory section, under the real options lens firm value depends not only on *passive firm over its assets in place* derived from competitive advantages due to committed investments in existing operating assets and processes, but also on value from *flexibility involving* investments where the *active firm* has discretionary right to react, respond and learn from new information to capture value from options using strategic flexibility (e.g. Trigeorgis, 1996). In addition, the literature has proposed that firms with strong strategic position or nonreplicable competitive advantages due to committed investments may be able to earn

⁸⁹ In this paper the terms business model innovation (BMI) and business model adaption are used in the sane meaning interchangeably.

abnormal rents in form of *strategic value* (Smit and Trigeorgis, 2017). This arguably also is related to the firm's strategic options that are operating through the strategic choices implemented into the firm's business model and the flexibility it provides. Hence, to illustrate how the proxy for capturing strategic flexibility in this paper also includes long-term effects from strategic choices related to the firm's business model, a decomposition of operating profitability (*OP*) into its components is informative. In this process, the paper uses the definition of organisational slack, that has been argued a storage of options (Bowman and Hurry, 1993) and a proxy for firms' variation in organisation flexibility in terms of its operating cost-driven processes (e.g. Choi et al., 2018):

$$OP_t = \frac{Sales_t - (COGS_t + SGA_t)}{TA_{t-1}} = (1 - Orgslack_t) \times ATO_t \quad (4.3)$$

Where $Orgslack_t = (COGS_t + SGA_t) / Sales_t$ and asset turnover, $ATO_t = Sales_t / TA_{t-1}$. In also recognising as suggested in the prior literature, and as argued in related papers, *ATO* can be seen as an elementary proxy for the business model of the firm that captures the efficiency of required capital investment per sales unit (*BM leanness*). Taken together, the decomposition of operating profitability provides insights into how the parts introduce asymmetry (skewness) as a combined effect for firm *i* at time *t* as strategic flexibility due to operating/organisational flexibility and flexibility due to changes in the underlying business model structure. This allows the paper in a basic way to separate operating skewness into a function composed of the skewness in the earnings processes and from skewness associated with the business model as shown in Eq. (4.4):

$$SK_{OP,t} = f(SK_{Orgslack,i,t}, SK_{ATO,i,t}) \equiv f(SK_{ORG,i,t}, SK_{BM,i,t}) \quad (4.4)$$

Prediction: Organisational flexible vs. business model flexibility

Following the reasoning above, it is suggested that skewness in the earnings processes (SK_{ORG}) captured in the marginal cost structures represents combined decision-making over simple and strategic options associated with the firm's current business model. For example, switching production inputs to take advantage of new materials made available, committing to options with follow-up investment into new product models to meet new demand for which the firm has made previous investment into research and development. Similarly, it is proposed that the skewness due to changes in the firms operating structures (SK_{BM}) should be representative of adaptive steps relating to the business model in response to strategic changes

where the firm commits to new longer-term strategic options. However, some scholars argue that reinventing a firm's BM is associated with high adoption costs that could be weighting against business model innovation (Casadesus-Masanell and Zhu, 2013). In addition, a new model might require more or less investment into resources or capabilities linked to asset structure changes that might bring positive effects via competitive advantages due to sunk cost or firm-specific assets, but such investment could also have a negative impact on the cost and capital structures of the firm (Hock et al., 2016; Teece, 2010). Given this, a significant and economical share of flexibility should, consistent with theory, come from changes in the underlying business model, but it is predicted that firms derive most of their strategic flexibility from short-term options in the organisational setting:

H6a: The main source of firm-level strategic flexibility is organisational flexibility, and a smaller part is related to the firm's business model.

Prediction: Business model rigidity

Drawing on the above discussion, business model structures could not only be viewed as source of flexibility, but also a barrier to flexibility via the implied rigidity that emerges from the balance between maintaining continuity (preservation) and keeping flexibility (change ability) in the firm-context, and that ultimately can become a source of friction limiting strategic adaptability (Brozovic, 2018; Combe, 2012). While it is established that, for example, internal processes or organisational structures can lead to issues with rigidity (Brozovic, 2018), the relationship between flexibility and rigidity in business models has recently started to become explored. For example, open innovation platforms has been suggested as a means to create more flexibility (Brozovic, 2018; Chesbrough et al., 2006). However, if firms with higher capital intensity are more or less flexible appears still to be an open question. The literature also reports that reinvention of the BM is a complex process that, apart from challenges related to funding of changes in capital structures, or difficulties in estimating impacts on the firms future cost structures, also is associated with organisational resistance and forces of inertia (Zott and Amit, 2010). Such issues, given that firms with larger resource bases in support of their business models are also generally less flexible, could potentially lead to that a change results in lower strategic flexibility. These arguments lead to the following hypothesis:

H6b: Firms with business models that are more capital intense are less flexible and therefore, firms with higher strategic flexibility (SI) are also more likely to have lower capital intensity than firms with lower strategic flexibility.

4.5 Data and methods

Data and sample

The sample is constructed using all US listed firms on the NYSE, AMEX, and NASDAQ markets⁹⁰ with available monthly stock market data in the CRSP database, rates from the Federal reserve, and quarterly financial statement data in COMPUSTAT across the paper study sample period 1989 – 2020⁹¹. The study relies on six-digit Global Industry Classification Standard (GICS) codes for industry identification⁹², requiring all firms to have available GICS6 classifiers, and each industry to have at least five members. In line with prior research, financial firms (GICS6 401000 – 403099 and 601000 – 601099) and utility firms (GICS6 551000 – 551099) are excluded due to differences to other industries in capital and financial statements structures as well as regulation (e.g. Trigeorgis and Lambertides, 2014). Following Jia and Yan (2017) firm-periods with end-of-quarter share price [*PRCCQ*] below 1 USD are excluded, and aligned with prior work this paper also excludes firm-periods with book value of equity [*CEQQ*] less than zero, and total assets [*ATQ*] below 1 million USD to limit effects due to small denominator sizes (e.g. Vorst and Yohn, 2018). Current period firm fundamentals are matched to leading quarter market information to account for look-ahead bias⁹³. Further, all firms are required to have at least eight quarters of data for variables included in the estimations of the conditional time-series skewness measure, and in order to apply the Dickinson (2011) firm life cycle approach, each firm is required to have available data over eight quarters for period change in cash flow [*CHECHQ*], net cash flows from operating [*OANCFQ*], investing [*IVNCFQ*] and financing [*FINCFQ*] activities. These criteria result in a final sample covering the period 1989 – 2020 with 422 124 firm-quarter (11 327 firms) observations. Table 4.1 presents the descriptive statistics. Definitions of all variables are provided in Appendix 4.A.

⁹⁰ Firms on these markets are included on the basis of CRSP share codes 10 or 11 as ordinary common shares.

⁹¹ The sample starts in 1989 when statement of cash flows became available for all firms (Dickinson, 2011).

⁹² A growing number of papers finds that GICS outperforms alternative industry schemes (e.g. Jennings et al., 2020; Lee et al., 2015; Bhojraj et al., 2003).

⁹³ The focus of this paper is on explaining current fundamental factors and therefore uses leading market information. In contrast past work investigates pricing information by applying lagged fundamental data (e.g. Del Viva et al., 2017; Trigeorgis and Lambertides, 2014; Fama and French, 1992). Early studies by Fama and French (1992) recommends minimum 6 months for annual data based on evidence of time for financial statement information to be taken up by the market. Recently Bartov and Konchitchki (2017) finds that mean filing calendar days delay for quarterly 10 Q reports are 71.90 days and 109.90 days for annual 10K filings. These findings support an approach using (minimum) leading two quarters (6 months) for annual, and one quarter for quarterly market data to match current period fundamental accounting information.

Table 4.1 – Descriptive statistics

The table shows descriptive statistics for the sample covering the period 1989 – 2020 and consisting of 422 124 firm-quarter observations from 11 327 US firms listed on the AMEX, NYSE and NASDAQ exchanges with available data. Stock prices are from CRSP and financial statement data from COMPUSTAT. The sample selection criteria follow the data and sample selection section. All variables defined in Appendix 4.A are winzorised at the 1st and 99th percentile. **Panel A** reports summary statistics with mean, standard deviation (Std. Dev.), inter-quartile range (IQR) and 25th (Q1), 50th (Median) and 75th (Q3) percentiles. **Panel B** reports variable means for all firms and across introduction, growth, maturity, shake-out and decline stages of the Dickinson (2011) firm life cycle.

Panel A - Summary statistics		Mean	Std. Dev.	Q1	Median	Q3	IQR
ME (Size)	MUSD	2 368.52	7 510.26	52.06	228.34	1 091.05	1 038.99
RET		0.03	0.29	-0.13	0.01	0.16	0.29
Beta (β)		1.20	1.48	0.37	1.08	1.91	1.54
B/M		0.75	0.76	0.30	0.53	0.91	0.61
OP		0.03	0.06	0.01	0.03	0.06	0.04
GP		0.09	0.09	0.04	0.08	0.13	0.09
EPS		0.19	0.60	-0.05	0.12	0.38	0.44
DTE (Leverage)		0.52	1.35	0.01	0.15	0.48	0.47
ATO (BM leanness)		0.52	0.65	0.18	0.35	0.62	0.44
PVfirm (MV)	MUSD	4 618.99	14 203.35	110.71	475.97	2 252.33	2 141.62
PVAIP	MUSD	3 611.94	11 409.95	66.54	309.07	1 638.86	1 572.32
PVGO	MUSD	714.23	2 759.14	0.00	0.00	140.15	140.15
GO		0.53	0.28	0.31	0.55	0.76	0.46
SI		0.08	1.01	-0.55	0.08	0.73	1.28
Innov (IC)		0.09	0.15	0.00	0.01	0.12	0.12
Invest		0.26	0.50	0.00	0.08	0.30	0.30
Divest		0.16	0.19	0.03	0.10	0.23	0.20
Hazard rate	x100	0.45	0.93	0.09	0.19	0.45	0.37
Sales growth		0.45	1.25	-0.03	0.17	0.48	0.50
Δ Market share		1.39	3.66	0.25	0.63	1.19	0.94
Orgslack		0.06	0.54	-0.08	-0.01	0.06	0.13
Cash		0.14	0.14	0.03	0.09	0.20	0.17
Constraint		5.28	2.62	3.00	5.25	7.50	4.50
Complexity		33.12	55.65	3.00	9.00	36.00	33.00
Distress		5.63	2.68	3.38	5.63	7.88	4.50
Ind. Concentration		0.11	0.08	0.06	0.09	0.15	0.09
Ind. Uncertainty		7.49	26.64	0.40	0.97	2.60	2.20
Ind. R&D Intensity		2.52	9.03	0.01	0.05	0.43	0.42
Ind. Sales Growth		-0.88	2.90	-0.79	-0.41	-0.14	0.65
Age (Firm age)	Years	26.90	21.51	11.50	21.25	35.00	23.50
Panel B – Means over the firm life cycle		Firm life cycle stage					
		Pooled	1 introduction	2 growth	3 maturity	4 shake-out	5 decline
ME (Size)	MUSD	2683.12	349.97	2014.56	4184.15	1861.16	297.44
RET		0.03	0.00	0.03	0.05	0.04	0.03
Beta (β)		1.20	1.45	1.30	1.06	1.05	1.24
B/M		0.78	0.78	0.77	0.74	0.97	1.04
OP		0.03	-0.03	0.04	0.05	0.02	-0.02
GP		0.09	0.04	0.09	0.11	0.08	0.06
EPS		0.20	-0.12	0.17	0.35	0.12	-0.12
DTE (Leverage)		0.53	0.60	0.58	0.43	0.71	0.65
ATO (BM leanness)		0.50	0.40	0.44	0.57	0.59	0.49
PVfirm (MV)	MUSD	4870.72	896.57	3426.78	6851.37	3911.37	1025.75
PVAIP	MUSD	3820.83	460.90	2513.36	5568.69	3052.70	663.65
PVGO	MUSD	738.26	359.76	713.32	833.95	547.20	342.64
GO		0.53	0.67	0.55	0.46	0.52	0.63
SI		0.08	-0.24	0.17	0.10	0.01	-0.24
Innov (IC)		0.09	0.18	0.12	0.05	0.03	0.05
Invest		0.27	0.46	0.37	0.15	0.16	0.22
Divest		0.17	0.35	0.13	0.14	0.26	0.38
Hazard rate	x100	0.45	1.59	0.39	0.22	0.52	1.51
Sales growth		0.45	1.22	0.64	0.15	0.14	0.47
Δ Market share		1.40	2.79	1.61	0.94	0.99	1.71
Orgslack		0.06	0.76	0.01	-0.03	0.08	0.57
Cash		0.14	0.19	0.14	0.12	0.18	0.22
Constraint		5.31	6.66	5.21	5.03	5.74	6.78
Complexity		32.43	13.57	29.02	39.92	31.98	20.82
Distress		5.62	4.61	5.38	6.22	5.23	4.24
Ind. Concentration		0.11	0.12	0.11	0.11	0.11	0.11
Ind. Uncertainty		7.55	16.88	8.03	4.77	5.73	8.80
Ind. R&D Intensity		2.55	7.73	3.02	0.85	1.21	3.26
Ind. Sales Growth		-0.88	-1.32	-0.89	-0.75	-0.79	-1.04
Age (Firm age)	Years	28.97	17.74	25.82	35.01	30.93	23.12

Methods

The main empirical context for measures and effects for investigations in this study is the past exercise period window (eight quarters) described in section 4.3, within firms' decisions over their options and implications for outcomes of innovation, market performance and earnings processes consistent with the implied *option chain theory* takes place, and within the proposed measure of strategic intensity (*SI*) is applied directly or indirectly via sorts into standard high-medium-low (HML) periodic (quarterly) quintiles⁹⁴.

The empirical analysis follows the structure in the hypothesis section and all predictions made are tested using t-tests with robust standard errors to account for unequal variances, heteroscedasticity and autocorrelation in the panel data. Significance levels are provided in relation to sample size⁹⁵. The econometrical methods relies on single or multiple factor sorts on firm characteristics (e.g. *SI*, firm Size of firm life cycle stage) and pair-wise mean-difference tests⁹⁶, or alternatively on Fama-Macbeth (1973) panel regressions⁹⁷. In addition, the survival investigation applies semi-parametric complementary log-log modelling to derive predicted hazard rates of firms-at-risk (e.g. Paik, 2014; Mata and Alves, 2018; Agarwal et al., 2002).

Measures, definitions and models

Firm life cycle proxy

A central method in this paper is the Dickinson life cycle stage approach (Dickinson, 2011) that encodes firm-period data based on suggestions in Gort and Klepper (1982) into the five distinct firm life cycle stages (introduction, growth, maturity, shake-out, and decline) represented by the ordinal variable FLC. Each of the five stages, as illustrated in Table 4.2, is defined via signs of activity-based cash flow patterns forming eight states and derived from the Statement of Financial Accounting Standard (SFAS) No. 95, statement of cash flows in which cash flow from operating activities (*SCFO*), cash flow from investing activities (*SCFI*) and cash flow from financing activities (*SCFI*) equal the change in periodic net cash (*change in cash* = *SCFO* + *SCFI* + *SCFI*) at any time.

⁹⁴ All firm quantiles measures (terciles, quintiles or deciles) in this paper are calculated for each period (quarter).

⁹⁵ Good (1992) proposes adjusting P-values for sample size N ($P_{adj} = P(N/100)^{1/2}$), suggesting that a 1% cut-off at $N=100$ should be ca. 0.1% for $N=10\ 000$, or ca. 0.03% at $N=100\ 000$ respective ca. 0.02% at $N=300\ 000$.

⁹⁶ In mean-difference tests based on factor sorts, the t-statistics are obtained by runs of panel regressions within sorted subsamples of pair-wise levels with robust standard errors clustered at the firm level.

⁹⁷ In this paper t-statistics for Fama and MacBeth (1973) panel regressions are estimated using the Newey and West (1987) procedure to control for heteroskedasticity as autocorrelation in the residuals with maximum number of lags $L=4(T/100)^{2/9}$ calculated for T quarters using the integer part as in Wooldridge (2015, p.430).

Table 4.2 – The Dickinson (2011) firm life cycle model

	FLC	Introduction	Growth	Maturity	Shake-out			Decline	
		1	2	3	4			5	
Cashflow type	Variable (sign)								
Operating	SCFO	–	+	+	–	+	+	–	–
Investing	SCFI	–	–	–	–	+	+	+	+
Funding	SCFF	+	+	–	–	+	–	+	–

In this paper the life cycle model is operationalised as a rolling average of the past eight quarters (trailing two years) of statement of cash flows to provide a stable life cycle definition across the past exercise window, and reduce noisiness in the underlying processes similar to in earlier work (e.g. Anderson et al., 2017; Yu et al., 2019). In addition, as in prior literature this paper excludes shake-out⁹⁸ from discussions arguing that there is a lack of economic meaning associated with this stage (see Hasan et al., 2017; Dickinson, 2011).

The firm's sources of flexibility – organisational and financial flexibility

The paper adds two common sources of flexibility as controls in the firm context, by including proxies for operating and financial flexibility that provide the firm (management) and shareholders with options to adapt and commit under uncertainty. As this paper concentrates on strategic flexibility from an overall firm-level perspective, it treats all sources of operational flexibility available to the firm without separation⁹⁹ and considers primarily options available to the firm's management. To proxy for a firm's ability to adapt its operating processes, resources and committed assets to fit or extend to meet opportunities and environmental challenges, by for example switching between sourcing alternatives, re-deploying resources, reverse investments or extend innovation, this paper follows and extends the definition from prior works (Choi et al., 2021; Trigeorgis and Lambertides, 2014) of Organisational slack or flexibility (*Orgslack*) as the industry-adjusted¹⁰⁰ lagged eight quarter average of quarterly sums of cost of goods sold (*COGS*) plus sales and general administrative expenses (*SGA*) less research and development expenses (*RD*) divided by net sales for each firm *i*, less the GICS6 industry median per quarter¹⁰¹. The proxy measure represents the recoverable slack potential

⁹⁸ The specification is silent on cases where cash flows are unsigned (zero), except for assigning all undefined patterns to shake-out by default (Dickinson, 2011, p.1974).

⁹⁹ Other papers have debated various definitions for example separating operational flexibility from growth-option driven flexibility (e.g. Kogut and Kulatilaka, 1994).

¹⁰⁰ The importance of controlling for industry-variation of organisational slack due to the relative nature of the measure has been pointed out in prior studies (see Miller and Leiblein, 1996; Azadegan et al., 2013), but is rare in the literature. This paper considers organisational slack above the industry median level.

¹⁰¹ Similar to the implementation in Chen et al. (2011) and Choi et al. (2021) this study includes cost of goods sold, and consistent with real options view of the firm drops research and development expenses from sales and general administrative expenses (e.g. Ball et al., 2015).

available to firm i (Miller and Leiblein, 1996) in relation to the median of its industry peers over the lagged past exercise period. Firms with more *Orgslack* are expected to have a positive relationship with future growth options (Trigeorgis and Lambertides, 2014) and achieved strategic flexibility captured in strategic intensity. Financial flexibility can be divided into sources available to the firm, such as retained cash or liquidity equivalents as a slack source available to the management, respective changes to the capital structure by redistribution of debt and equity is a source and option that is dependent on the shareholders consent rather than the firm via its management. The primary proxy for *operating* financial flexibility is average cash holdings (*Cash*) that is calculated as the lagged eight quarter average of the ratio of cash deflated by lagged total assets (Faff et al., 2016). The effect of cash as a source of unabsorbed slack (Singh, 1986) on ability to exercise strategic flexibility in the context of creation of new and exercise of future options is expected to be positive (Trigeorgis and Lambertides, 2014)¹⁰².

Present value of the firm, its assets in place (AIP) and growth options (GO)

In order to analyse firm-level value creation under effects of strategic flexibility, this paper follows previous real options studies, and defines present value of the firm (PV_{firm}) as equal to the market value of the firm (MV). Consistent with theory, PV_{firm} is also the sum of the present value of the firm's assets-in-place under no-growth and going-concern assumptions ($PVAIP$) and the present value of its portfolio of future growth options ($PVGO$). Hence, $PVGO$ is the implied difference between firm market value (PV_{firm}) and $PVAIP$ (see Del Viva et al., 2017; Trigeorgis and Lambertides, 2014; Cao et al., 2008). Present value of the assets-in-place for firm i at time t is defined as enterprise value in terms of the perpetual operating cash flows:

$$PVAIP_{i,t} = \frac{CFO_{i,t}}{WACC_{i,t}}, \quad (4.5)$$

where $CFO_{i,t}$ is the sum of current and the last three quarterly operating cash flows before growth investments¹⁰³, and $WACC_{i,t}$ is the discount rate represented by the firm's weighted average cost of capital. Similar to the procedure in Cao et al. (2008), $WACC_{i,t}$ is estimated considering the market model using the 60-month average premium of the Standard & Poor's (S&P) 500 index portfolio over the 1-month T-bill rate, and effective tax rate is derived as the

¹⁰² Other papers (e.g. Trigeorgis and Lambertides, 2014; Del Viva et al., 2017) routinely apply debt-based leverage as a proxies (e.g. debt-to-equity) for financial flexibility. However, as this is an option providing financial flexibility (negatively related to future growth options) for the shareholders that also is likely to capture distress or risk following these studies, this paper excludes it as proxy in the main tests for these reasons.

¹⁰³ To reduce high quarterly variation in the value of assets-in-place, this paper limits $PVAIP$ to a maximum of MV , and in order to avoid issues due to negative present value, exclude periods with negative $PVAIP$.

ratio between income taxes [$TXTQ$] and pre-tax income [PIQ], with $GICS6$ industry average rate for firms without these variables available. As in Trigeorgis and Lambertides (2014) the cost of debt is estimated to be four points lower than for the cost for equity. Different from these papers that apply beta of one for all firms, $WACC_{i,t}$ in this study is calculated using firm-specific betas that are estimated based on 12-month market model regressions on daily stock returns. Hence, the market implied present value of growth options for firm i at time t is:

$$PVGO_{i,t} = PVfirm_{i,t} - PVAIP_{i,t}. \quad (4.6)$$

To facilitate analyses of change in each of the present values ($\Delta PVfirm$, $\Delta PVGO$ and $\Delta PVAIP$) for firm i at time t to capture value creation across the past exercise window ($t-1 \dots t-8$), the paper applies the sum of all periodic changes deflated by opening window total assets:

$$(a)\Delta PVfirm_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} (PVfirm_{i,\tau} - PVfirm_{i,\tau-1})}{TA_{i,t-9}}, \quad (b)\Delta PVGO_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} (PVGO_{i,\tau} - PVGO_{i,\tau-1})}{TA_{i,t-9}}, \quad (4.7)$$

$$(c)\Delta PVAIP_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} (PVAIP_{i,\tau} - PVAIP_{i,\tau-1})}{TA_{i,t-9}}.$$

Further, as in prior work, market implied growth option intensity (GO) for firm i at time t is defined as the percentage of firm market value ($PVfirm$) due to the value of $PVGO$:

$$GO_{i,t} = \frac{PVGO_{i,t}}{MV_{i,t}}, \quad (4.8)$$

The firm's operating real options – New option creation, exercise and divestment

To capture the firm's options within the past exercise window, this paper extends from prior works (Kumar and Li, 2016; Del Viva et al., 2021) that separate firm's investments into past growth and future growth components. These papers consider that a firm in each period, if identified as research and development (R&D) active, treats all asset growth as investment into new options for innovative capacity (IC)¹⁰⁴, and otherwise consider investment as growth exercise (GE). Hence, this paper follows Kumar and Li (2016) by creating $ICfirm$ as a dummy variable identifying IC-active firms by setting the dummy to one (else zero) if the firm report non-missing R&D expenditures in a quarter. Different, from these studies, that assign all asset growth in a period as either IC or GE , this paper argues that investments in any period is likely

¹⁰⁴ While Kumar and Li (2016) focus on asset growth ($AG = \Delta TA = TA_t - TA_{t-1}$), Del Viva et al. (2021) takes as more detailed view considering both AG and accruals based investment ($INV = \Delta PPE + \Delta Inventories$). They reflect on wider differences in definitions and argue that AG by inclusion of intangibles should be a more comprehensive measure proxying for effects of IC .

to be composed of both (*IC* and *GE*) and therefore only recognises the actual level of reported R&D expenses (*RD*) as *IC*-investment ($IC_{i,t} = RD_{i,t}$), and any asset change in excess of this as *GE* investment ($GE_{i,t} = AG_{i,t} - RD_{i,t}, \text{ if } AG_{i,t} \geq RD_{i,t}, \text{ else } 0$). This argumentation is also aligned with for example Kumar and Li (2016) who also notice that the *IC* and growth exercise investments are complex and inseparable. However, both the *IC* and *GE* options are *calls* based on the firm's assets-in-place, and earlier works have argued and shown, that firms also have *put* options, whereof one option is to divest some of its assets provided as a degree of reversibility in periods with falling markets or capacity overhang (e.g. Aretz and Pope, 2018; Pindyck, 1988). Therefore, this paper also allows a firm to divest part of its assets in place, by recognising any negative period change in assets as divestiture ($DIV_{i,t} = \text{abs}(AG_{i,t}), \text{ if } AG_{i,t} < 0, \text{ else } 0$). This is of course a simplification as noted by for example Kumar and Li (2016), due to that firms are more likely to have concurrent and more complex investment processes where all these options are interacting, but for the purpose of the paper, with a degree of measurement error, the implied options provide a top-level perspective that is useful for investigating firm behaviour. To capture overall investments (*IC* and *GE*) and divestments (*DIV*) for firm *i* over the past eight quarter exercise window ($t-1 \dots t-8$), the quarterly sums of each of *IC*, *GE*, and *DIV* deflated by opening window total assets are operationalised into variables *Innov* (*IC*), *Invest* (*GE*) and *Divest* (*DIV*):

$$(a) Innov_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} IC_{i,\tau}}{TA_{i,t-9}}, \quad (b) Invest_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} GE_{i,\tau}}{TA_{i,t-9}}, \quad (c) Divest_{i,t} = \frac{\sum_{\tau=t-8}^{t-1} DIV_{i,\tau}}{TA_{i,t-9}}. \quad (4.9)$$

High-clockspped industries (fast markets)

In order to allow separation of the sample into firms outside and inside a set of high-growth technology industries known for constituting high-clockspped industry sectors (fast markets) to investigate differences between firms with low and high growth-orientation, this paper follows Bhojraj and Lee's (2002) definition and categorise firms in the sample using a dummy variable *TechInd* that is zero for all other firms, and set to one for firms that in the period belongs to one of the three high technology sectors: Telecom (*GICS6*: 352020, 352010, 351010, 351020), Computers (*GICS6*: 252010, 451030, 452020, 453010, 151040, 255040, 451020) and Biotechnology (*GICS6*: 201040, 201060, 251010, 252010, 252010, 254010, 452010, 452030, 254010, 402010, 451010, 501010, 501020, 502010)¹⁰⁵.

¹⁰⁵ In this paper the industry classifications are sampled based on the Global Industry Classification Standard (*GICS*) given its high value relevance (see Bhojraj et al., 2003), and hence all other industry codes used in the

New firms, growth firms and new growth firms

For the purpose of the empirical investigation in this paper for each period, firms that are classified as part of introduction ($FLC = 1$), are treated as new or emergent firms in their early stage of development. In addition, firms that are in a high-technology industry ($TechInd = 1$) are classified as growth firms. The combination of firms that are both currently in the introduction ($FLC = 1$) and in a high-technology industry are defined as new growth firms ($FLC = 1$ and $TechInd = 1$). These operational definitions allow the paper to examine how new and new growth firms are different from other firms.¹⁰⁶

Firm survival and hazard rate models for prediction of firms' risk of exit

In order to analyse the relationship between levels of strategic intensity and firms' risk of exit as a measure of survival across industrial contexts and firm life cycle stages, this paper develops discrete-time hazard rate models. More specifically, hazard rate models are estimated to predict risk of exit for a *negative reason*¹⁰⁷ in each observed firm-period in the sample and apply sorts and mean-difference methods to test impact on firm risk of exit between specific life cycle and industry contexts over levels of strategic intensity. Building from previous studies, a general hazard rate model is specified as a function of study variables and firm-level controls for factors important to firm survival reported in prior work (e.g. Agarwal and Gort, 2002; Tsvetkova et al., 2014):

$$Hazard\ rate = f(FLC\ stage, TechInd, SI\ level, Age, Size, Profit) . \quad (4.10)$$

The study variables that are defined over the past exercise window capture the effect of strategic flexibility via level of strategic intensity (*SI level*), and the firm's contextual hazard through life cycle stage (*FLC stage*) and whether or not it is a member of high-growth industry (*TechInd*). In addition to these central covariates, the model includes firm-level

prior papers were translated into GICS6. Alternative definitions such as Haltiwanger et al. (2014) have been used in the literature and these yield similar results in untabulated tests. A table of some high growth industry definitions are attached as Appendix 4.B.

¹⁰⁶ Consistency between age and life cycle indicators: Though there is a discrepancy between the life cycle stages and age of firms, the logic that firms can enter, exit and re-enter stages across its life is consistent with theory, and therefore new is not limited to newly incorporated firms, but focus on newly entered introduction stage. Despite this, the distribution of firms particularly across introduction, growth and maturity are largely in sequence with firm age, while firms that enter the shake-out stage and enter decline are composed more of a mixture of young and older firms. Therefore, the proxy in the paper at least is reasonably consistent between age in the introduction stage, allowing for the use of this subsample to proxy for new firms.

¹⁰⁷ Following Qian et al. (2019) a firm that has exited markets for a *negative reason* is defined as one that delisted with a CRSP delist code 400, 401, 403, 450, 460, 470, 480, 490, 500, 505, 510, 513, 514, 516, 517, 519, 520, 535, 550, 551, 552, 560, 561, 570, 572, 574, 575, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, or 591.

control variables recognised in the literature. *Age* of the firm accounts for variation in accumulated learning and is common measure that capture liability of newness (e.g. Agarwal and Gort, 2002; Kim and Lee, 2016), while firm levels of *Size* via sales¹⁰⁸ provides information in relation to the liability of smallness and ability of active learning (Pe'er et al., 2016; Tsvetkova et al., 2014). Both *Age* and *Size* are expected to have a positive relationship to firm survival. In addition, firm *Profit* is reported to have a positive effect on survival (Paik, 2014).

Due to that the firms in the sample are observed quarterly, the hazard rate model is operationalised in discrete-observed time-at-risk periods (interval-censored time) as a function of the probability of a firm's exit at a random time (T_{exit})¹⁰⁹ in period t provided that the firm has not yet exited in the last period ($t - 1$): $h_i(t) = \Pr[t - 1 < T_{exit} \leq t \mid T_{exit} > t - 1]$. To estimate the risk of exit for a firm i during time period t , considering its life cycle stage (**FLC**), clockspeed industry association (**TechInd**), SI level (**SIq**) and control variables (**X**), this paper follows earlier studies (see Mata and Alves, 2018; Agarwal et al., 2002; Yang et al., 2017) in applying a complementary log-log distribution model as the time-discrete equivalent of the Cox proportional hazard model that supports time-varying covariates and non-monotonic distribution of failure rates commonly associated with firm exit in the literature¹¹⁰:

$$\log(-\log(1 - h_i(t))) = \gamma' FLC_{i,t} + \eta' TechInd_{i,t} + \theta' SIq_{i,t} + \beta' X_{i,t} + \delta_{i,t} + \alpha_t. \quad (4.11)$$

where, $FLC_{i,t}$ is the vector of firm life cycle stages ($FLC1 \dots FLC5$) excluding the shake-out stage ($FLC4$)¹¹¹. $TechInd_{i,t}$ is the dummy variable set to one if the firm is in a high-clockspeed industry as defined above, and $SIq_{i,t}$ is a vector of three dummies representing a positive ($SI+$, $q5$), low ($low SI$, $q3$) and negative ($SI-$, $q1$) quintile level of strategic intensity. The control variables in $X_{i,t}$ are as introduced above, firm age (*Age*) in years, firm size by sales quintile estimated quarterly (*Sizeq*) and average firm operating profitability (*OP*) across the past exercise period (*Profit*). For these, γ' , η' , θ' , and β' are the associated regression parameter vectors to be estimated. In addition, $\delta_{i,t}$ is the vector of quarter-year dummies to control for

¹⁰⁸ Various size measures are used in the literature, e.g. number of employees, total assets or sales, and it is suggested that results are similar indecently of measure (see Tsvetkova et al., 2014; Agarwal et al., 2002).

¹⁰⁹ To facilitate this analysis, a dependent binomial variable (*FirmExit*) is set to one for the last available period for a firm that has exited with a negative reason, else zero.

¹¹⁰ The probability distribution of firm exit is commonly found to increase in early firm life following liability of adolescence theory, then decrease with firm age (e.g. Cressy, 2006; Bruderl and Schussler, 1990).

¹¹¹ As is common in the literature and in order to avoid overspecification or collinearity issues some variation such as *SI* quintiles two and four, shake-out life cycle stage (*FLC4*) and low-technology firms ($TechInd = 0$) are part of the baseline hazard rate along with unexplained variation due to quarterly time-periods.

fixed effect of economy-wide conditions, and α_t is the baseline hazard, expressed as a non-parametrical function of period-at-risk dummies to account for fixed time effects¹¹². Prediction of the hazard rate for each firm i at interval t ($\hat{h}_i(t)$), given the actual values for each of the considered covariates is achieved by reformulating equation (4.11) into the following form:

$$\hat{h}_i(t) = 1 - \exp\left(-\exp(\gamma' FLC_{i,t} + \eta' TechInd_{i,t} + \theta' SIq_{i,t} + \beta' X_{i,t} + \delta_{i,t} + \hat{\alpha}_t)\right) \quad (4.12)$$

Other measures and controls

In addition to the above measures, to provide further controls and capture related effects within tests, the paper includes a number of variables, all of which are defined in detail in Appendix 4.A and also introduced in the results section. To measure firm size (*Size*), market capitalization of equity (*ME*) is used (e.g. Del Viva et al., 2017), and to estimate firm age (*Age*) either the date of the firm's incorporation or alternative first date when firm appeared in CRSP or COMPUSTAT listings are used (e.g. Loderer et al., 2017). In the main tests, the lagged eight-quarter averages of the following variables are calculated: Organisational complexity (*Complexity*) estimated using the product of the numbers of business and geographical segments (e.g. Markarian and Parbonetti, 2007), firm financial distress (*Distress*) represented as quarterly deciles of Altman's Z (Altman, 2000) and financial constraints (*Constraint*) proxied via quarterly deciles of the Whited and Wu (2006) WW-index. In addition, lagged eight-quarter cumulative percentage of sales growth (*Sales growth*) captures firm growth, and past eight-quarter cumulative percentage of firm market share growth ($\Delta Market\ share$) proxies for changes in market outcomes (e.g. Fresard, 2010). Effects of environmental dynamism over the past eight-quarters is proxied via the underlying components following Eroglu and Hofer (2014) via *Industry concentration* using the Herfindahl–Hirschman index (e.g. Li and Li, 2010), *Industry uncertainty* measured as the standard deviation of percentage industry sales growth (e.g. Choi et al., 2018), and through *Industry R&D Intensity* captured via average of all firm-level R&D intensity within each industry (Tong and Li, 2011). To provide proxies for market risk in robustness tests, following Soliman (2008) the three Fama-French factors *Beta* (β), book-to-market ratio (*B/M*) and *Size* (as defined above) are included. Also for robustness tests, the paper includes the market-based debt to equity ratio (*DTE*) following Kumar and Li

¹¹² The paper also considered dummies to capture unobserved industry fixed effects (Agarwal et al., 2002). However, the findings that the dummies rendered the industry-driven *TechInd* variable powerless while providing similar results while included or not, led to that they were excluded in the final model specification.

(2016) and stock returns (*RET*) together with the alternative earnings predictors of firm-level skewness gross profit (*GP*) as in Novy-Marx. (2013) and earnings per share (*EPS*) calculated as in prior work (e.g. Jia and Yan, 2017). Lastly, the asset-turn-over ratio (*ATO*) is used to proxy for business model leanness (and assessment of business model rigidity).

4.6 Results

Strategic flexibility across the firm life cycle

Normalisation of growth options and strategic flexibility over the life cycle

To investigate the relationship between strategic flexibility proxied via strategic intensity (*SI*) and growth options (*GO*), and test the related predictions at the firm portfolio-level across the firm life cycle, the sample is classified into the five Dickinson (2011) firm life cycle (*FLC*) categories and pooled over all stages. Strategic intensity is estimated using the equal-weighted approach to capture the overall level of achieved strategic flexibility. In addition, to provide further insights, the five control variables organisational slack (*Orgslack*) representing organisational flexibility, financial flexibility (*Cash*), financial constraints (*Constraint*), organisational complexity (*Complexity*) and firm age (*Age*) are added for the pooled sample and each firm life cycle stage.

Table 4.3 reports pooled and distribution of mean observations between life cycle stages for dependents (*GO* and *SI*) and control variables, as well as provide mean-differences with pair-wise test statistics between introduction–growth/growth–maturity/introduction–maturity for all firm sizes, respective firms sorted on large (*q5*), medium (*q3*) and small firm (*q1*) market equity (*ME*) firm size quintiles. In addition, mean-differences and test statistics are reported for pooled and stage-wise differences between small and large firms in terms of strategic intensity (*SI*) and growth options (*GO*). The main relationships are also provided charted in Figure 4.4.

A first observation of the firm age distribution confirms the literature arguments that firms of all ages are likely to be found in the decline and shake-out stages with age adopting an inverted U-shape (Faff et al., 2016), as the average firm age for both shake-out (30.5 years) and decline (20.0 years) in Table 4.3 are lower than for firms in the mature stage (35.5 years). Hence, the focus of the analysis of life cycle stages in this study will be on the introduction to maturity stages where the firm ages appear monotonic across all firm sizes¹¹³.

¹¹³ Hence in this test, shake-out and decline stages are marked with grey background in figures and tables.

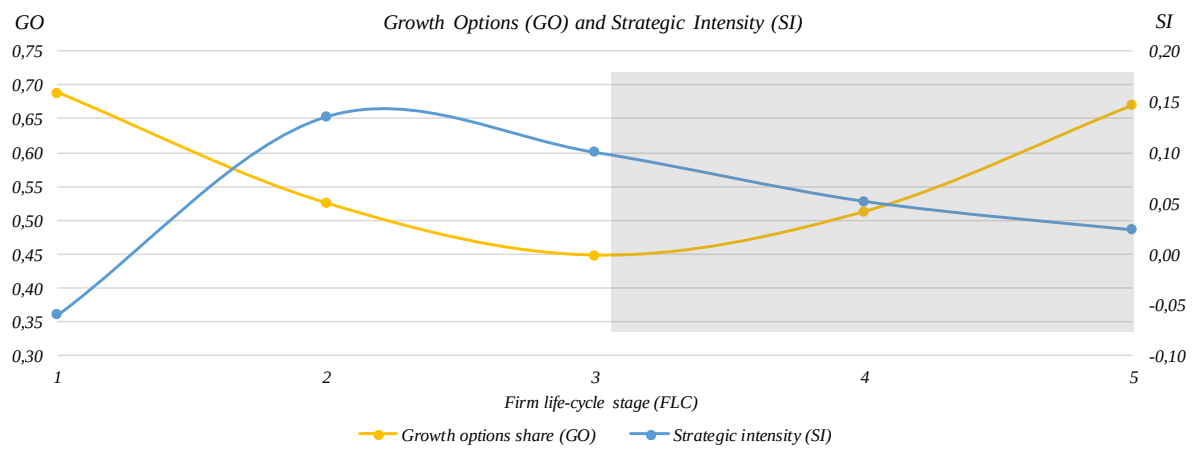
Table 4.3 – Growth options and strategic flexibility across the firm life cycle

The table presents mean observations of growth option share of firm value (*GO*), strategic intensity (*SI*), financial constraints (*WW-index*) deciles and firm age (*age*) across firm life cycle stages (*FLC*) and over quintiles representing large (*q5*), medium-sized (*q3*) and small firms (*q1*) based on market equity (*me*). Financial constraint indicators are estimated as deciles of the Whited and Wu (2006) index. The variables are defined in Appendix 4.A and calculated using quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness used in the *strategic intensity (SI)* proxy extends from Gu and Wu (2003) and applies equal-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. The firm life cycle (*FLC*) model follows Dickinson (2011). Further, pair-wise mean difference test statistics associated with the predictions made in this paper between introduction/growth respective growth/maturity stage and between firm size quintiles *q5* (large firms) and *q1* (small firms) are reported for *GO* and *SI*. The statistics shown in parentheses are calculated using two-sided t-tests with robust standard errors clustered at the firm-level. Significance levels are indicated using ##, #, *, **, and *** for 5%, 1%, 0.5%, 0.1% and 0.01%.

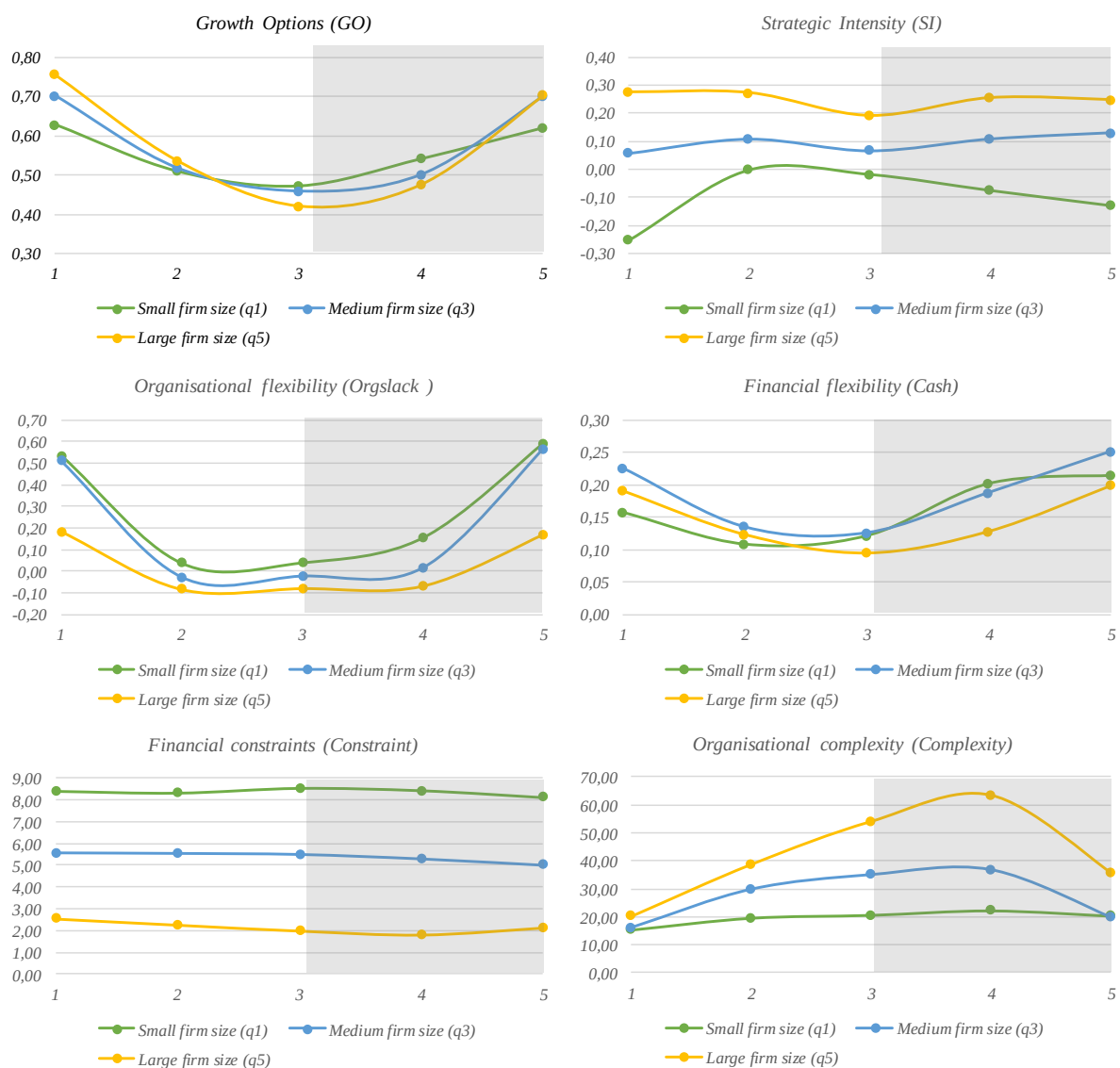
Observations (mean)	Firm life cycle stage						Stage-wise mean differences		
	Pooled	1 Introduction	2 Growth	3 Maturity	4 Shake-out	5 Decline	Intro. vs. Growth	Growth vs. Mature	Intro. vs. Mature
All firm sizes									
Growth options share (<i>GO</i>)	0.53	0.69	0.53	0.45	0.51	0.67	-0.16*** (-34.52)	-0.08*** (-22.56)	-0.24*** (-49.23)
Strategic intensity (<i>SI</i>)	0.08	-0.06	0.14	0.10	0.05	0.02	0.20*** (12.39)	-0.04** (-3.83)	0.16*** (9.73)
Org. flexibility (<i>Orgslack</i>)	0.06	0.51	-0.03	-0.03	0.04	0.60			
Fin. flexibility (<i>Cash</i>)	0.14	0.20	0.13	0.11	0.18	0.23			
Fin. constraints (<i>Constraint</i>)	5.31	6.39	5.12	4.96	5.74	6.21			
Org. complexity (<i>Complexity</i>)	32.78	15.88	30.90	39.96	37.49	20.70			
Firm age	29.00	17.96	27.43	35.51	30.45	20.02			
Obs. <i>SI</i> (<i>N</i>)	307 339	41 982	99 000	123 797	22 642	19 918			
Large firm size (q5)									
Growth options share (<i>GO</i>)	0.49	0.76	0.54	0.42	0.48	0.70	-0.22*** (-13.73)	-0.12*** (-16.43)	-0.34*** (-20.96)
Strategic intensity (<i>SI</i>)	0.23	0.27	0.27	0.19	0.25	0.25	0.00 (-0.05)	-0.08*** (-4.04)	-0.08 (-1.66)
Org. flexibility (<i>Orgslack</i>)	-0.07	0.18	-0.08	-0.08	-0.07	0.17			
Fin. flexibility (<i>Cash</i>)	0.11	0.19	0.12	0.09	0.13	0.20			
Fin. constraints (<i>Constraint</i>)	2.07	2.54	2.24	1.96	1.77	2.11			
Org. complexity (<i>Complexity</i>)	48.01	20.18	38.64	53.94	63.35	35.93			
Firm age	38.78	22.85	32.89	43.21	42.09	30.35			
Obs. <i>SI</i> (<i>N</i>)	65 084	1 901	22 433	36 620	3 591	539			
Medium firm size (q3)									
Growth options share (<i>GO</i>)	0.54	0.70	0.52	0.46	0.50	0.70	-0.18*** (-21.90)	-0.06*** (-9.40)	-0.24*** (-27.49)
Strategic intensity (<i>SI</i>)	0.09	0.06	0.11	0.07	0.11	0.13	0.05 (1.71)	-0.04## (-2.37)	0.01 (0.30)
Org. flexibility (<i>Orgslack</i>)	0.08	0.51	-0.03	-0.02	0.01	0.57			
Fin. flexibility (<i>Cash</i>)	0.15	0.22	0.13	0.13	0.19	0.25			
Fin. constraints (<i>Constraint</i>)	5.47	5.55	5.53	5.48	5.29	5.01			
Org. complexity (<i>Complexity</i>)	29.64	16.01	29.74	34.97	36.77	19.78			
Firm age	27.13	17.63	26.19	33.41	29.29	17.99			
Obs. <i>SI</i> (<i>N</i>)	59 550	8 888	20 929	21 998	3 983	3 752			
Small firm size (q1)									
Growth options share (<i>GO</i>)	0.54	0.63	0.51	0.47	0.54	0.62	-0.12*** (-12.31)	-0.04*** (-4.37)	-0.15*** (-15.83)
Strategic intensity (<i>SI</i>)	-0.09	-0.25	0.00	-0.02	-0.07	-0.13	0.25*** (10.23)	-0.02 (-0.82)	0.23*** (10.24)
Org. flexibility (<i>Orgslack</i>)	0.20	0.53	0.04	0.04	0.15	0.59			
Fin. flexibility (<i>Cash</i>)	0.14	0.16	0.11	0.12	0.20	0.21			
Fin. constraints (<i>Constraint</i>)	8.39	8.38	8.31	8.51	8.41	8.12			
Org. complexity (<i>Complexity</i>)	19.51	15.45	19.61	20.64	22.20	20.34			
Firm age	23.01	17.81	23.12	26.65	25.71	21.25			
Obs. <i>SI</i> (<i>N</i>)	61 867	13 897	14 156	19 408	6 820	7 586			
Size mean differences (q5 - q1)									
GO Large vs. small firms	-0.04*** (-7.20)	0.13*** (7.68)	0.03** (3.01)	-0.05*** (-6.68)	-0.07# (-2.71)	0.08### (2.46)			
SI Large vs. small firms	0.31*** (16.89)	0.53*** (10.17)	0.27*** (10.70)	0.21*** (8.70)	0.33*** (8.15)	0.38*** (4.11)			

Figure 4.4 – Growth Options and Strategic Intensity across firm life cycle stages

(A) – All firm sizes.



(B) – Small (q1), medium (q3) and large (q5) firm quintile sizes (with control variables).



For all firm sizes, the growth options share of firm value is highest in the introduction stage (0.69), followed by the growth stage (0.53) and at lowest in the mature firm stage (0.45). The stage-wise mean-differences across introduction and maturity are all negative and significant, confirming the first hypothesis (**H1a**) that the firm's real options appear to be normalising as predicted in the real options literature (e.g. Schwartz and Moon, 2001).

Further, the relationship seems to be both significant and consistent across all firm sizes. In the second hypothesis (**H1b**) it was predicted that overall, as firms develop, the level of strategic intensity (*SI*) would increase as firms that are in a position to do so, act on and exercise their growth options and convert these into assets-in-place. The expectation was to observe an increase in *SI* over all stages and hence a constant rate in the normalisation process was assumed. However, as the mean-difference results show in Table 4.3, the rate of normalisation is twice as high between the introduction and growth stage (-0.16) compared to the growth and maturity stages (-0.08). The resulting *SI* reflect the change in the rate of growth options conversion that is positive across introduction to maturity stages (0.16) as predicted, with variation due to the stage-wise difference in net growth exercise rate¹¹⁴.

Firm size and strategic flexibility

The results also provide insights into the open question about the role of firm size in firms' ability to exercise strategic flexibility. It was hypothesised (**H2a**) that strategic flexibility is enhanced by firm size due to the comprehensive evidence of small (and new) firm financial constraints in the literature. The reported mean-differences between large (*q5*) and small (*q1*) firms in Table 4.3 support the hypothesis since the difference in strategic intensity for each life cycle stage is significant and positive, proposing that large firms appear to achieve more flexibility compared to small firms. One explanation for the result could be the additional finding that large firms also seem to have more growth options than small firms in the introduction (0.13) and growth stages (0.03). Though the pooled result indicates a small but significant mean-difference (-0.04) supporting that small firms should overall have some more growth options compared to large firms, the results also suggest that these options are in the mature, shake-out or decline stages, rather than in the start-up introduction to growth stages.

¹¹⁴ The exercise rate differences create a peak in achieved strategic intensity following the introduction and growth stages (0.20) that as the conversion rate decreases, becomes negative (-0.04) as the conversion rate slows down between growth and maturity.

In more detail, the above prediction of normalisation of strategic intensity that appears to hold for the pooled sample of all firm sizes, does not seem to hold consistently across firm size quintiles. While the expected normalisation pattern remains significant and positive (0.23) for small firms, the stage-wise patterns for medium and large sized firms is mixed and generally insignificant as their levels of strategic intensity appear less variant and positive over the introduction to mature life cycle stages. Two important findings implied by the results are that the variation in strategic flexibility appears driven by small firms and that small firms also on average have negative or no outcome of strategic flexibility across all life cycle stages. These results are consistent with arguments for outcomes of strategic flexibility in the literature (e.g. Brozovic, 2018) that commonly suggest small firms are more likely to be financially constrained due to severe underfunding problems relative to larger firms affecting their abilities to pursue market opportunities (Carter and Auken, 2005). A related accounting explanation for the negative strategic intensity of small and new (early stage) firms, propose that large early stage innovation investments that is followed by proportionally large expensing activities not fully classified as research and development can contribute to both increased negative skewness and sustained firm losses (e.g. Joos and Plesko, 2005; Darrough and Ye, 2007). In addition, the relatively small asset bases of smaller firms with are likely to amplify such effects.

Interestingly, the results do not provide any evidence in support of the argument that large firms could be limited in their abilities to be strategically flexible due to their relative degree of organisational complexity and related challenges to attention (e.g. Barnett, 2008), as the data suggests that strategic flexibility increases consistently with firm size in all life cycle stages. A related argument holds that large firms should have more slack resources at their disposal as a source of flexibility (Carter and Auken, 2005). The results suggest the opposite, as the measure of organisational slack (*Orgslack*) indicate that small firms have a higher level than large firms in all stages.

Taken together, the findings provide evidence that growth options are normalising across the introduction to maturity stages following the expectations in the real options literature, and that achieved strategic flexibility appears to follow the rate of growth options exercise over the firm life cycle stages. However, these results also suggest that while larger firms are likely to enjoy more growth options than smaller firms and positive outcomes from strategic flexibility, smaller firms are less likely to capture growth options and also more likely to experience negative outcomes consistent with effects of financial constraints.

Value creation and levels of strategic flexibility across the life cycle

The third test focuses on value creation and outcomes of levels of strategic intensity (*SI*) within the past exercise period, and hence the measure of *SI* is estimated using the end-weighted skewness approach to give weight to strategic flexibility within the exercise window. As the investigation concentrates on the effects within the eight quarter past window, the main dependent variables are change in elements of firm value ($\Delta PVGO$, $\Delta PVAIP$ and ΔPV_{firm}) with added controls for expected outcomes other than value creation by inclusion of firm growth (*Sales growth*) and increase of market share ($\Delta Market\ share$) as outcomes suggested by the chain-effect theory. In addition, and to control for the investment behaviour as calls and puts on the assets of firms in the same window, proxies of new IC options creation (*Innov*), growth exercise investment (*Invest*) and asset divestiture (*Divest*) are included. As in the first two tests, the sample is first sorted into Dickinson (2011) firm-life-cycle stages, and then further into quintiles on level of strategic intensity to represent groups of firms with a positive ($SI+$, $q5$), low or passive (*low SI*, $q3$) and negative ($SI-$, $q1$) quintile level of strategic intensity. The hypotheses are tested using mean-difference between firm groups with a positive ($SI+$, $q5$) and negative ($SI-$, $q1$) in the pooled sample (firms in all life stages) and for new firms (introduction stage firms).

Table 4.4 reports the results of dependents and controls for all levels respective for each quintile level of strategic intensity ($q1$, $q3$ and $q5$) in the pooled sample and over each of the firm life-cycle stages. In addition, mean-differences between positive ($SI+$, $q5$) and negative ($SI-$, $q1$) with associated robust t-statistics are provided for change in firm value and each of the control variables. Figure 4.5 presents the tabulated data in bar charts with each variable for firms at positive, low and negative *SI* levels.

The first and general prediction suggests that overall, firms with a higher (lower) level of achieved strategic flexibility captured in strategic intensity should following the chain-effect theory, be related to higher (lower) outcomes in market achievements followed by increase (decrease) in firm growth and ultimately achieve positive (negative) financial value creation effects. The results provide support for this hypothesis (***H3a***) as the mean-difference in ΔPV_{firm} between high positive and negative *SI*-firms is large (0.52) and significant in the pooled sample of firms. Moreover, the effect holds not only at the pooled level of firms, but also across each of the firm life cycle stages.

Table 4.4 – Value creation, growth and investment over levels of strategic flexibility across the firm life cycle

The table presents firm-level mean changes (and *SI+* vs. *SI-* mean differences) in present value, growth, market share and investment variables within the past eight quarter exercise window for all firms pooled and for firms in each life cycle stage and levels of strategic flexibility. The variables defined in Appendix 4.A are calculated using quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness used in the *strategic intensity (SI) proxy* extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. The firm life cycle (*FLC*) model follows Dickinson (2011). For each life cycle stage, the number of *SI* observations are shown (*N*). Test statistics are reported for mean differences between high positive (*q5, SI+*) and high negative (*q1, SI-*) quintiles of strategic intensity in variables associated with the predictions made in the paper. Test statistics shown in parentheses are calculated using two-sided t-tests with robust standard errors clustered at the firm-level and significance levels are indicated using ##, #, *, **, and *** for 5%, 1%, 0.5%, 0.1% and 0.01%.

Observations (mean)	Firm life cycle stage					
	<i>Pooled</i>	<i>1 Introduction</i>	<i>2 Growth</i>	<i>3 Maturity</i>	<i>4 Shake-out</i>	<i>5 Decline</i>
All SI levels						
<i>APVGO</i>	0.20	0.53	0.31	0.09	0.02	0.17
<i>APVAIP</i>	0.29	0.34	0.49	0.17	0.01	0.05
<i>APVfirm</i>	0.50	0.86	0.82	0.26	0.02	0.21
<i>Sales growth</i>	0.36	0.77	0.53	0.14	0.11	0.41
<i>ΔMarket share</i>	1.12	1.87	1.23	0.81	0.90	1.53
<i>Innov (IC)</i>	0.09	0.20	0.08	0.04	0.07	0.19
<i>Invest</i>	0.44	0.52	0.68	0.30	0.28	0.17
<i>Divest</i>	0.24	0.45	0.16	0.18	0.32	0.48
<i>Obs. SI (N)</i>	290 478	39 549	94 973	115 972	21 531	18 453
SI+ (q5)						
<i>APVGO</i>	0.29	0.70	0.48	0.16	0.07	0.11
<i>APVAIP</i>	0.44	0.59	0.69	0.32	0.17	0.26
<i>APVfirm</i>	0.74	1.29	1.19	0.47	0.25	0.33
<i>Sales growth</i>	0.52	1.08	0.74	0.24	0.28	0.73
<i>ΔMarket share</i>	1.33	2.32	1.49	0.90	1.11	2.08
<i>Innov (IC)</i>	0.10	0.25	0.09	0.05	0.07	0.22
<i>Invest</i>	0.43	0.40	0.71	0.33	0.25	0.13
<i>Divest</i>	0.24	0.41	0.17	0.18	0.32	0.48
<i>Obs. SI (N)</i>	57 478	7 201	17 057	23 982	5 007	4 231
SI (passive, q3)						
<i>APVGO</i>	0.19	0.56	0.32	0.08	-0.03	0.05
<i>APVAIP</i>	0.31	0.39	0.54	0.16	0.00	0.15
<i>APVfirm</i>	0.52	0.97	0.89	0.25	-0.04	0.25
<i>Sales growth</i>	0.35	0.79	0.54	0.14	0.08	0.33
<i>ΔMarket share</i>	1.11	1.86	1.24	0.81	0.86	1.33
<i>Innov (IC)</i>	0.08	0.20	0.08	0.04	0.06	0.17
<i>Invest</i>	0.46	0.56	0.69	0.31	0.29	0.19
<i>Divest</i>	0.23	0.46	0.16	0.18	0.32	0.47
<i>Obs. SI (N)</i>	58 454	7 583	19 655	23 966	4 146	3 104
SI- (q1)						
<i>APVGO</i>	0.10	0.35	0.17	0.00	-0.03	0.12
<i>APVAIP</i>	0.12	0.15	0.28	-0.01	-0.12	-0.18
<i>APVfirm</i>	0.22	0.43	0.46	-0.02	-0.16	-0.05
<i>Sales growth</i>	0.22	0.51	0.33	0.03	-0.04	0.24
<i>ΔMarket share</i>	0.98	1.49	1.00	0.74	0.70	1.32
<i>Innov (IC)</i>	0.09	0.17	0.07	0.04	0.06	0.18
<i>Invest</i>	0.44	0.54	0.64	0.28	0.33	0.19
<i>Divest</i>	0.26	0.47	0.16	0.18	0.33	0.51
<i>Obs. SI (N)</i>	58 061	9 467	19 758	20 214	4 057	4 565
Mean differences:						
<i>APVfirm SI+ vs. SI-</i>	0,52*** (18,20)	0,86*** (5,03)	0,73*** (13,41)	0,49*** (18,93)	0,41*** (5,95)	0,38## (2,33)
<i>Sales growth SI+ vs. SI-</i>	0,30*** (30,38)	0,57*** (15,62)	0,41*** (25,26)	0,21*** (32,18)	0,32*** (15,33)	0,49*** (10,97)
<i>ΔMarket share SI+ vs. SI-</i>	0,35*** (14,05)	0,83*** (10,27)	0,48*** (13,27)	0,16*** (5,27)	0,41*** (5,97)	0,76*** (6,56)
<i>Innov (IC) SI+ vs. SI-</i>	0,02*** (6,92)	0,08*** (10,48)	0,02*** (6,07)	0,01** (3,48)	0,01## (2,07)	0,05*** (5,87)
<i>Invest SI+ vs. SI-</i>	-0,01 (-0,53)	-0,14** (-3,49)	0,07## (2,20)	0,06## (2,47)	-0,08 (-1,38)	-0,06 (-1,71)
<i>Divest SI+ vs. SI-</i>	-0,01** (-3,79)	-0,06*** (-5,26)	0,01## (2,12)	0,01 (1,27)	-0,01 (-1,03)	-0,03## (-2,48)

Figure 4.5 – Value creation, growth and investment over levels of strategic flexibility across the firm life cycle



It also appears that positive *SI*-firms are not only converting more options into assets-in-place providing a higher level of ΔPV_{AIP} , but also appear to generate more new growth options via the change in market implied options value ΔPV_{GO} . The investment behaviour is largely consistent with the change in ΔPV_{GO} as creation of new options via investment in innovation capability (*Innov*, *IC*) is also comparably higher for positive *SI*-firms, and both market share growth ($\Delta Market\ share$) and firm growth proxied via sales growth are higher for these firms. Also, firms with a higher level of achieved strategic flexibility in the introduction, shake-out and decline stages seem to have a lower degree of overall divestiture (-0.01). This could suggest that firms with higher levels of strategic flexibility also have higher levels of resource adaptability as argued in earlier work (e.g. Ebben and Johnson, 2005) being more flexible with existing resources to match unexpected changes in their environment. An alternative explanation evident from the results, could be that positive-*SI* firms are generally more profitable, and therefore have less pressure to engage in asset divestiture. Finally, the data also indicates that firms with high levels of positive achieved *SI* seems to invest less in growth exercise options in the introduction stage compared to firms with lower or negative levels of *SI*. One explanation for this observation, could be that the firms in the sample at higher positive *SI* levels are also more innovation-oriented firms (e.g. high-technology) with a higher level of *IC* investment in their early stages of development, and perhaps therefore also firms with smaller asset bases in reflection of lower levels of asset growth investment. Consistently with the results in the previous test at the portfolio-level, change in new value creation within the past exercise window from growth options in this test are also monotonically declining across predominantly the introduction to mature stages, as predicted by the real options theory.

Lastly, the second prediction (**H3b**) hypothesised of the importance for new firms to achieve strategic flexibility and a statistically and economically significant relationship between accomplished levels of *SI* and value creation for new firms. The mean-difference between high positive (*q5*) and negative (*q1*) new firms is 0.86 and significant supporting the hypothesis. The difference is larger than for firms in any other firm life cycle stage, and strengthens the suggestion that the relationship between new firm value creation and strategic flexibility is both significant and economically relevant consistent with arguments in the literature (e.g. Brinckmann et al., 2019; Dai et al., 2018).

These results suggest that there is a strong relationship between strategic flexibility and firm-level performance in value creation and growth. Specifically, for new and early stage firms.

Strategic flexibility of firms within and across high growth-oriented industries

To investigate the relationship between strategic flexibility and firm performance conditional on economical contexts with lower or higher levels of implied technological change and innovation-orientation (clockspeed), this section approaches empirical tests in three steps.

In the first step to address the prediction that firms within industries with higher levels of technology are also more strategically flexible, the sample is sorted into low- respective high-clockspeed industries representing markets with lower and higher levels of technology-driven firms using the classification provided via the *TechInd* dummy variable and then further sorted into life cycle stages (*FLC*) following the Dickinson (2011) approach. In this analysis strategic intensity is estimated using the equal-weighted skewness approach to capture the overall level of asymmetry.

The result tabulated in Panel A of Table 4.5 and also illustrated in Figure 4.6, provide general insights into how firms with expected higher respective lower levels of technology-driven growth-orientation differs in terms of strategic intensity. Not only is the resulting mean-difference (Panel B.3 in Table 4.5) between high and low-clockspeed firms significant (0.06, t-value: 4.21) providing support for hypothesis (**H4a**) that firms in faster markets are generally more strategically flexible than firms in less intense environments, also the relationship appears to holds across all life cycle stages.

Figure 4.6 – Strategic flexibility across firm life cycle stages in low- and high-clockspeed firms

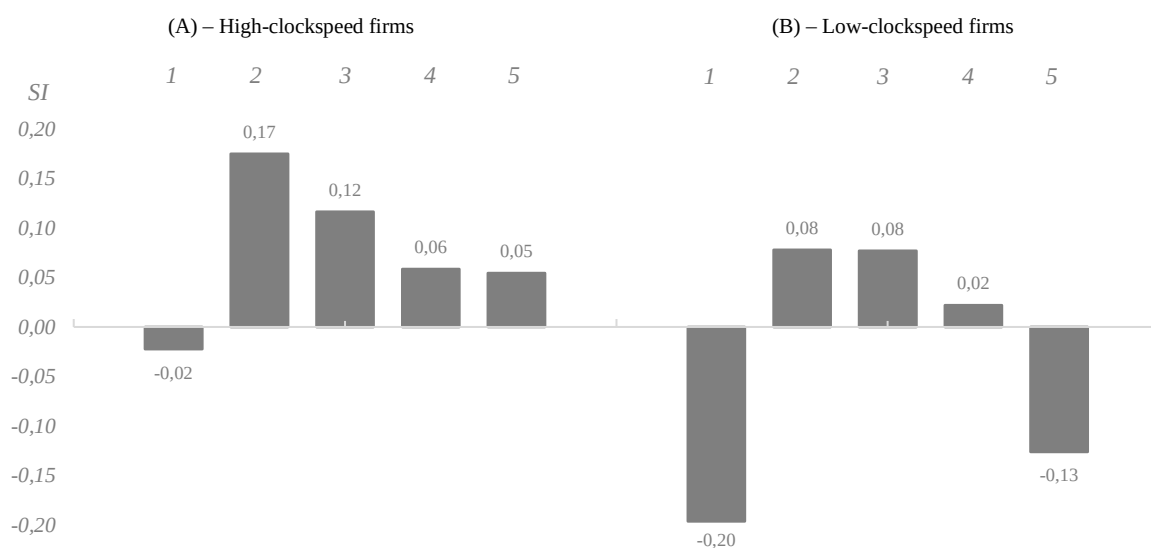


Table 4.5 – Strategic flexibility of firms within/outside high growth-oriented industries

The table presents descriptive and test statistics for variation of strategic flexibility (*SI*), performance (value components and growth) and environmental dynamics (competition, uncertainty and innovation) among new, established and all firms inside high-technology (*high-clockspeed*) industries and outside high-technology (*low-clockspeed*) industries. New firms (*new*) are proxied using the introduction stage ($FLC = 1$) of the Dickinson (2011) firm life cycle model estimated over the lagged eight quarters and established firms (*established*) are firms in the growth and mature life cycle stages ($FLC=2$ or $FLC=3$). All firms are new and established firms combined. Firms in the shake-out and decline stages are excluded in this table due to their limited economical interpretation and mixed stage nature. Technology firms are defined as belonging to high-technology (*high-clockspeed*) industry sectors as suggested in Bhojraj and Lee (2002) with all other firms considered non-technology firms. The variables defined in Appendix 4.A are calculated using quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness used in the *strategic intensity* (*SI*) proxy in Panel A extends from Gu and Wu (2003) and uses equal-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. In Panel B, the estimation of *SI* uses end-weighted third moments to capture changes inside the pasted exercise period window. **Panel A** reports mean of strategic flexibility (*SI*) and number of *SI* observations (*N*) across the firm life cycle stages for low- and high-clockspeed firms. **Panel B** reports mean change in variables for low- and high-clockspeed firms for new, established and all firms over the past eight-quarter exercise window. In Panel B.1 strategic intensity is tabulated. In Panel B.2 mean change in the firm-level value creation ($\Delta PVGO$, $\Delta PVAIP$ and $\Delta PVfirm$), growth (*Sales growth*), and financial flexibility (*Cash*) is shown. It also reports mean averages for the three environmental dynamism variables, *Industry Concentration* as a measure for competition ($1 - concentration$), *Industry Uncertainty* and *Industry R&D Intensity* over the same past exercise window. Panel B.3 reports pair-wise mean-differences between high- and low-clockspeed industries for firm and industry variables respective mean-difference test statistics for strategic Intensity associated with the predictions made in the paper. The test statistics shown in parentheses are calculated using two-sided t-tests with robust standard errors clustered at the firm-level and significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A - Strategic intensity across the life cycle stage						
		Firm life cycle stage				
		1	2	3	4	5
	Pooled	Introduction	Growth	Maturity	Shake-out	Decline
High-clockspeed firms	0.10	-0.02	0.17	0.12	0.06	0.05
Low-clockspeed firms	0.04	-0.20	0.08	0.08	0.02	-0.13
Panel B - Strategic intensity, performance and environmental dynamism in low- and high-clockspeed firms (new and established)						
	Low-clockspeed			High-clockspeed		
	new	established	all	new	established	all
Panel B.1 - Strategic Intensity						
Strategic intensity (SI)	-0.196	0.077	0.052	-0.023	0.144	0.108
Obs. SI (N)	10 375	102 256	112 631	31 563	115 060	146 623
Panel B.2 – Performance and environmental dynamism						
$\Delta PVGO$	0.26	0.15	0.15	0.57	0.22	0.25
$\Delta PVAIP$	0.32	0.28	0.29	0.39	0.33	0.33
ΔPV_{firm}	0.54	0.44	0.45	0.96	0.55	0.58
Sales growth	0.73	0.31	0.34	0.79	0.33	0.42
Financial flexibility (Cash)	0.12	0.09	0.09	0.23	0.14	0.16
Industry Concentration	0.11	0.10	0.10	0.11	0.08	0.09
Industry Uncertainty	2.55	2.50	2.50	12.07	5.60	6.99
Industry R&D Intensity	0.17	0.11	0.12	8.39	1.39	2.88
Obs. SI (N)	6 465	59 792	66 257	19 387	68 629	88 016
Panel B.3 - Mean differences						
	High- vs Low-clockspeed (Performance and environmental dynamism)			Test statistics (Strategic Intensity)		
	new	established	all			
Value creation (ΔPV_{firm})	0.31** (3.24)	0.07*** (4.24)	0.10*** (5.22)	High- vs. low-clockspeed (all firms) 0.06*** (4.21)		
Growth (Sales growth)	0.06 (1.80)	0.03*** (4.05)	0.08*** (8.90)	New vs. established firms (high-clockspeed firms) -0.17*** (-8.85)		
Financial flexibility (Cash)	0.10*** (16.13)	0.05*** (18.57)	0.07*** (23.46)			
Industry Concentration	0.01 (0.87)	-0.01*** (-7.95)	-0.01*** (-5.68)			
Industry Uncertainty	9.51*** (23.44)	3.10*** (18.18)	4.48*** (26.16)			
Industry R&D Intensity	8.22*** (25.03)	1.28*** (16.15)	2.77*** (23.74)			

In the second step to investigate the difference between new and established firm flexibility, high- and low-clockspeed firms are sorted into *new firms* (introduction stage) and *established firms* (growth or mature stages) leaving out the shake-out and decline stages due to their mixed nature in firm development, following the same argument as in earlier tests. Given the importance of strategic flexibility for new firms in the literature (e.g. Brinckmann et al., 2019), this application of the Dickinson (2011) life cycle specification allows the investigation to focus more specifically on differences between *new* and *established* firms conditional on low- and high-clockspeed contexts. Moreover, in this step the end-weighted skewness estimation is applied allowing focus on differences in strategic intensity within the past exercise window.

The results of strategic flexibility for *new* and *established* firms together with descriptive summaries for all firms in the low- and high-clockspeed industry groups are tabulated in Panel B.1 of Table 4.5. To further facilitate the analysis, control variables representing change in value creation ($\Delta PVGO$, $\Delta PVAIP$ and $\Delta PVfirm$) along with sales growth (*Sales growth*), financial flexibility (*Cash*) and the three environmental dynamism components (*Industry Concentration*, *Industry Uncertainty* and *Industry R&D intensity*) are included as presented in Panel B.2. Similarly, to the investigation in the previous subsection, mean-differences with related test statistics are included for overall change in firm value, sales growth, financial flexibility and the environmental dynamism components in Panel B.3.

The second hypothesis (**H4b**) argued that new high-clockspeed firms should be more constrained and hence, less able to exert strategic flexibility compared to established firms in the same setting. The results are consistent with this prediction, as the test of new high-clockspeed firms in Panel B.3 is negatively loaded (-0.17) and significant (t-value: -8.81). This result appears to be general as the outcome both for high- and low-clockspeed industries is similar to the tests in the previous subsection, providing some evidence to suggest that new firms are less strategically flexible than established firms. In addition, their strategic intensities are negative on average. Despite the negative levels, new firms in higher clockspeed industries appear significantly more flexible (-0.02) than their low-clockspeed counterparts (-0.19). The mean-difference control for financial flexibility implies that one explanation could be that firms in high-clockspeed industries are less financially constrained, with more cash resources available, and therefore able to exercise more growth options. Moreover, the results suggest that high-clockspeed firms are experiencing higher value creation (0.12) as well as higher growth (0.12) and that these effects are more pronounced for new firms. The difference in value creation seems related to the higher value of growth options for high-clockspeed firms.

In the final step, as the literature also argues that environmental dynamism influences the relationship between strategic flexibility and firm performance (Mitchell et al., 2011) the implications are briefly explored outside the hypotheses for each dynamism component.

The role of environmental uncertainty is an important driver of option creation (e.g. Trigeorgis and Reuer, 2017) and value that is often associated with technological change in fast moving markets (Dess and Beard, 1984). The results confirm that firms in high-clocksPEED contexts appear to be experiencing higher levels of uncertainty (7.89), and significantly higher for new firms (20.01) compared to their low-clocksPEED counterparts. This could also explain the outcome in the tests in the previous subsection, where specifically new firms were found to have lower investments and higher IC option creation in the introduction stage. That firms in high-clocksPEED industries that are more innovation driven, and that this is more prominent for new compared to established firms and over lower clocksPEED firms is further corroborated by the higher Industry R&D Intensity for high-clocksPEED industries. The literature has also suggested that competition in fast-moving markets is likely to be more intense (Volberda, 1996). The results for *Industry Concentration* suggest that on average high-clocksPEED industries appear to experience a small (-0.01) but significant lower level of concentration for high-clocksPEED environments for both new and established firms, translating to an equally small higher level of competition for these industries.

In brief, the findings suggest that strategic flexibility is more prevalent for new and established firms in faster markets and more technology-oriented contexts, consistent with arguments in the literature and in the predictions in this paper. Though the results support the real options expectation of significantly higher uncertainty in such innovation-driven markets, the variation in competition seems less distinct between higher- and lower-clocksPEED firms.

Survival and strategic flexibility

The examination of the effect strategic flexibility proxied via strategic intensity (*SI*) has on firm survival represented by risk of exit (hazard rate) is approached in two parts. In the first part results from each estimation of the specifications of the hazard rate model in Equation (4.11) are reported in order to evaluate that the model is relevant to explain hazard rate for the selected covariates. Once the model is assessed, the final specification is selected to predict hazard rates for each firm and time period observed following Equation (4.12).

Table 4.6 – Estimation results from complementary log-logistic hazard rate regressions

The table reports coefficients, constants and descriptive statistics for models from complementary log-logistic step-wise regressions based on the hazard rate model in the method section. Coefficients and constants are in exponentiated form. Model 1 excludes all covariates and controls providing the baseline hazard. Models 2 – 4 successively introduces covariate sets, starting with levels of SI in model 2, adding the high-technology industry indicator in model 3, and life cycle stages in model 4. Finally, in model 5 the controls are included. All variables are described in the method section and in Appendix 4.A. The sample includes all firms with quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. Dummies for firm-time intervals and calendar quarters are omitted for brevity. Z-statistics at means are provided for model variables in parentheses. Statistical significance levels are indicated using ##, #, *, **, and *** for 5%, 1%, 0.5%, 0.1% and 0.01%.

Panel A – Hazard rate complementary log-log regression results (full sample)

Explanatory variable	Model (dependent variable: FirmExit)				
	(1)	(2)	(3)	(4)	(5)
SI+		0.668*** (5.12)	0.669*** (5.10)	0.661*** (5.25)	0.665*** (3.90)
SI_low		0.850## (2.29)	0.849## (2.29)	0.855## (2.20)	0.856 (1.68)
SI-		1.977*** (12.42)	1.978*** (12.43)	1.767*** (10.34)	1.773*** (8.09)
TechInd			0.961 (0.84)	0.698*** (7.31)	0.563*** (8.94)
Introduction stage (FLC1)				2.233*** (8.49)	2.289*** (6.12)
Growth stage (FLC2)				0.477*** (7.34)	0.829 (1.36)
Maturity stage (FLC3)				0.411*** (8.60)	0.619** (3.34)
Decline stage (FLC5)				2.314*** (8.17)	1.963*** (4.59)
Control variables					
Firm Age (years)					1.003 (1.42)
Firm Size (sales quintile)					0.779*** (8.51)
Firm Profitability (Avg. OP)					0.002*** (11.32)
Firm-periods (QY)	Yes	Yes	Yes	Yes	Yes
Constant	0.004*** (4.52)	0.004*** (4.55)	0.004*** (4.53)	0.009** (3.86)	0.033# (2.73)
Log likelihood	-10 454.680	-10 314.570	-10 314.220	-9 842.153	-6 158.564
Wald Chi-square	1 357.908	1 638.119	1 638.822	2 582.954	1 960.875
P-value (Wald Chi-square)	<0.001	<0.001	<0.001	<0.001	<0.001
Number of exits	1 828	1 828	1 828	1 828	1 106
Observations (N)	297 488	297 488	297 488	297 488	258 003

The second part applies the predicted firm-period hazard rates through using triple-sort into groups of firms based on technology industry association, firm development stage (new or established), respective level of strategic intensity to address posed hypotheses regarding firm survival and strategic intensity.

Estimation of hazard rate models

Table 4.6 reports the models. The coefficients are shown in exponentiated form and hence, provides effect on the hazard ratio for a unit-change in the covariate. For dummy variables this relates to a change from zero to one, and for continuous covariates a one-unit increase. For example, a coefficient with less than one (< 1) represents a decrease in risk, while a loading of one (≥ 1) or higher represent no change or an increase in risk of exit.

Variables are introduced following the hierarchical approach as in prior studies, starting with model 1 only taking the baseline hazard. In model 2 indicator variables for positive (*SI+*), low (*low SI*) and negative (*SI-*) levels of strategic intensity are added which are all significant. Notably, the effect of *SI* on hazard rate is in sequence with the predicted outcomes, as a unit change in *SI+* lowers the hazard rate by 0.67, and a more passive firm (*low SI*) is associated with a positive effect 0.85 on hazard, while *SI-* has a negative impact on survival odds of 1.98. Model 3 introduces the effect of a firm being a member of a high-clockspeed industry via the *TechInd* dummy variable. The coefficient of 0.96 (*t-value of 0.84*) is not significant in this specification suggesting that membership is not in itself having an effect on survival odds. Then in model 4 as firm life stages are added, the coefficient for effect of *TechInd* becomes significant, suggesting that provided life cycle information, belonging to a high-technology industry lowers the hazard rate by a unit-factor of 0.698. As expected, firms in the introduction stage (*FLC1*) are likely to be exhibited to a high risk effect of exit of 2.23, while firms entering into growth stage (*FLC2*) are impacted by a lower risk of 0.48 and firms becoming mature are at a yet lower level of risk with a hazard rate impact of ca. 0.41. The highest risk of exit 2.31 are seen by firms entering the decline stage. Though the shake-out stage has been omitted in these models due to collinearity, the findings are providing new insights, as the relationship between the Dickinson (2011) firm life cycle model and firm survival has not been explored in prior literature. Then, in model 5 the control variables are entered. The results show that while both firm size at 0.78 and firm profitability with a coefficient of 0.002 contribute to a positive effect on firm survival probability, and specifically profitability lowers the hazard rate strongly. Interestingly, the effect of firm age is at unity (1.00) and insignificant in the model. Further untabulated analysis evidence suggests that the inclusion of spell time effect and calendar quarter dummies to account for baseline hazard and econometric effects, also capture variation in age differences.

Overall, even if the explanatory power of most covariates is moderated and loose some significance as controls are introduced, the general effect of firm life cycle stage and strategic intensity on hazard rate holds significantly throughout these models, providing some evidence that life cycle stage is important to survival and more importantly that strategic intensity appear to have a positive impact on survival odds for firms.

Finally, as model 5, that included controls has the highest log likelihood, it is selected to provide a basic model for prediction of individual hazard rates for each firm-period.

Table 4.7 – Survival via hazard rates for firms and levels of strategic flexibility

The table presents mean predictions of firm-level hazard rates, $\hat{h}_i$ (x100) as indicators of survival estimated using the hazard rate model in the method section and quantile pairwise comparisons of differences between firms with positive strategic intensity ($q5$, $SI+$), passive firm SI ($q3$) and negative SI ($SI-$, $q1$). The variables defined in Appendix 4.A are calculated using quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. **Panel A** reports hazard rates (x100) for all firms and for firms within high- and low-clock industries ($TechInd = 1$), respectively into subgroups for each with new firms ($FLC = 1$), established firms ($FLC = 2$ and $FLC = 3$) and all firms independently of newness. **Panel B** reports pairwise mean difference comparisons and tests statistics in hazard rate for positive SI ($q5$, $SI+$) versus passive firm ($q3$) and positive SI ($q5$, $SI+$) versus negative SI ($q1$, $SI-$) and **Panel C** reports specific tests for mean difference $SI+$ vs. $SI-$ (positive less negative SI). Test statistics shown in parentheses are calculated using two-sided t-tests with robust standard errors and significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A – Hazard rates and controls (mean observations)									
	<i>Low-clockspeed</i>			<i>High-clockspeed</i>			<i>All firms</i>		
	<i>new</i>	<i>established</i>	<i>all</i>	<i>new</i>	<i>established</i>	<i>all</i>	<i>new</i>	<i>established</i>	<i>all</i>
<i>All SI levels</i>									
<i>Hazard rate (x100)</i>	2.05	0.34	0.47	1.26	0.19	0.40	1.45	0.26	0.43
<i>Obs. Hazard rate (N)</i>	4 726	58 397	63 123	15 520	65 953	81 473	20 246	124 350	144 596
<i>SI+ (q5)</i>									
<i>Hazard rate (x100)</i>	1.06	0.19	0.25	0.64	0.11	0.21	0.72	0.15	0.22
<i>Obs. Hazard rate (N)</i>	1 157	18 235	19 392	5 082	22 680	27 762	6 239	40 915	47 154
<i>Low SI (q3)</i>									
<i>Hazard rate (x100)</i>	1.46	0.26	0.34	0.93	0.15	0.29	1.06	0.20	0.31
<i>Obs. Hazard rate (N)</i>	1 555	20 903	22 458	4 794	22 402	27 196	6 349	43 305	49 654
<i>SI- (q1)</i>									
<i>Hazard rate (x100)</i>	3.08	0.57	0.80	2.10	0.33	0.71	2.36	0.44	0.75
<i>Obs. Hazard rate (N)</i>	2 014	19 259	21 273	5 644	20 871	26 515	7 658	40 130	47 788
Panel B – Comparison of hazard rates for levels of strategic intensity per firm type									
<i>Mean-differences (hazard rate):</i>									
<i>Hazard rate, SI+ vs- low SI</i>	-0.40*** (-5.84)	-0.07*** (-18.76)	-0.10*** (-14.12)	-0.29*** (-10.73)	-0.04*** (-21.37)	-0.08*** (-12.43)	-0.34*** (-12.93)	-0.06*** (-26.34)	-0.09*** (-18.84)
<i>Hazard rate, SI+ vs- SI-</i>	-2.01*** (-13.60)	-0.37*** (-46.92)	-0.56*** (-27.44)	-1.46*** (-26.25)	-0.22*** (-52.76)	-0.50*** (-29.73)	-1.64*** (-28.49)	-0.29*** (-61.75)	-0.53*** (-40.45)
Panel C – Test statistics for hypothesis tests of hazard rates for levels of strategic intensity per firm type									
<i>Mean-differences Tests (Hazard rate):</i>									
	Mean-differences within SI levels								
	<i>All SI</i>	<i>SI+</i>	<i>Low SI</i>	<i>SI-</i>					
<i>New vs. Established</i>	1.19*** (80.26)	0.57*** (54.18)	0.86*** (51.70)	1.92*** (58.35)					
<i>High-tech vs. Low-tech</i>	-0.07*** (-5.85)	-0.04*** (-5.13)	-0.06*** (-6.04)	-0.10** (-3.63)					

Firm survival via hazard rate and levels of strategic flexibility

Panel A of Table 4.7 reports mean observations of hazard rates sorted into groups of all, new and established firms within high- and low-clock industries respectively for each of all, positive ($SI+$), *Low SI* respective negative ($SI-$) levels of SI . In panel B mean-differences of hazard rates are reported for each sorting context between $SI+$ and *low SI*, respective $SI+$ and $SI-$ levels. Panel C provides mean-differences in hazard rate within each SI level (*all SI*, $SI+$, *Low SI* and $SI-$) for hypothesis testing of difference between new and established firms, respective between high- and low-clockspeed firms.

The first prediction (**H5a**) theorised of a positive general relationship between strategic flexibility and firm survival for all firms, implying that for more strategically active and flexible firms a lower risk of exit and longer survival persistence would be expected. The mean-difference result for all firms in Panel B supports the hypothesis both for *SI+* vs. low *SI* (-0.09) and *SI+* vs. *SI-* (-0.53) *SI* levels. Notable, the effect of strategic flexibility on survival odds is more prominent for new ventures compared to established firms. Further, the results show a positive effect across all firm contexts, indicating a general positive relationship between survival and firms achieving positive outcomes of strategic intensity.

In the second hypothesis (**H5b**) it was argued that new firms due to their more constrained nature would be less able to exert protective measures compared to their more established counterparts, independent of industry clockspeed or level of strategic intensity. The results in Panel C provide mean-differences within each of the positive (*SI+*), low *SI* and negative (*SI-*) *SI* levels along with for means for all *SI* levels. The hypothesis is supported as new firms on average experience a higher hazard rate (1.19) compared to established firms. The relationship holds for firms at each *SI* level, and for firms that achieve a positive (*SI+*) level, the difference is the smallest (0.57), while the largest difference exists between new and established firms with a negative outcome of *SI* (1.92). All results are strongly significant in the sample.

In the third hypothesis (**H5c**) it was posited that firms in high-clockspeed industries due to their overall higher levels of strategic and financial flexibility also should be associated with higher survival persistence related to lower hazard rates compared to low-clockspeed firms. The results in Panel C confirm the hypothesis in that high-clockspeed firms on average have a small, but significantly lower risk of exit of 0.07 compared to low-clockspeed firms. The results also hold with significance at each of the positive (*SI+*), low *SI* and negative (*SI-*) *SI* levels, where the differences appear to increase with lower levels of strategic intensity.

In sum, the theorised relationship between levels of strategic intensity and survival persistence is both significant and appear to be consistent across new and established firms within and across higher-paced industries. Moreover, the effect seems stronger for new firms, and the data also indicates that for new low-clockspeed ventures the difference in risk of exit between firms that are successfully in achieving strategic flexibility and those who have negative outcome can be substantial (-2.01). Taken together, the results provide evidence to propose that strategic intensity appear to be a significant factor in firm survival persistence.

Strategic flexibility in the short and long run

To test the implied short- and long-term effects of firm-level strategic flexibility via its underlying components representing organisational and business model-related flexibility, panel regression models are specified to estimate how much of the variation in strategic intensity operationalised as skewness based on operating profitability ($SI = SK_{OP}$) that can be explained by skewness of its components: organisational slack ($SK_{ORG} = SK_{Orgslack}$) and asset-turnover representing the firms operating (business model) structure ($SK_{BM} = SK_{ATO}$). In addition, the literature suggests that skewness, apart from managerial flexibility over the firms' earnings processes, could result from variation and uncertainty in *sales demand* around a firm's products or services (Kulatilaka and Perotti, 1998) or due to changes in *leverage* representing financial flexibility over firms' capital structures (Copeland and Antikarov, 2003). Hence, both skewness of sales demand (SK_{Sales}) and debt-to-equity ratio (SK_{DTE})¹¹⁵ are added as controls.

Panel A of Table 4.8 reports the results from panel regressions following the Fama and MacBeth (1973) procedure with associated t-statistics estimated using Newey-West (1987) robust standard errors. Models 1 – 3 present coefficients from regressions on each of the independent variables SK_{ORG} (model 1) and SK_{BM} (model 2), and combined in model 3 on the dependent (SK_{OP}). Model 4 includes both independent variables and control variables to account for their impact on the coefficients of the independent variables. All coefficients in these regressions are statistically and economically significant. Consistent with the hypothesis (**H6a**) findings suggest via adjusted R^2 that while both SK_{ORG} (0.510) and SK_{BM} (0.176) individually contribute to explain the overall skewness in SK_{OP} , the explanatory effect of asymmetry related to the organisational marginal cost structures is significantly higher than the skewness that is associated with the firms operating structures related to the business model. More, due to the correlation between the independents (-0.129)¹¹⁶ reported in Panel B, the combined effect in adjusted R^2 (0.620) in model 3 suggests that in presence of SK_{ORG} , the marginal contribution of SK_{BM} after correlation is ca. 0.11. The presence of controls in model 4 does not change the outcome, suggesting that the effects are related to source of skewness within firms in the sample.

¹¹⁵ Variation in leverage (DTE) is not expected to impact on variation in operating profitability (e.g. Ball et al., 2016) and skewness of DTE is included only to control comprehensively for alternative sources of skewness.

¹¹⁶ The negative loading for the relationship is related to that a negative skewness in Organisational slack represent a positive earnings effect introduced via lower marginals in the firms' costing and expense structures.

Table 4.8 – Strategic intensity components over the short- and long-term

The table presents results of average Fama and MacBeth (1973) cross-sectional regressions and Pearson correlations for independent variables based on quarterly financial statement observations from COMPUSTAT between 1989 and 2020 with winsorizing at 1% and 99%. The variables are defined as in Appendix A, and estimation of conditional time-series skewness extending from Gu and Wu (2003) uses end-weighted (see similar to approach used in Cao et al. (2008) to obtain more weight for recent information) third-moments of the lagged eight quarters as representation of the past exercise period window. **Panel A** reports quarterly regressions of *strategic intensity* (skewness of operating profitability, SK_{OP}) as dependent variable using the Fama and MacBeth (1973) approach of averaging cross-sectional quarterly coefficients and calculation of t-statistics using Newey-West (1987) robust standard errors. Independent variables are skewness of *Orgslack* (SK_{ORG}) and skewness of *ATO* as proxy for business model leanness (SK_{BM}), and control variables skewness of *Sales* (SK_{Sales}) and *DTE* (SK_{DTE}). In model 5 the independent is *ATO* as proxy for business model leanness. Except for model 5, models 1 to 4 are estimated for each independent, and for all independents combined with or without controls to provide information on the marginal contribution of each variable. **Panel B** reports Pearson correlations. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A – Regression results					
Explanatory variable	Model (dependent variable: SK_{OP})				
	(1)	(2)	(3)	(4)	(5)
SK_{ORG}	-0.669*** (-93,36)		-0.629*** (-79,50)	-0.635*** (-78,44)	
SK_{BM}		0.413*** (55,75)	0.342*** (46,26)	0.310*** (46,73)	
<i>ATO</i> (BM leanness)					0.022*** (5,44)
Controls	not incl.	not incl.	not incl.	included	not incl.
Adj. R^2 (overall, avg.)	0.497	0.165	0.606	0.611	0.002
Observations (N)	310 587	316 306	310 587	245 253	319 490
Panel B – Correlations					
Variables	SK_{ORG}	SK_{BM}	SK_{Sales}	SK_{DTE}	<i>ATO</i>
SK_{ORG}	1.000				
SK_{BM}	-0.124***	1.000			
SK_{Sales}	-0.184***	0.522***	1.000		
SK_{DTE}	0.123***	-0.065***	0.001***	1.000	
<i>ATO</i>	-0.061***	0.013***	0.047***	-0.069***	1.000

Model 5 in Panel A presents the result from regression of *ATO* on SK_{OP} , that is used to test the relationship between strategic intensity (SK_{OP}) and a firm's business model structure represented by *ATO*, as a proxy for the relative capital base required to support a level of sales that is argued as a leanness factor of the firm's business model (*BM leanness*). A positive (negative) relationship infers that less (more) capital investment is related to a higher (lower) level of achieved strategic intensity. The coefficient is small but statistically significant, supporting the prediction (**H6b**) that more capital intense business models are likely to introduce some rigidity as argued in the literature.

The implications of these findings are that while organisational structures likely offer firms most opportunities for strategic flexibility in the short term, their business models provide a source of flexibility due to strategic choice in the longer term. The results also indicate that the capital intensity of business models is an important consideration in this context due to its negative relationship with firms' overall abilities to achieve strategic flexibility.

4.7 Robustness and post-hoc analyses

Explaining future returns and value creation: comparing alternative predictors

Following the discussion in section 4.3 the literature has suggested other possible earnings measures that could have been applied as candidates to capture the effects of decision-making in the firm's earnings processes. For example, gross profit (GP) and earnings per share (EPS) are two measures that have been contrasted in prior work (e.g. Jia and Yan, 2017). It has been reported that both skewness in GP (SK_{GP}) and EPS (SK_{EPS}) are able to predict next quarter returns (Jia and Yan, 2017), but whether skewness in operating profitability (SK_{OP}) is a useful predictor of stock returns or how it compares to other skewness measures is not yet known.

Hence, to compare the three skewness measures (SK_{OP} , SK_{GP} and SK_{EPS}), a first test examines which of the three that can best explain next quarter stock returns (RET). In a second test the investigation is extended to the ability of the three measures to also predict future value creation in change of average present value of assets-in-place ($\Delta PVAIP$) over the leading four quarters. Using Fama and MacBeth (1973) regressions with Newey-West (1987) robust standard errors, models are specified for each dependent and each predictor individually. Then with all predictors combined under the assumption that less influenceable independents will lose power in presence of more dominant ones. In addition, controls for the French-Fama risk factors, Size (ME), β (Beta) and book-to-market ratio (B/M) are added to account for market based risk consistent with previous work (e.g. Soliman, 2008).

Predicting next quarter stock returns

Panel A of Table 4.9 reports results for the regression on stock returns, initially without controls as individual predictors in models (1a, 2a and 3a). In model 4a all predictors are included without controls, and in model 5a including controls. The direct explanatory effect of skewness in terms of adjusted R^2 in all of the regression is small, however the coefficients are positive and statistically significant. As expected, predictors lose power in presence of others, with the coefficient of SK_{GP} (0.054) slightly higher than that of SK_{OP} (0.053) and with SK_{EPS} at (0.028). Following inclusion of risk controls SK_{OP} at (0.057) gains power and becomes the strongest predictor, while both SK_{GP} (0.05) and SK_{EPS} (0.037) lose explanatory power. In sum, SK_{OP} remains the strongest predictor of RET , suggesting that skewness of OP dominates skewness of GP and EPS in these regressions after controlling for risk factors.

Table 4.9 – Power of alternative profitability skewness predictors of strategic intensity in returns and value created

The table presents results of average Fama and MacBeth (1973) quarterly cross-sectional regressions and Pearson correlations for alternative profitability skewness predictors based on quarterly financial statement observations from COMPUSTAT between 1989 and 2020 with winsorizing at 1% and 99%. All variables are defined as in Appendix A. Estimation of conditional time-series skewness extending from Gu and Wu (2003) uses end-weighted third-moments of the lagged eight quarters as representation of the past exercise period window. Control variables are Fama-French risk factors, β (Beta), Size (ME) and book-to-market ratio (B/M) to control for risk (e.g. Soliman, 2008). Controls are reported as all included or excluded. Models 1a – 4b resp. 1b – 4b are run without controls and in Models 5a and 5b all controls are included to assess their contribution. In all regressions calculation of t-statistics is based on Newey-West (1987) robust standard errors. **Panel A** reports quarterly regressions on next quarter returns (RET) as dependent variable (Models 1a – 5a). **Panel B** reports quarterly the regressions with leading four quarter average change of present value of assets-in-place deflated by opening total assets ($\Delta PVAIP$) as dependent variable (Models 1b – 5b). Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A – Regression results for next quarter returns (RET)					
Explanatory variable	Model (dependent, RET)				
	(1a)	(2a)	(3a)	(4a)	(5a)
SK_{OP}	0.097*** (13.33)			0.053*** (8.29)	0.057*** (9.26)
SK_{GP}		0.089*** (14.91)		0.054*** (7.87)	0.050*** (9.57)
SK_{EPS}			0.056*** (7.07)	0.028** (3.58)	0.037*** (7.74)
Controls	Not incl.	Not incl.	Not incl.	Not incl.	Included
Adj. R^2 (overall, avg.)	0.005	0.004	0.005	0.009	0.035
Observations (N)	303 099	309 772	324 247	299 642	290 797

Panel B – Regression results for leading four quarter average of change in present value of assets in place ($\Delta PVAIP$)					
Explanatory variable	Model (dependent, $\Delta PVAIP$)				
	(1b)	(2b)	(3b)	(4b)	(5b)
SK_{OP}	0.138*** (9.91)			0.121*** (5.73)	0.108*** (6.59)
SK_{GP}		0.064*** (7.73)		-0.025 (-2.05)	-0.024 (-1.65)
SK_{EPS}			0.099*** (8.30)	0.064*** (6.87)	0.029# (2.64)
Controls	Not incl.	Not incl.	Not incl.	Not incl.	Included
Adj. R^2 (overall, avg.)	0.020	0.003	0.018	0.023	0.116
Observations (N)	117 083	117 079	121 187	116 892	116 892

Predicting future average value-creation

The results of the regressions on next year's average $\Delta PVAIP$ is reported in Panel B of Table 4.9. The models and controls are specified in the same fashion as for RET . Interestingly, SK_{GP} appears to be the weakest predictor of fundamentally driven value creation that independently in model 2b provides a positive coefficient (0.064), but in presence of the other two predictors turns negative and barely significant. Both SK_{OP} and SK_{EPS} are significant with positive coefficients in the individual models (1b respective 3b) with SK_{OP} also having a significantly larger coefficient (0.138) than SK_{EPS} (0.099). In the combined model (4b) the coefficient for SK_{OP} (0.121) dominates the others, with SK_{EPS} at (0.054) lower, but significant, and SK_{GP} (-0.025) losing most of its power. With risk controls included, both SK_{EPS} (0.029) and SK_{GP} (-0.024) lose most of their significance and predictive power as their coefficients are drastically reduced, while the significance for SK_{OP} is improved and its coefficient at 0.108 remains the strongest predictor also in these regressions.

These findings can be explained by noting that both *OP* and *GP* provide measures of profitability that are stronger linked to near-time market returns compared to *EPS* that is based on net income and therefore also includes information relating to non-current, non-operating activities and minority interests¹¹⁷. In addition, taking into account implications for fundamental earnings, *OP* improves on *GP* by including *SGA* that has incremental predictive power, while excluding R&D information that is more related to longer-term growth (Ball et al., 2015). Overall, these results demonstrate that skewness in operating profitability (SK_{OP}) provides a stable and significant predictor of future stock returns consistent with expectation for earnings skewness in prior studies (Jia and Yan, 2017). The results also add to the literature by showing that SK_{OP} is able to predict changes in near future intrinsic firm value creation.

The results further indicate that the direct power of fundamental skewness and implied effect of strategic flexibility via strategic intensity is small (ca. 0.5% for returns and 2% for value creation), but strongly statistically significant. This is consistent with expectations in earlier research (e.g. Herhausen et al., 2021). However, since strategic intensity is able to effectively identify firms that are likely to be significantly associated with future performance in returns and value creation, applying sort methods as in this paper could facilitate studies of secondary and higher effects in portfolios of firms based on their levels of strategic intensity.

Persistence and mean-reversion in levels of strategic intensity

An important question emerging from the results in the previous sections, which illustrates the ability of strategic intensity (*SI*) to explain past achieved strategic flexibility and predict near time stock returns and future value creation, is whether firms with currently high positive or low negative levels of strategic intensity are likely to see these levels persist in the future. More specifically, as it is known in the literature that firms' levels of profitability tend to mean-revert to longer term levels in the cross-section over time (e.g. Nissim and Penman, 2001; Vorst and Yohn, 2018; Freeman et al., 1982; Dickinson, 2011), open questions are whether also skewness of profitability that underpins the measure of strategic intensity in this study is likely to exhibit such convergence patterns, and towards what future levels. Understanding persistence behaviour is important in the valuation context since analysts who for example identify firms by levels of strategic intensity as a driver of value creation, are keen to understand if there is a predictive relationship between current and future levels of *SI*.

¹¹⁷ Prior research confirms that net income provides limited incremental power over *ME* (size) or *B/M* (e.g. Fama and French, 1996).

Table 4.10 – Strategic intensity convergence analysis descriptive statistics

The table provides descriptive statistics for convergence analysis of portfolios based on quintile levels of strategic intensity (*SI*) estimated using end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window calculated based on the conditional time-series skewness extending from Gu and Wu (2003). The convergence test, based on Nissim and Penman (2001), forms annual overlapping portfolios as in Dickinson and Sommers (2012) of median strategic intensity quintiles for firms in the years 1991 to 2005 with available current base year ($t=0$) and five following ($t=1, \dots, 5$) years. This results in 25 six-year replications (base year plus five subsequent years) that are matched to shape the final sample of medians used in the analysis. All variables are based on quarterly financial statement data from COMPUSTAT winzorisized at 1% and 99%. As in Nissim and Penman (2001) spearman rank correlation between each period and its lagged value ($Corr_t$) and variance of each period divided by the variance of the base period are estimated (Var_t/Var_0) to provide indicators of explanatory power and speed of mean reversion. **Panel A** reports means of all *SI* levels for base year and each of the following five years together with correlation coefficient, mean reversion rate and number of observations (*N*). **Panel B** reports median observations for each quintile *SI* level portfolio (including positive *SI* ($q5$), low *SI* ($q3$) respective negative *SI* ($q1$) levels) together with descriptive statistics as in panel A. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

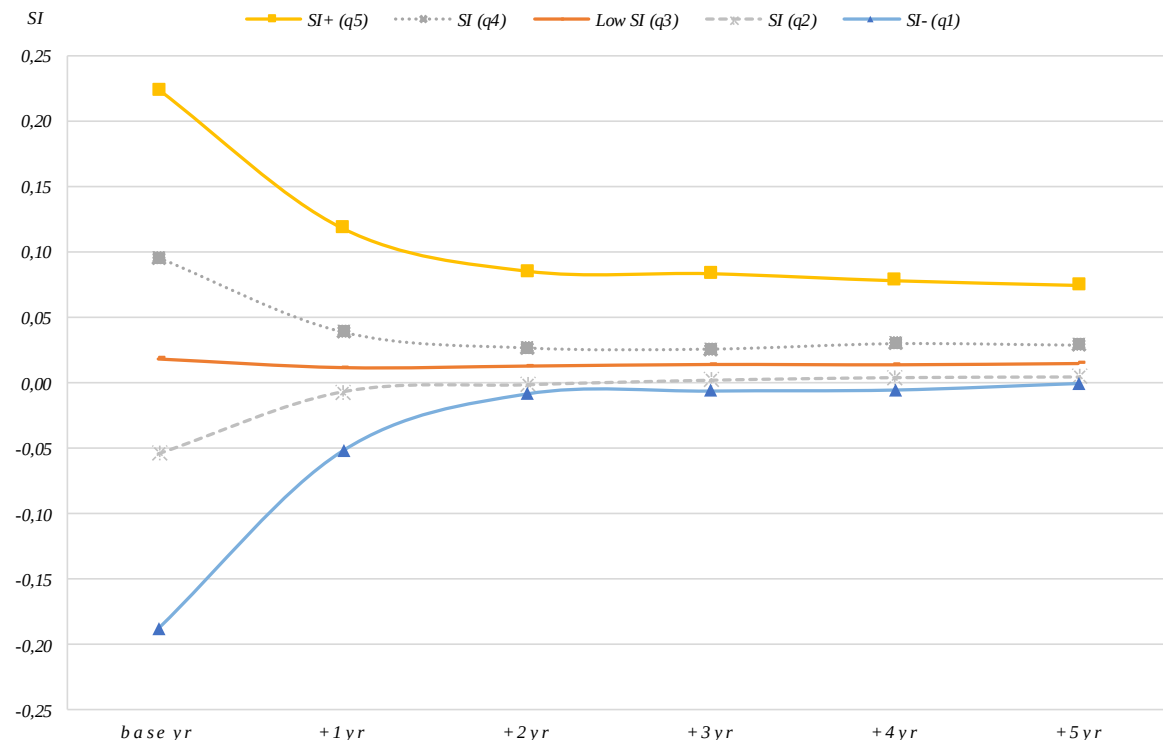
	All firms (year from quintile formation period)					
	base year	+1yr	+2yr	+3yr	+4yr	+5yr
Panel A - Summary statistics (all <i>SI</i> portfolios)						
<i>SI</i>	0.019	0.022	0.023	0.024	0.024	0.024
$Corr_t (SI_t, SI_{t-1})$	1.000***	0.937***	0.827***	0.777***	0.756***	0.705***
<i>MR rate</i> (Var_t/Var_0)		0,181	0,078	0,071	0,062	0,055
<i>N</i>	66 023	66 023	66 023	66 023	66 023	66 023
Panel B - <i>SI</i> (means of portfolio median levels)						
<i>SI+</i> ($q5$)	0.224	0.118	0.085	0.083	0.078	0.074
<i>SI</i> ($q4$)	0.096	0.039	0.027	0.026	0.030	0.029
Low <i>SI</i> ($q3$)	0.019	0.011	0.012	0.014	0.013	0.015
<i>SI</i> ($q2$)	-0.054	-0.007	-0.002	0.002	0.004	0.004
<i>SI-</i> ($q1$)	-0.188	-0.052	-0.008	-0.006	-0.005	0.000

In other words, evidence of persistence or mean-reversion to expected future levels translates into value relevance and hence into consideration of strategic intensity as a possible factor in forecasting and valuation. To examine persistence and mean-reversion, this section focus on portfolios of firms within the sample with positive (*SI+*, $q5$), low *SI* ($q3$) respective negative (*SI-*, $q1$) select quintile levels of strategic intensity, and applies the Nissim and Penman (2001) *convergence test* adapted for overlapping annual data as in Dickinson and Sommers (2012). Following the procedure for this test, portfolios of firms in the selected quintiles are formed for overlapping five-year intervals starting in the first quarter of 1991¹¹⁸, leading to 25 replications in the sample from 1991 to 2015. For each of these portfolios, medians of *SI* are calculated for the portfolio-forming (base) year and for each of the following five years¹¹⁹. Next, the mean of these medians is quantified as an overall measure. For each period, spearman rank correlations ($Corr_t$) between *SI* in each period and its time-series lag are calculated as a measure similar to that of the regression R^2 , and the ratio of variances (Var_t/Var_0) between the current period and the base period of *SI* acts as that of a regression slope coefficient and an indication of the rate of mean-reversion (Nissim and Penman, 2001).

¹¹⁸ As firms are observed quarterly and *SI* is estimated using the past eight quarters, the first *SI* measure is available in first quarter of year three in the sample that starts in 1989. Different from Nissim and Penman (2001) who form decile portfolios, this paper form quintile portfolios of *SI*. Forming in deciles of *SI* is attached in Appendix 4.D.

¹¹⁹ Due to estimation of *SI* across eight quarters there is overlap between portfolio years. Untabulated tests with and without overlapping and different lengths of the past exercise window (four instead of eight quarters for the *SI* measure) yields robustly similar patterns.

Figure 4.7 – Evolution of quintile level portfolios on *SI* across the future five years



The results are presented in Table 4.10 with overall descriptive statistics in panel A, and the means for each of the median quintile portfolios in Panel B. All correlation coefficients in the result are significant. Figure 4.7 illustrates the time-series behaviour for each of the quintile levels for brevity. The second and fourth quintiles are included for completeness only as the analysis is centred on evolution of the *SI+*, *low SI* and *SI-* quintiles following the theme in the paper.

The statistics in panel A shows that at the overall portfolio level, both correlations across subsequent five years from portfolio formation (base year) and variance ratios across these years suggest a monotonically decreasing reversion pattern. In Figure 4.7, the means of portfolios medians representing portfolios of firms with different *SI* quintiles levels in the base year also display typical mean reversion patterns similarity to what has been shown for levels of profitability in prior work (e.g. Dickinson and Sommers, 2012). As is visibly clear in Figure 4.7, while both *SI+* and *SI-* firms revert towards lower *SI* levels with opposite signs, it is also evident that firms in the *low SI* (*q3*) quintile are operating at low stable levels across the five-year window with some variation. The initial reversion for both *SI+* and *SI-* firms appear strongest in the first year following the formation and thereafter at lower levels. Particularly interesting is that while firms with negative *SI* levels revert upwards close to the *low SI* level around zero, firms with high positive *SI* levels seem to converge at levels distinctly higher than

the low *SI* level. In this case *SI*+ firms are at ca. 0.074 after five years that is ca. five times higher in median compared to ca. 0.015 for passive firms, while initial *SI*- firms have a level close to zero in the same time frame. In sum, these results provide new evidence in support of that also skewness in fundamental profitability can be seen as a mean reverting process where positive *SI* firms are not only more likely to enjoy current higher levels of achieved strategic flexibility, but that this information is related to the possibility that these firms are also expected to be associated with positive persistence in value creation over future years.

Forecasting future profitability using current levels of strategic intensity

Motivated by the findings of the predictor and the convergence tests that combined suggest that *SI* can predict near future intrinsic value creation and that positive levels of *SI* are likely to persist with a degree of mean reversion (MR) over further years, another question arises, asking whether there is a relationship between *current levels* of *SI* and *future levels of profitability*.

To explore this relationship, portfolios are formed for lagged average four-quarter operating profitability (*OP4*)¹²⁰ based on quintile levels of *SI* in the base year using similar steps as in the convergence test in the previous section, enabling tracking of portfolios on *OP4* over the next five years. As in the convergence test, the overall means along with serial-correlations and variance ratios are estimated to analyse reversion in *OP4*. In testing the relationship between *current levels* of *SI* and *future levels of profit*, percentage change of mean-differences in *OP4* over five-years are calculated for all portfolios of *SI*-quantiles to the low *SI* (*q3*) quantile.

The resulting percentage changes tabulated in Table 4.11 and illustrated in Figure 4.8 are all significant and provide a simple, yet insightful comparison of future value creation potential for firms at a current level of *SI*. It is also evident from these results that the relationship between current and future values of profitability is non-linear as also noted by Nissim and Penman (2001). The results contribute new empirical evidence to suggest that firms in the current period that has a high positive *SI* level is also likely to have a comparably higher average profitability over the future five years. For example as reported in the percentage mean-differences in Panel B, the five-year *OP4* for portfolios of firms at the *SI*+ level is expected to be 8.9% higher than for more passive firm portfolios (*low SI*), and firms in portfolios with high negative *SI*- levels, though their profitability is anticipated to recover due to mean reversion, could experience 16.6% lower profitability compared to *low SI* firm portfolios.

¹²⁰ Mean past four-quarter *OP* (*OP4*) provides a seasonality-adjusted measure of annual mean quarter profitability.

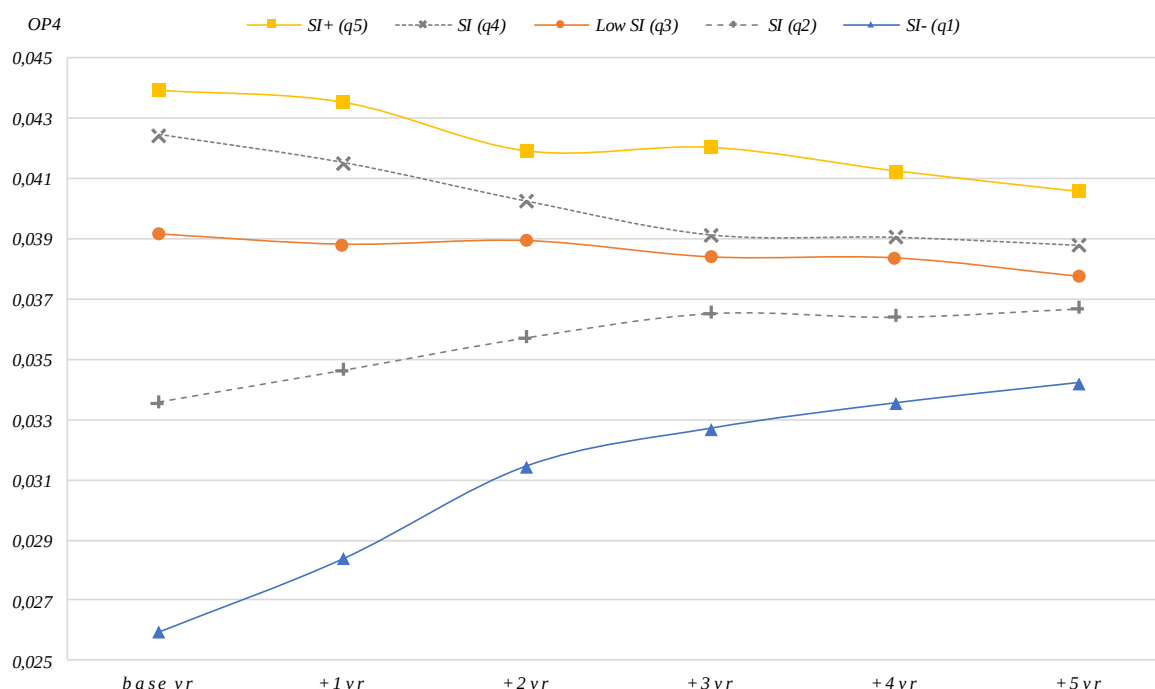
Table 4.11 – Profitability forecasting analysis

The table reports descriptive and test statistics for five-year portfolio means of medians of trailing four-quarter average operating profitability (*OP4*) formed based on quintiles of levels of strategic intensity (*SI*) in each base year (1991, ... 2015) following the procedure for ratio convergence test in Nissim and Penman (2001) modified to use overlapping annual portfolios as in Dickinson and Sommers (2012). All variables are defined in Appendix 4.A. The sample covers firms with quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. **Panel A** reports summary statistics for *OP4* across all quintiles, including average, portfolio-year correlations (*Corr_t*), mean reversion (*MR*) rate and sample size (*N*) that are calculated as in Nissim and Penman (2001). **Panel B** reports statistics at the portfolio level for each quintile level of *SI*, with means of median *OP4* portfolio levels for the portfolio forming year (base yr) and each of the following five years. As in prior analyses, the focus is on comparing outcomes for firms sorted on high positive strategic intensity (*q5*, *SI+*), passive firms with low *SI* (*q3*) respective negative *SI* (*SI-*, *q1*). Averages for each *SI*-quintile formed portfolio for years one to five is calculated and percentage mean-differences for each *SI* quintile compared to the low *SI* (*q3*) level estimated to provide a test of differences in future profitability. Two-sided t-tests statics are calculated for means and mean-differences. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A - Summary statistics							
	Total <i>OP4</i> portfolios (year from quintile formation)						
	base yr	+1yr	+2yr	+3yr	+4yr	+5yr	
<i>OP4</i> (overall average)	0.037	0.037	0.038	0.038	0.038	0.038	
<i>Corr_t</i> (<i>OP_t</i> <i>OP_{t-1}</i>)	1.000***	0.934***	0.894***	0.875***	0.834***	0.786***	
<i>MR</i> rate (<i>Var_t</i> / <i>Var₀</i>)		0.694	0.408	0.338	0.287	0.256	
<i>N</i>	66 023	66 023	66 023	66 023	66 023	66 023	

Panel B – Portfolio level statistics								
	Means of portfolio <i>OP4</i> medians (year from quintile formation)						<i>OP4</i> across +1yr to +5yr	
	base yr	+1yr	+2yr	+3yr	+4yr	+5yr	Average	<i>SI</i> quint. vs. low <i>SI</i> (%)
<i>SI+</i> (<i>q5</i>)	0.044	0.044	0.042	0.042	0.041	0.041	0.042***	8.9%*
<i>SI</i> (<i>q4</i>)	0.042	0.042	0.040	0.039	0.039	0.039	0.040***	3.4%
Low <i>SI</i> (<i>q3</i>)	0.039	0.039	0.039	0.038	0.038	0.038	0.038***	0.0%
<i>SI</i> (<i>q2</i>)	0.034	0.035	0.036	0.037	0.036	0.037	0.036***	-6.3%*
<i>SI-</i> (<i>q1</i>)	0.026	0.028	0.031	0.033	0.034	0.034	0.032***	-16.6%*
Spread <i>q5</i> vs. <i>q1</i> (abs. diff.)	0.018	0.015	0.010	0.009	0.008	0.006	0.010	25.5%

Figure 4.8 – Future profitability for portfolios formed on levels strategic intensity (means for medians of *OP4*)



This amounts to a potential spread in *OP4* of over 25% between portfolios of firms at *SI+* and *SI-* levels. These differences can be explained through the outcomes in the prior sections in the paper, finding that firms with current higher positive *SI* levels are more likely (with some

degree of decay) to experience future higher *SI* levels, and that such higher and more positive levels of *SI* are also associated with higher expected achieved value creation over past exercise windows. Taken together, the empirical results amount to a new contribution proposing that *SI* is value relevant in that there exists a significant mean-difference relationship between current levels of strategic intensity and future levels of average quarterly profitability. In addition to this, in an extra test in Appendix 4.E, forming portfolios on levels of *SI* also appear to be able of explaining part of future market premium measured in market-to-book-value of equity (*M/B*). In light of this early evidence, it is therefore plausible to suggest that selecting firms on their levels of *SI* (as realised *SF*) offers a rudimentary approach to peer selection that could be combined with other value-relevant factors such as industry or life cycle information to form part of an investment strategy for analysts. The results of this simple test suggest that firms' current patterns of decision-making that are related to resulting realised *SF* captured in *SI* contribute to explain variation in future value creation.

Hazard rate patterns and *SI* levels across firm age and life cycle stages

As a final test, provided that the effects of strategic intensity was investigated for new and established firms based on their high-clockspeed industry membership, it would be interesting to explore if the uncovered positive relationships between levels of strategic intensity holds robustly for firm age and across all individual life cycle stages (Dickinson, 2011). Hence, in this section sorting methods that was used to investigate the relationship between firm survival via hazard rate and levels of strategic intensity within the new and established firm contexts in the main tests of hypotheses are repeated with alternative sorts to explore the relationship along firm age and across the full set of firm life cycle stages.

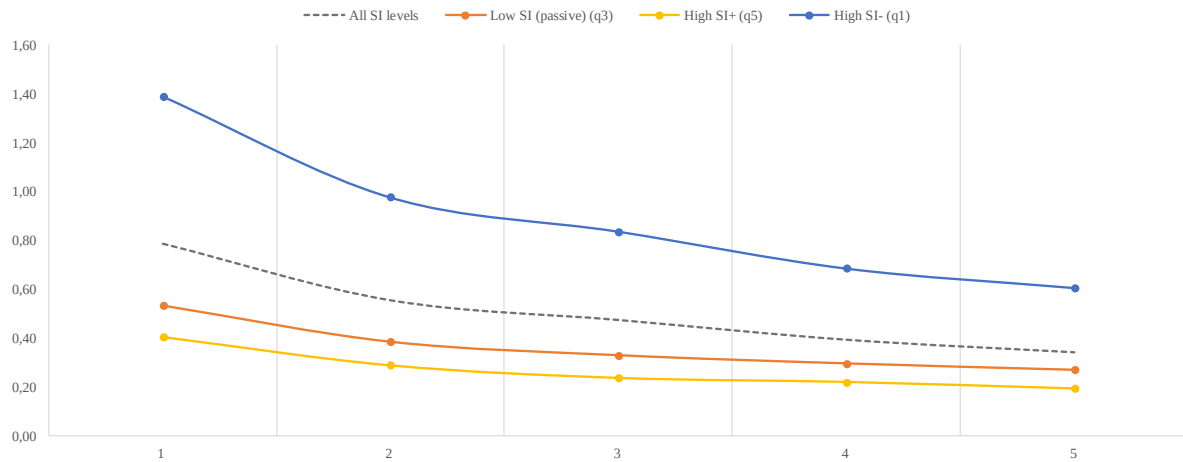
Hazard rate and *SI* levels over firm age quintiles

In the first test, the sample is double-sorted on levels of strategic intensity and age quintiles. Hazard rates are tabulated in Panel A of Table 4.12 for each sorted portfolio of firms and mean-difference tests are performed at each age quintile between positive (*SI*+) and low *SI*, respectively between positive (*SI*+) and negative levels of *SI* (*SI*–) as in the main test. The Hazard rates (x100) illustrated in Figure 4.9A imply an expected initial higher risk of exit¹²¹ lowers over age quintiles for all levels of strategic intensity.

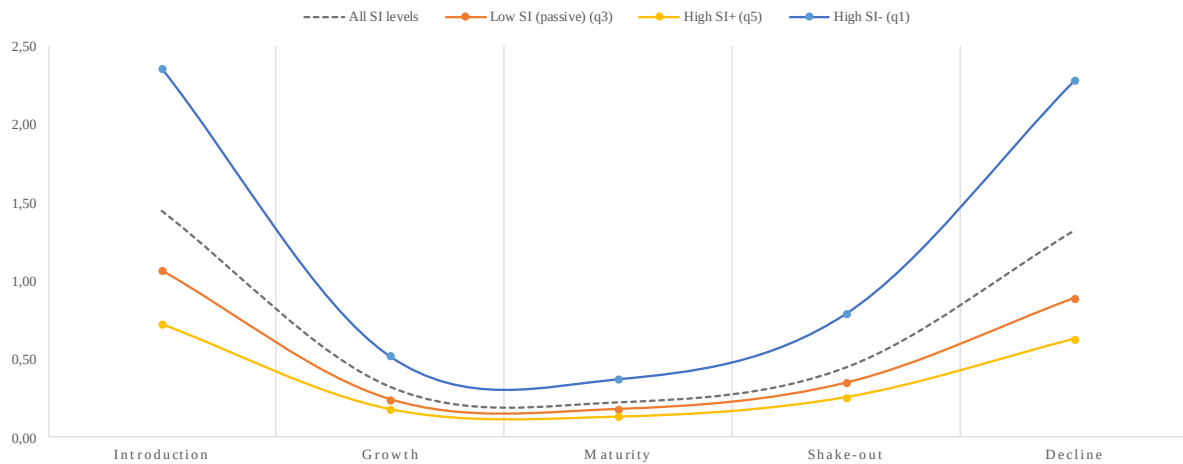
¹²¹ Age quintiles suggest behaviour consistent with liability of newness (Stinchcombe, 1965), however, a finer granular approach could reveal a different pattern such as liability of adolescence (Bruderl and Schussler, 1990).

Figure 4.9 – Hazard rate and strategic Intensity levels over firm age and life cycle stages.

(A) – Mean hazard rates (x100) and strategic Intensity levels over firm age (quintiles)



(B) – Mean hazard rates (x100) and strategic Intensity levels across Dickinson (2011) firm life cycle stages



In relative terms the difference between a low and positive level of SI is small (range: -0.08 to -0.13) compared to firms with a negative outcome from strategic flexibility (range: -0.99 to -0.41). The difference between a negative and positive level of SI for young firms in the first quintile is the largest (-0.99). Overall, the results suggest that levels of strategic intensity and its effect on firm survival holds over age quintiles.

Hazard rate across SI levels over firm life cycle stages

In the second test, double-sorting is applied to the sample on strategic intensity levels and firm life cycle stages following the Dickinson (2011) approach, with hazard rates tabled for each portfolio context as is reported in Panel B of Table 4.12 and charted in Figure 4.9B. The results from the sorts largely corroborates the estimation regression models in the main survival analysis test, with highest risk of exit in introduction (1.45) and decline (1.32), while the risk is lower for growth (0.32) and lowest for firms in the mature stages (0.22).

Table 4.12 – Hazard rates and levels of strategic intensity (SI) across firm age quintiles and life cycle stages

The table presents mean predictions of firm-level hazard rates, $\hat{h}_i$ (x100) as indicators of survival estimated using the hazard rate model in the method section for firms sorted on positive strategic intensity (q5, SI+), passive firm SI (q3) and negative SI (SI-, q1). All variables are defined in Appendix 4.A. The sample covers firms with quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. **Panel A** reports hazard rates (x100) for firms additionally sorted into firm life cycle stages following the Dickinson model (2011). **Panel B** reports hazard rates (x100) for firms also sorted by their firm age quintile. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

Panel A – Hazard rate and SI vs. firm age (mean)		<i>Firm age quintiles</i>				
	<i>Pooled</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>All SI levels</i>						
Hazard rate (x100)	0.48	0.79	0.56	0.47	0.39	0.34
Firm Age	30.10	8.30	14.57	22.19	33.04	60.52
Obs. Hazard rate (N)	166 527	20 997	33 078	36 302	38 507	37 643
<i>High SI+ (q5)</i>						
Hazard rate (x100)	0.25	0.40	0.29	0.24	0.22	0.19
Firm Age	30.55	8.43	14.71	22.21	32.93	60.30
Obs. Hazard rate (N)	55 375	6 810	11 053	11 559	12 791	13 162
<i>Low SI (passive) (q3)</i>						
Hazard rate (x100)	0.34	0.53	0.38	0.33	0.29	0.27
Firm Age	30.68	8.23	14.61	22.25	33.15	60.73
Obs. Hazard rate (N)	56 038	6 903	10 577	12 099	13 349	13 110
<i>High SI- (q1)</i>						
Hazard rate (x100)	0.86	1.39	0.97	0.83	0.68	0.60
Firm Age	29.05	8.26	14.39	22.10	33.03	60.54
Obs. Hazard rate (N)	55 114	7 284	11 448	12 644	12 367	11 371
<u>Mean-differences (hazard rate):</u>						
Hazard rate, SI+ vs- low SI	-0.09*** (-18.61)	-0.13*** (-6.23)	-0.10*** (-7.96)	-0.09*** (-10.46)	-0.08*** (-9.93)	-0.08*** (-11.34)
Hazard rate, SI+ vs- SI-	-0.60*** (-42.62)	-0.99*** (-18.70)	-0.69*** (-21.98)	-0.60*** (-21.45)	-0.46*** (-24.11)	-0.41*** (-18.31)
Panel B – Hazard rate and SI vs. firm life cycle (mean)		<i>Firm life cycle stage</i>				
	<i>Pooled</i>	<i>1 Introduction</i>	<i>2 Growth</i>	<i>3 Maturity</i>	<i>4 Shake-out</i>	<i>5 Decline</i>
<i>All SI levels</i>						
Hazard rate (x100)	0.48	1.45	0.32	0.22	0.44	1.32
Firm Age	30.10	19.03	28.12	36.11	31.56	20.16
Obs. Hazard rate (N)	166 527	20 246	55 588	68 762	12 146	9 785
<i>High SI+ (q5)</i>						
Hazard rate (x100)	0.25	0.72	0.18	0.13	0.25	0.63
Firm Age	30.55	18.99	28.44	36.28	32.42	19.27
Obs. Hazard rate (N)	55 375	6 239	16 725	24 190	4 675	3 546
<i>Low SI (passive) (q3)</i>						
Hazard rate (x100)	0.34	1.06	0.24	0.18	0.34	0.89
Firm Age	30.68	19.39	28.11	36.44	32.22	21.91
Obs. Hazard rate (N)	56 038	6 349	19 382	23 923	3 854	2 530
<i>High SI- (q1)</i>						
Hazard rate (x100)	0.86	2.36	0.52	0.37	0.79	2.28
Firm Age	29.05	18.76	27.85	35.53	29.75	19.83
Obs. Hazard rate (N)	55 114	7 658	19 481	20 649	3 617	3 709
<u>Mean-differences (hazard rate):</u>						
Hazard rate, SI+ vs- low SI	-0.09*** (-18.61)	-0.34*** (-12.93)	-0.06*** (-18.48)	-0.05*** (-19.59)	-0.09*** (-9.71)	-0.26*** (-9.54)
Hazard rate, SI+ vs- SI-	-0.60*** (-42.62)	-1.64*** (-28.49)	-0.34*** (-48.81)	-0.24*** (-48.53)	-0.54*** (-24.89)	-1.65*** (-23.45)

In addition, the shake-out stage that was part of baseline hazard in the regression specifications, have a hazard rate of 0.44, placing it at a risk level between the levels of introduction and decline. In terms of mean-differences, all tests are significant across both positive (SI+) and low SI levels respective between positive (SI+) and negative (SI-) levels, also confirming that the relationship is robust across all firm life cycle stages. The above suggest that the effect of strategic intensity on survival by evidence of firm-level hazard rates is both monotonic across over all life cycle stages and across age quintiles.

4.8 Conclusions

This paper introduces strategic intensity (*SI*) as a proxy for effects of strategic flexibility under the real options perspective of the firm in a contribution to narrow the long-standing measurement gap in the strategic management literature by providing a practical measure for analysis of strategic flexibility. It then applies the proxy to investigate empirical questions raised in the real options and strategic management literatures through thematic hypotheses focusing on firm-level outcomes for value creation and impacts of strategic flexibility. Hence, the main contribution of this work, apart from its analysis of value creation under the real options view of the firm, is the novel methodical approach to estimate the *level of realised* strategic flexibility that is both unbiased and preference free in that it makes no assumptions in relation to the distribution of the underlying data. This allows *SI* to be utilised in future research as an alternative econometric approach to qualitative designs in answering questions about how management-decision activity at the firm-level relates to important concepts and factors.

Returning to the paper question, several observations and findings in the study have direct implications relevant to the relationship between strategic flexibility (*SF*) and outcomes as survival, growth and firm value creation for both established and new firms: First, consistent with theoretical expectations, the results point to that growth options normalise across the firm life cycle and that *SF* is likely to peak in the growth stage. Second, these findings also indicate that firm size affects both firms' availability of options and their ability to achieve positive outcomes from *SF*. In addition, the evidence suggests that small and new firms though their potential for available slack proposes a higher capacity for flexibility compared to larger or older firms, are less likely to achieve positive effects of *SF* due to financial constraints. Third, the findings support the implicit relationship between *SF* and firm performance in terms of options creation, growth and value creation that underpins the chain-effect in prior studies, and that these effects are more prominent for new firms. Fourth, firms in high-clockspeed industries are likely to achieve more *SF* compared to firms in contexts with lower clockspeed, and though new firms are found to be more constrained independent of industry choice, new firms in industries with higher clockspeed appear less constrained and linked to improved funding compared to that of new firms in lower clockspeed settings. Fifth, *SF* has a positive effect on firm survival that is more critical for new firms, and significantly more so for new firms in lower clockspeed industries. Sixth, *SF* is not only likely to arrive through the firm's organisational setting linked to short-term decisions, but also via its business model structures

that are related to the longer-term strategic (flexibility) choices. Finally, the combined findings from the robustness and post hoc tests uncover that not only is *SI* able to predict stock returns as reported by earlier studies, but also future value creation over longer time horizons. This was demonstrated in the forecasting post hoc test that built on the novel discovery that firms with higher positive levels of *SI* are likely to exhibit persistence in achieved *SF* over the next five years, leading to the new empirical insight that there exists a significant relationship between *current levels of SI* and *future levels of profitability*. This and the additional insight showing that this relationship is also visible in future market premium suggest that *SI* provides additional information useful for valuation of going concerns.

Taken together, the paper contributes to the literature by providing *SI* as a new methodical lens for investigation of *SF* and demonstrates that selecting firms on their levels of *SI* is also associated with information for future value creation that could be applied to i.e. new firm performance assessment and valuation to alleviate information constraints.

The study is naturally limited by the sample and the nature of the *SI* measure in that while it is able to capture implied effects related to decision-activity at the firm-level, it is not able to explain the underlying decisions and other factors might impact on the skewness. Hence, one direction of future research could be to apply *SI* in combination with qualitative methods to investigate relationships between *SI* and actual firm decisions. The empirical analysis in this study provides incremental findings to suggest that while firms' abilities to achieve strategic flexibility has significant positive implications for value creation, survival and growth as theorised, it also unveils that despite the argued importance of strategic flexibility for small and new firms, the results indicate severe constraints for these firms that warrants further research.

The combined finding that *SI* can predict future medium-term value creation and that it has mean-reversion properties to future levels, leads to the related question whether using *SI* levels as a peer selection dimension could improve comparable valuation due to the inclusion of information related to firm-level decision-making flexibility. Future research could address this opportunity to improve valuation of new/early stage firms where peer approaches are suitable.

From a practical standpoint, as not all firms are likely to achieve significant levels of strategic flexibility due to differences in strategic decision-making and factors impacting abilities to fund growth or structure their organisations, *SI* could be considered by managers or analysts as a complementary means of analysis to select firms on their levels of ability to achieve performance through implied strategic flexibility.

Appendix 4.A – Variable definitions

Table 4.A.1 – Variable definitions. This table reports variables used in the paper. Market data are from the CRSP monthly set and interest rates from the Federal Reserve. Financial statement information is from the COMPUSTAT North America daily updates set, collected at the end of quarter. COMPUSTAT data items are provided in square brackets. Market variables (*ME*, *MV*, *RET*) are matched to current period fundamentals by being estimated leading one quarter. Firm fundamental variables are on quarterly basis at the firm level. Industry variables are estimated using six-digit GICS codes (*GICS6*). Notes and helpers applied to simplify definitions are at the end of the table.

Label (alt. label)	Description	Measurement definition
<i>ME (Size)</i>	Quarter leading market value of equity (Market cap.)	Share price [<i>PRCCQ</i>] multiplied by shares outstanding [<i>CSHOQ</i>], quarter leading (matched) market value of equity, e.g. Del Viva et al. (2017).
<i>RET</i>	Quarterly leading returns	Quarterly leading buy-and-hold return using CRSP monthly files, (<i>ret</i>) based on monthly stock returns and adjusted for delisting, with missing delisting returns in case of liquidation (delisting codes 500 or between 520 and 584) set to -30% for NYSE/AMEX firms (Shumway, 1997) and to -55% for NASDAQ (or other market) firms (Shumway and Warther, 1999).
<i>Beta (β)</i>	Quarterly leading beta	<i>Beta</i> for each firm-period <i>t</i> is estimated by a market model regression using 12 months of daily returns between period <i>t+1</i> and <i>t-11</i> , e.g. Del Viva et al. (2017).
<i>B/M</i>	Book-to-market ratio	The book-to-market ratio is estimated as fiscal year-end values for book value of equity [<i>CEQQ</i>] over <i>ME</i> , e.g. Trigeorgis and Lambertides (2014).
<i>OP</i>	Operating profitability	<i>OP</i> is (Sales [<i>SALEQ</i>] less Cost of goods sold [<i>COGSQ</i>] less sales and general admin. expenses [<i>XSGAQ</i>], plus research and development expenses [<i>XRDQ</i>] *) over lagged total assets [<i>ATQ</i>](<i>t-1</i>), extended from Ball et al. (2015).
<i>GP</i>	Gross profit	Gross profit is (Sales [<i>SALEQ</i>] less Cost of goods sold [<i>COGSQ</i>]) divided by total assets [<i>ATQ</i>], Novy-Marx. (2013).
<i>EPS</i>	Earnings per share	Earnings per share calculated excluding extraordinary items [<i>IBQ - DVPQ</i>] over shares outstanding [<i>CSHOQ</i>] (e.g. Jia and Yan, 2017).
<i>DTE (Leverage)</i>	Debt-to-equity ratio (financial flexibility)	<i>DTE</i> is the debt to equity ratio, estimated as the lagged eight quarter average of total debt [<i>DLTTQ + DLCQ</i>] over market value of equity (<i>ME</i>) as in Kumar and Li (2016).
<i>ATO (BM leanness)</i>	Asset-turnover ratio	<i>ATO</i> is sales [<i>SALEQ</i>](<i>t</i>) over lagged total assets [<i>ATQ</i>](<i>t-1</i>).
<i>PVfirm (MV)</i>	Quarter leading enterprise value (Firm market value)	Leading market value of equity (<i>ME</i>) plus total liabilities [<i>LTQ</i>](<i>t</i>), quarter leading (matched) market value of firm, e.g. Del Viva et al. (2017).
<i>PVAIP</i>	Present value of assets-in-place (<i>AIP</i>)	The perpetual no-growth value of the firm calculated for firm <i>i</i> at time <i>t</i> as the sum of the current and the past three quarters cash flow from operations before growth investments (<i>CFO_{i,t}</i>) over the firm's weighted average cost of capital (<i>WACC_{i,t}</i>), $PVAIP_{i,t} = CFO_{i,t} / WACC_{i,t}$ (e.g. Del Viva et al., 2021).
<i>PVGO</i>	Present value of growth options	The market implied value of firm <i>i</i> 's growth options at time <i>t</i> is difference between market value for the firm (<i>PVfirm</i>) and the present value of its assets-in-place (<i>PVAIP</i>), $PVGO_{i,t} = PVfirm_{i,t} - PVAIP_{i,t}$ (e.g. Del Viva et al., 2021)
<i>GO</i>	Growth options (market implied)	Defined following procedure in prior work (see Del Viva et al., 2017, 2021; Trigeorgis and Lambertides, 2014; Cao et al., 2008) as the percentage of firm market value (<i>PVfirm</i> or <i>MV</i>) that is due to present value of future growth options (<i>PVGO</i>): $GO_{i,t} = \frac{PVfirm_{i,t} - PVGO_{i,t}}{PVfirm_{i,t}}.$
<i>SK_X</i>	Conditional time-series skewness for variable <i>X</i>	The conditional time-series skewness following Jia and Yan (2017) based on Gu and Wu (2003) for any variable <i>X</i> (e.g. <i>OP</i> , <i>GP</i> , <i>EPS</i> , <i>Orgslack</i> or <i>ATO</i>) in a rolling time window quarters <i>t-1</i> to <i>t-8</i> (past exercise window): $SK_{X,t} = \frac{n}{(n-1)(n-2)} \sum_{\tau=t-n}^{t-1} \mathbf{w} \left(\frac{x_{\tau} - \mu_x}{\sigma_x} \right)^3,$ where μ_x and σ_x are the sample average, and standard deviation of <i>X</i> across the time window of length <i>n</i> quarters, and W is an eight-dimensional vector of weights. W is a vector of ones for equal-weighted and the vector (0.03, 0.06, 0.08, 0.11, 0.14, 0.17, 0.19, 0.22) for end-weighted application (see section 3).

Table 4.A.1 – Variable definitions (continued).

Label (alt. label)	Description	Measurement definition
<i>SI</i>	Strategic intensity	Defined as the conditional time-series skewness of operating profitability, SK_{Op} .
<i>Innov (IC)</i>	New option creation (<i>call</i>)	New option generation (<i>as call option</i>) proxied by the total sum of quarterly reported R&D expenses [$XRDQ$] over the past eight quarters where the firm was an IC active firm ($IC_{firm} = 1$) deflated by opening total assets [ATQ] in quarter $t-8$. Extending from Kumar and Li (2016).
<i>Invest</i>	Growth option exercise (<i>call</i>)	Exercise of growth option investment (<i>call option</i>) extends from Kumar and Li (2016) for investments as the sum of quarterly <i>option exercise</i> over the past eight quarters, deflated by opening total assets [ATQ] in quarter $t-8$. <i>Option exercise</i> is calculated as change in total assets [ATQ](t) – [ATQ]($t-1$) for each quarter, where the change is positive, else <i>Option exercise</i> is set to zero.
<i>Divest</i>	Divest option exercise (<i>put</i>)	Divestment considered as <i>put</i> options is the sum of quarterly asset <i>divestment</i> over the past eight quarters, deflated by opening total assets [ATQ] in quarter $t-8$. <i>Divestment</i> is calculated as the absolute value of change in total assets [ATQ](t) – [ATQ]($t-1$) for each quarter, where the change is negative, else set to zero.
<i>Hazard rate</i>	Hazard rate, $h(t)$	Hazard rate is the conditional probability of firm exit, predicted for each firm period based on estimations from a complementary log-log model with <i>FirmExit</i> as binomial dependent variable that is one for the period where a firm exits an exchange for a negative reason (based on CRSP delist codes), else zero: $\hat{h}_i(t) = 1 - \exp\left(-\exp\left(\gamma' FLC_{i,t} + \eta' TechInd_{i,t} + \theta' SI_{q,t} + \beta' X_{i,t} + \delta_{i,t} + \hat{\alpha}_t\right)\right)$ The model controls for level of strategic intensity, firm life cycle stage, whether the firm is in a high-clockspeed (high-technology) industry, firm age, firm size, and operating profitability, as detailed in the methods section.
<i>Sales growth</i>	Firm growth	Cumulative percentage change in sales ($[SALEQ](t) / [SALEQ](t-1) - 1$) calculated over the past eight quarters, $t-8$ to $t-1$.
<i>ΔMarket share</i>	Firm market share growth	Cumulative eight-period of lagged firm market share growth, defined as periodical growth in sales ($\Delta[SALEQ]_{firm,i}$) less average GICS6 industry sales growth ($\Delta[SALEQ]_{GICS6}$) in the same period (e.g. Fresard, 2010).
<i>Orgslack</i>	Organisational slack (Organisational flexibility)	<i>Orgslack</i> is the industry-adjusted, lagged eight quarter average of quarterly sums of cost of goods sold [$COGSQ$] plus sales and general administrative expenses [$XSGAQ$] less research and development expenses [$XRDQ$] divided by net sales (<i>Sales</i>) for each firm, less the median industry (<i>GICS6</i>) level of the variable in the same quarter, extended from Choi et al.(2018).
<i>Cash</i>	Financial flexibility (cash holding)	Cash holdings, a common proxy for operating financial flexibility (Trigeorgis and Lambertides, 2014) that is calculated as the lagged eight quarter average of the ratio of cash [$CHEQ$] to lagged total assets [ATQ]($t-1$) (e.g. Faff et al., 2016).
<i>Constraint</i>	Financial constraints	Financial <i>Constraint</i> is the trailing eight quarter average of quarterly deciles on the Whited and Wu (2006) WW-index: $WW = 0.652 - 0.091 \left[\frac{IBQ + DPQ}{ATQ} \right] - 0.0628 + 0.021 \left[\frac{DLTTQ}{ATQ} \right] - 0.044 \ln(ATQ) + 0.102SG_{IND} - 0.035SG$ where δ is an indicator set to one if DVQ is positive, and zero otherwise, SG_{IND} is average industry sales growth, estimated separately for each GICS6 industry and each quarter, and SG is firm-level sales growth in each quarter. *****
<i>Complexity</i>	Organisational complexity (Diversification)	Organisational <i>Complexity</i> is the lagged eight-quarter average of the quarterly product of the number of business segments [$BUSSEG$] and geographical segments [$GEOSEG$] for the firm, based on (Markarian and Parbonetti, 2007).
<i>Distress</i>	Financial distress	Financial <i>Distress</i> level is estimated using average deciles of the Altman's Z (Altman, 2000) over the past eight quarters.
<i>Ind. Concentration</i>	Industry concentration (proxy for competition)	Industry competition level is proxied via the Herfindahl–Hirschman index (HHI) that is calculated for each firm i and quarter t based on sales [$SALEQ$] within a GICS6 industry with N_{GICS6} firms as: $Industry\ concentration_{i,t} = \left[\frac{Sales_{i,t}}{\sum_{i=1}^{N_{GICS6}} Sales_{i,t}} \right]^2 \quad (\text{e.g. Li and Li, 2010}).$ A lower value of concentration is interpreted as a higher level of competition.

Table 4.A.1 – Variable definitions (continued).

Label (alt. label)	Description	Measurement definition
<i>Ind. Uncertainty</i>	Industry demand uncertainty	Standard deviation of the lagged GICS6 industry quarterly observations for all firms' quarterly percentage sales growth ($[SALEQ]_t / [SALEQ]_{t-1} - 1$) in the same GICS6 industry between quarters $t - 1$ and $t - 8$, e.g. Choi et al. (2018).
<i>Ind. R&D Intensity</i>	Industry research and development intensity (industry technology level)	Average of eight period lagged ($t - 1$ to $t - 8$) quarterly firm-level research intensity ($RDINT$) observations for all firms in the same GICS6 industry, based on Tong and Li (2011). $RDINT$ is calculated as quarterly research and development expenses $[XRDQ]$ over net sales $[SALEQ]$.
<i>Ind. Sales Growth</i>	Industry sales growth	Cumulative lagged eight-period ($t - 1$ to $t - 8$) GICS6 industry sales growth ($\Delta[SALEQ]_{GICS6}$).
<i>Age</i>	Firm age (years)	Years since the date of the firm's incorporation (incorporation date) for firms where this data is made available.*** For firms where the Incorporation is unavailable, this paper follows prior research (e.g. Loderer et al., 2017; Dickinson, 2011) and assume that firm are born at the time they first appear in CRSP or COMPUSTAT listings (listing age). Both CRSP and COMPUSTAT Listing age are considered, for each firm-period and the earliest of these two dates is used where they differ.
<i>FLC</i>	Firm life-cycle stage	Firm stage of development following Dickinson (2011) estimating firm life cycle stage (introduction=1, growth=2, maturity=3, shake-out=4 and decline=5) using signs of sums for each of the cash flows from operating $[OANCFQ]$, investing $[IVNCFQ]$ and financing $[FINCFQ]$ activities over the lagged eight quarters as activity-based cash flow patterns (see section 5).****
<i>ICfirm</i>	IC active firm	A dummy set to one for an innovation capacity (IC) active firm that creates new options in the period by reporting non-zero R&D expenses (Kumar and Li, 2016), else set to zero.
<i>TechInd</i>	High-clockspeed industry	The dummy set to one if firm in period belongs to a high-clockspeed (high-technology) industry as defined in Bhojraj and Lee (2002), and else set to zero.
<i>NewFirm</i>	New firm	Dummy set to one if firm in period is classified as an introduction stage firm ($FLC = 1$) in the Dickinson FLC model, and else set to zero.
<i>NewGrowth</i>	New growth firm	Dummy set to one if firm in period is classified as an introduction stage firm ($FLC = 1$) in the Dickinson FLC model and is also belonging to a growth (high-technology) industry as defined in Bhojraj and Lee (2002), else set to zero.
<i>FirmExit</i>	Firm exit	A dummy set to one in the last quarter period when a firm is delisted for a negative reason using CRSP delist codes (see section 5), else set to zero.

Helpers:

WC (working capital)** = accounts receivables $[REQTQ]$ plus other current assets $[ACQ]$ less (accounts payable $[APQ]$ plus other current liabilities $[LCOQ]$), adapted from Fairfield et al. (2003).

AC (operating accruals) = Change in working capital (ΔWC) less depreciation and amortisation $[DPQ]$, where $\Delta WC = WC(t) - WC(t - 1)$, based on Fairfield et al. (2003).

OI (operating income)* = operating income after depreciation $[OIADPQ]$ plus research and development expenses $[XRDQ]$, based on Ball et al. (2016).

CFO (cash flow from operations) = operating income (OI) less accruals (AC), (see Fairfield et al., 2003).

$WACC$ (market beta-based discount rate) = $R_{ce}(1 - DTE) + R_{cd}DTE(1 - R_{tax})$, where $R_{ce} = R_f + \beta(R_m - R_f)$ is the cost of equity estimated with firm raw beta (β) estimated using market model regressions (12 months of daily returns), R_m (market risk) is 60-month average premium of the Standard & Poor's (S&P) 500 index portfolio over the 1-month T-bill rate as R_f (risk-free rate). As in prior work R_{cd} is the cost of debt is set to four points (0.04) lower than R_m , and R_{tax} is tax rate $[TXTQ]$ over pre-tax income $[PIQ]$ (e.g. Trigeorgis and Lambertides, 2014).

Notes:

* Ball et al. (2015) removes research and development bias from operating income, effectively treating it as a capitalised asset.

** Recognition of stock as investment, moving stock from working capital (WC) to fixed working capital.

*** For listed IPO start-up firms in the COMPUSTAT sample, Incorporation dates are available via the IPO dataset provided and maintained by Jay Ritter (Loughran and Ritter, 2004).

**** In Dickinson (2011) the stages are calculated based on annual data, but these have also been estimated using rolling windows across multiple years (e.g. Anderson et al., 2017; Drobetz et al., 2015). This paper applies quarterly data to achieve a two-year trailing measure.

***** In most of the literature the intercept (0.652) from table 1, model 4, p. 541 of the WW paper is omitted, possible leading to negative index results.

Appendix 4.B – High-growth (technology) industry definitions

Table 4.B.1 – Examples of definitions of high technology (*fast-moving sectors*) industries.

Study/Report	Industry (% in sample)	Code (in study) *	GICS6 Code **
Bhojraj and Lee (2002), Klobucnik and Sievers (2013) (SIC code)	Biotechnology (18%)	2833 – 2836	352020, 352010, 351010
		8731 – 8734	351020
	Computers (40%)	3570 – 3577	252010, 451030, 452020, 453010
		7371 – 7379	151040, 255040, 451020
	Electronics (31%)	3600 – 3674	201040, 201060, 251010, 252010, 252010, 254010, 452010, 452030
	Telecom (11%)	4810 – 4841	254010, 402010, 451010, 501010, 501020, 502010
Haltiwanger et al. (2014) (NAICS code)	<u>ICT technology high technology</u>		
	Computers	3341, 3342, 3344, 3345	452010, 452020, 351010
	Software and data	5112, 5162, 5179, 5181, 5182	202010, 451030, 451030, 501010
	Computer design services	5415	151040
	<u>Miscellaneous High technology</u>		
	Pharmaceutics	3254	352010
	Aerospace	3364	201010
	Architectural services	5413	101010
	Scientific research services	5417	351020
Behm (2003) (SIC code)	Telecom (33,3%)	3661, 3663, 3669, 4812, 4813, 4822, 4899	451010, 452010, 452030, 501010, 501020
	Biotechnology (33,3%)	2833, 2834, 2835, 2836, 3823, 3826, 8731	351010, 351020, 352010, 352020, 352030, 452030
	Medical equipment (33,3%)	3841, 3842, 3843, 3844, 3845, 3851, 5047, 5048	252030, 351010, 351020

Notes: *This is the original industry classification code used in the related papers as either SIC or NAICS (see leftmost column). ** The translation from SIC4 and NAICS4 is an approximation for best fit, based on the original sector identifiers.

Appendix 4.C – Concepts and links to strategic flexibility

Table 4.C.1 – Strategic flexibility literature review papers: concepts and relationships to strategic flexibility.

Concept	Dimension	Relationship	Studies
Demand uncertainty ^{1,2,3}	Trigger	+	Positive: Combe (2012); Brozovic (2018)
		–	Negative: Herhausen et al. (2021)
	Moderator	+ *	Directional (weak) moderator: Herhausen et al. (2021)
Environmental dynamism ¹	Trigger	+	Positive: Combe (2012); Brozovic (2018)
		–	Negative: Herhausen et al. (2021)
	Moderator	+	Herhausen et al. (2021)
Competitive intensity ^{1,2,3}	Trigger	+	Positive: Combe (2012); Brozovic (2018); Herhausen et al. (2021)
	Moderator	+ *	Directional (weak) moderator: Herhausen et al. (2021)
Market complexity ^{2,3}	Trigger	+	Combe (2012); Brozovic (2018)
Resources ^{1,2,3}	Enabler	+	Positive: Combe (2012); Brozovic (2018)
		–	Negative: Herhausen et al. (2021)
Creation of options ^{1,2,3}	Enabler	+	Combe (2012); Brozovic (2018); Herhausen et al. (2021)
Strategic variety ^{1,2,3}	Enabler	+	Combe (2012); Brozovic (2018); Herhausen et al. (2021)
New Technology ²	Enabler	+	Brozovic (2018)
Market orientation ^{1,2,3}	Enabler	+	Combe (2012); Brozovic (2018); Herhausen et al. (2021)
Rigidity ²	Barrier	–	Brozovic (2018)
Management issues ²	Barrier	–	Brozovic (2018)
Lack of funding ²	Barrier	–	Brozovic (2018)
Firm size ^{1,2}	Barrier	i	Brozovic (2018); Herhausen et al. (2021)
	Moderator	0	Insignificant moderator effect: Herhausen et al. (2021)
Firm age ¹	Barrier	+	Herhausen et al. (2021)
	Moderator	0	Insignificant moderator effect: Herhausen et al. (2021)
Past success ¹	Barrier	–	Herhausen et al. (2021)
Competitive advantage ^{1,2,3}	Outcome	+	Combe (2012); Brozovic (2018); Herhausen et al. (2021)
Reduction of risk ²	Outcome	+	Brozovic (2018)
Resistance (persistence) ²	Outcome	+	Brozovic (2018)
Innovation outcomes ^{1,2,3}	Outcome	+	Combe (2012); Brozovic (2018); Herhausen et al. (2021)
Market outcomes ^{1,2,3} (chain effect: via innovation) ¹	Outcome	+	Combe (2012); Brozovic (2018)
			Indirectly via innovation: Herhausen et al. (2021)
Financial performance ^{1,2,3} (chain effect: via market) ¹	Outcome	+	Combe (2012); Brozovic (2018)
			Indirectly via innovation and market effects: Herhausen et al. (2021)

Notes: The concepts are derived from a systematic analysis of higher-tier (ABS 3/4/4, Chartered Association of Business Schools' Academic Journal Guide 2018) literature reviews published over the last decade. Dimension refers to moderator (contingency), antecedent such as triggers, enablers, and inhibitors/barriers and outcome (consequences) as suggested in Brozovic (2018) and Herhausen et al. (2021). Relationships are coded as significant positive (+), negative (–), or insignificant (i). Footnote references: 1) Herhausen et al. (2021), 2) Brozovic (2018), and 3) Combe (2012). *) reported as possibly insignificant due to sample size, but with directional support for effect of relationship, and hence a weak or inconclusive indicator.*

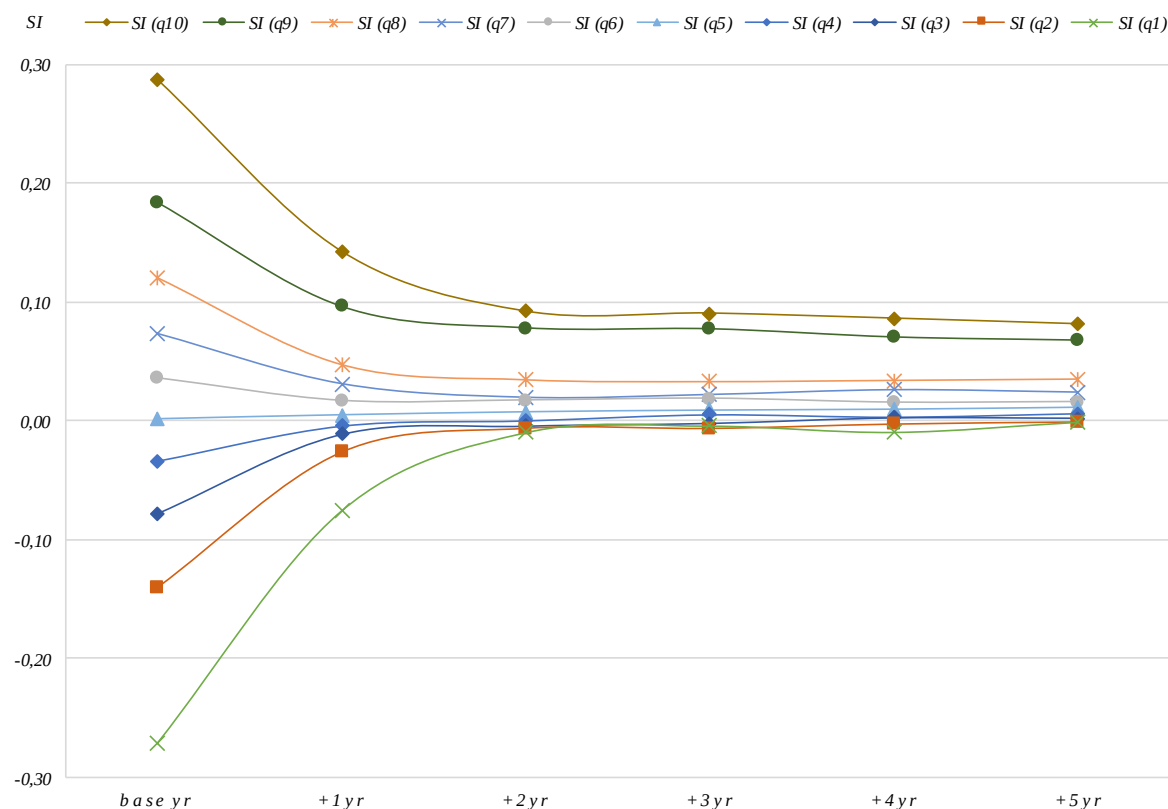
Appendix 4.D – Convergence analysis (additional data)

Table 4.D.1 – Strategic intensity convergence analysis descriptive statistics (decile portfolios of SI)

The table provides descriptive statistics for convergence analysis of portfolios based on decile levels of strategic intensity (SI) estimated using end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window calculated based on the conditional time-series skewness extending from Gu and Wu (2003). The convergence test, based on Nissim and Penman (2001), forms annual overlapping portfolios as in Dickinson and Sommers (2012) of median strategic intensity deciles for firms in the years 1991 to 2005 with available current base year ($t=0$) and five following ($t=1, \dots, 5$) years. This results in 25 six-year replications (base year plus five subsequent years) that are matched to shape the final sample of medians used in the analysis. All variables are based on quarterly financial statement data from COMPUSTAT winzorisized at 1% and 99%. As in Nissim and Penman (2001) spearman rank correlation between each period and its lagged value ($Corr_t$) and variance of each period divided by the variance of the base period are estimated (Var_t/Var_0) to provide indicators of explanatory power and speed of mean reversion. **Panel A** reports means of all SI levels for base year and each of the following five years together with correlation coefficient, mean reversion rate and number of observations (N). **Panel B** reports median observations for each decile SI level portfolio together with descriptive statistics as in panel A. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

	All firms (year from decile formation period)					
	base yr	+1yr	+2yr	+3yr	+4yr	+5yr
Panel A - Summary statistics (all SI portfolios)						
SI (overall average)	0.018	0.022	0.023	0.024	0.024	0.024
$Corr_t (SI_t SI_{t-1})$	1.000***	0.929***	0.805***	0.767***	0.746***	0.699***
MR rate (Var_t/Var_0)		0.162	0.067	0.063	0.057	0.050
N	66 023	66 023	66 023	66 023	66 023	66 023
Panel B - SI (means of portfolio median levels)						
SI (q10)	0.287	0.143	0.092	0.091	0.086	0.082
SI (q9)	0.184	0.096	0.078	0.077	0.070	0.068
SI (q8)	0.121	0.047	0.035	0.033	0.034	0.035
SI (q7)	0.074	0.031	0.019	0.022	0.026	0.024
SI (q6)	0.036	0.017	0.017	0.019	0.015	0.016
SI (q5)	0.001	0.005	0.008	0.009	0.010	0.012
SI (q4)	-0.034	-0.004	0.000	0.006	0.004	0.007
SI (q3)	-0.078	-0.011	-0.004	-0.002	0.003	0.002
SI (q2)	-0.140	-0.026	-0.006	-0.006	-0.003	-0.001
SI (q1)	-0.271	-0.075	-0.009	-0.004	-0.009	-0.001

Figure 4.D.1 – Evolution of SI decile portfolios across the future five years



Appendix 4.E – Future market premium in *M/B* and *SI*-portfolios

Table 4.E.1 – Market premium forecasting on *SI*-portfolios– *M/B* (market-to-book-value of equity)

The table reports descriptive and test statistics for five-year portfolio means of medians of market-to-book-value of equity (*M/B*) formed based on quintiles of levels of strategic intensity (*SI*) in each base year (1991, ... 2015) following the procedure for ratio convergence test in Nissim and Penman (2001) modified to use overlapping annual portfolios as in Dickinson and Sommers (2012). All variables are defined in Appendix A. *M/B* is calculated as the inverse of *B/M* (book-to-market ratio). The sample covers firms with quarterly financial statement data from COMPUSTAT between 1989 and 2020 and winzorised at 1% and 99%. The estimation of conditional time-series skewness extends from Gu and Wu (2003) and uses end-weighted third-moments of the lagged eight quarters in its representation of the past exercise period window. **Panel A** reports summary statistics for *M/B* across all quintiles, including average, portfolio-year correlations (*Corr_t*), mean reversion (*MR*) rate and sample size (*N*) that are calculated as in Nissim and Penman (2001). **Panel B** reports statistics at the portfolio level for each quintile level of *SI*, with means of median *M/B* portfolio levels for the portfolio forming year (base yr) and each of the following five years. As in prior analyses, the focus is on comparing outcomes for firms sorted on high positive strategic intensity (*q5*, *SI+*), passive firms with low *SI* (*q3*) respective negative *SI* (*SI-*, *q1*). Averages for each *SI*-quintile formed portfolio for years one to five is calculated and percentage mean-differences for each *SI* quintile compared to the low *SI* (*q3*) level estimated to provide a test of differences in future profitability. Two-sided t-tests statics are calculated for means and mean-differences. Statistical significance levels are indicated using #, *, **, and *** for 1%, 0.5%, 0.1% and 0.01%.

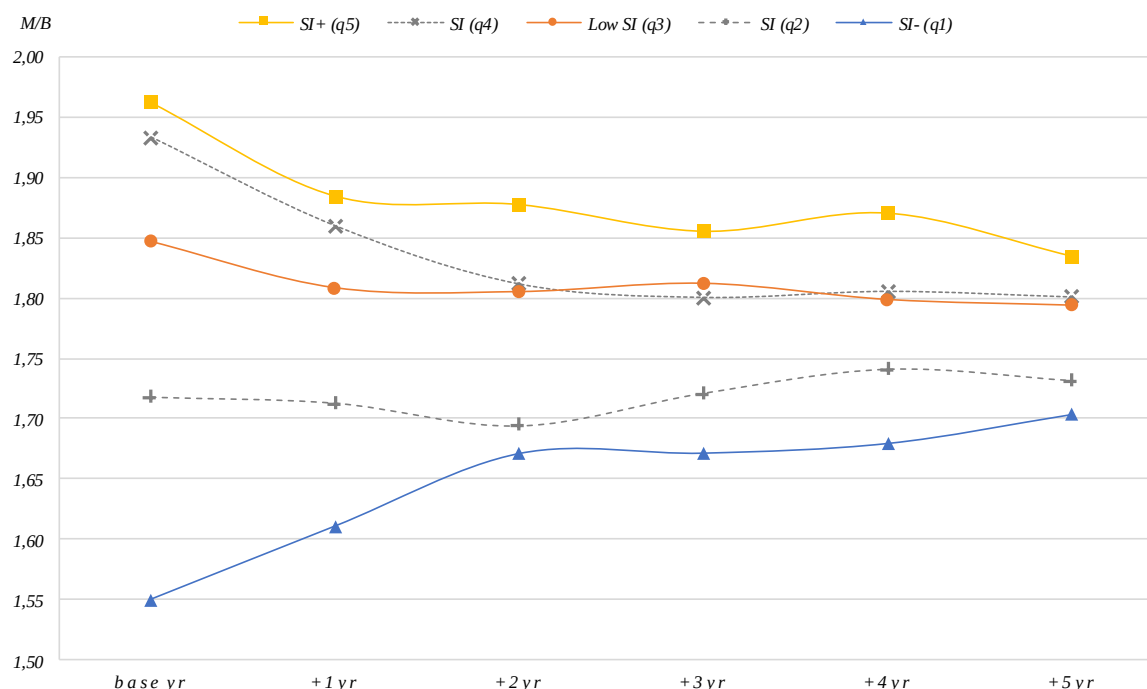
Panel A – Summary statistics

	Total <i>M/B</i> portfolios (year from quintile formation)					
	base yr	+1yr	+2yr	+3yr	+4yr	+5yr
<i>M/B</i> (overall average)	1.802	1.775	1.772	1.772	1.779	1.773
<i>Corr_t</i> (<i>OP_t</i> <i>OP_{t-1}</i>)	1.000***	0.428***	0.437***	0.479***	0.520***	0.494***
<i>MR</i> rate (<i>Var_t</i> / <i>Var₀</i>)		0.890	0.897	0.915	0.887	0.904
<i>N</i>	66 023	66 023	66 023	66 023	66 023	66 023

Panel B – Portfolio level statistics

	Means of portfolio <i>M/B</i> medians (year from quintile formation)						<i>M/B</i> across +1yr to +5yr	
	base yr	+1yr	+2yr	+3yr	+4yr	+5yr	Average	<i>SI</i> quint. vs. low <i>SI</i> (%)
<i>SI+</i> (<i>q5</i>)	1.962	1.885	1.877	1.855	1.870	1.835	1.864***	3.4%*
<i>SI</i> (<i>q4</i>)	1.933	1.860	1.812	1.801	1.806	1.801	1.816***	0.7%
Low <i>SI</i> (<i>q3</i>)	1.847	1.808	1.805	1.812	1.798	1.794	1.803***	0.0%
<i>SI</i> (<i>q2</i>)	1.718	1.713	1.694	1.721	1.740	1.731	1.720***	-4.6%**
<i>SI-</i> (<i>q1</i>)	1.550	1.611	1.671	1.671	1.679	1.703	1.667***	-7.6%**
Spread <i>q5</i> vs. <i>q1</i> (abs. diff.)	0.412	0.274	0.206	0.184	0.191	0.131	0.197	10.9%

Figure 4.E.1 – Future *M/B* in portfolios formed on levels strategic intensity (means for medians of *M/B* ratios)



5. Conclusions

This thesis is motivated by the need to generate new insights and find approaches to improve valuation of businesses that are currently not operating under a sense of steady-state with stable financial flows that can be used in linear models for forecasting or in common ratio-based peer selection. Particularly firms in emergent or growth stages of development or firms that are operating under higher levels of uncertainty with substantial value linked to future growth options in competitive markets do not fulfil such conditions. Instead their valuation requires alternative approaches for assessment of future options and methods that recognise non-linear value effects of flexibility.

By taking a real options view of the firm and also recognising that strategic choice provides a long-term source of flexibility that complements organisationally driven strategic flexibility in the short-term, and in building on recent research in fundamental higher moments, this thesis addresses limitations in the literature in an original contribution across the included research papers to further the empirical understanding of the role strategic flexibility plays in value creation and by methodically adding to improved valuation of firms across all life cycle stages.

The findings in the review in chapter 2 contributes to the literature not only by taking a real options perspective to enrich our understanding of the firm valuation puzzle across an extensive set of literatures or by uncovering and relationally mapping issues to shed light on how information asymmetries and lack of information that drives frictions in the underlying funding processes interacts to help explain reported issues in forecasting, capitalisation and firm financial constraints in emergent stages, but also by showing how these findings are related to and negatively impacts on these firms' ability to exercise flexibility and capture growth options at all stages. Findings also suggest that while strategic flexibility in this context is important and valuable, the empirical understanding of firm-level flexibility, particularly acute in earlier stages of venture development appears both incomplete and under-represented in the existing body of research.

The second paper in chapter 3 makes contributions to the strategic group, business model and peer selection literatures by addressing the open questions uncovered in the review asking if business model and strategic groups are related concepts and whether structural relatedness of business models based on strategic dimensions suggested in the prior literature can provide a third dimension of firm-similarity that complements economic and accounting dimensions.

Taking an extensive approach to evaluation strategic choice in peer selection efficacy across three methods in the previous work, findings in this early and novel contribution provide results confirming that strategic choice embedded in business model structures has relevance to further our understanding of how peer selection can be made on strategic basis.

The third paper in chapter 4 contributes to the financial management, strategic management and financial statement literatures by introducing strategic intensity (*SI*) that captures firm-level flexibility via asymmetry in earnings processes as a new fundamental proxy for realised strategic flexibility (*SF*), and by applying the new proxy to investigate and answer empirical questions raised in these literatures. The new empirical findings reveal that growth options are significantly related to levels of achieved strategic flexibility in a normalising process over the stages of development and that both firm size and whether the firm is part of a high-growth industry plays important roles for firms' abilities to exercise strategic flexibility. The combined findings infer general and positive relationships between realised strategic flexibility at the firm-level and performance in options creation, growth, value creation and survival that are found specifically important to new firms. The findings from the convergence and forecasting tests that extends from the financial statement literature contribute to knowledge by providing novel evidence that firms with higher levels of achieved strategic flexibility are not only likely to experience stronger persistence and lower mean reversion compared to firms with lower or negative levels, but also by revealing significant relationships between current levels of strategic flexibility and future levels of profitability and market value that has direct implications for valuation.

Taken together, the work in this thesis makes several original contributions to the literatures.

The critical review in chapter 2 that is a first to focus on the problems of firm valuation and strategic flexibility under the real options lens provides a contribution to our understanding of the underlying problems both in the emergent venture capital valuation context and beyond for businesses in more established stages of development.

The paper in chapter 3 provides several novel contributions by being a first study to consider strategic choice operationalised via business model dimensions as mechanism for peer selection and in comparable firm valuation. Hence, it adds to both the strategic management and the strategic groups literatures via the analysis of strategic group and business model relatedness and by showing that business models can provide a new opportunity to progress strategic group research. In addition, the study contributes to the accounting and the peer

selection literatures by undertaking a comprehensive examination of peer efficacy based on three methods: group homogeneity, group variance, and valuation accuracy, and finally by being a first study to apply these tests to comprehensively examine viability of strategic choice and firm life cycle information in peer selection.

The study in chapter 4 makes a number of contributions to the related literatures. First, it narrows the measurement gap in strategic management in a contribution to the real options literature by arguing theoretically for and providing a practical proxy of realised strategic flexibility in a methodical contribution that captures effects of decision-driven flexibility at the firm-level suitable for low-frequency quarterly financial statement data. Second, it applies the proxy as methodical lens in an extensive empirical contribution to several debates relating to firms' ability to be flexible in presence of options, and answer questions raised in the real options and strategic management literatures. Third, it contributes to the financial statement literature by reporting findings demonstrating that intrinsic value creation is in part related to non-linear and non-normal effects due to firm-level flexibility in the earnings processes as predicted by the real options theory, and that such effects also exhibit mean reversion and persistence behaviour similar to that of what has been reported in the ratio analysis literature.

The findings in this thesis indicate some limitations and provide for some interesting avenues for future research. In the peer selection study in chapter 3 there are a number of limitations that require more attention in future work. First, due to the choice to anchor business model factors into the economy rather than into industry, life cycle stage or combined contexts. This choice combined with that no optimal selection or weighted treatment of factors was considered could help explain why the multidimensional strategic peer did not improve in the more specific life cycle and industry contexts. Given these observations and the findings proposing that life cycle information appears to improve similarity within industry contexts, anchoring within such settings and more carefully considering factors and weighting in the models could provide significant improvements and should be further examined. Second, even if business model-based peers were confirmed in both intra-variance and valuation accuracy tests the choice of factors were biased due to their partial inclusion in the homogeneity test that renders the homogeneity results partly unreliable. Third, the robustness analyses reveal that the common practice in the literature of using a fixed peer group size in tests is likely to introduce errors due to sensitivity to peer approach, context and factors involved, and due to that it is not realistic to assume that all firms has the same number of peers. Future work could improve on this by investigating effects of peer group size in peer selection more extensively. Finally,

future work could control for effects of firms that either operate within multiple industries or are active with multiple business models, and examine whether the results of strategic similarity holds universally across privately and public firms. Also, the work in chapter 4 suggests some limitations opening for future work. Though realised strategic flexibility captured in the strategic intensity proxy provides an ability to explain variation of effects related to decision-activity at the overall firm-level, it is not able to provide detailed explanations for the underlying conditions, factors or managerial decisions. Therefore, future studies could approach this problem by application of strategic intensity in relation to qualitative methods to examine possible relationships between firm-level decision activity and suggested levels of strategic intensity. Given that the new evidence in this work imply that levels of strategic intensity can predict future medium-term value creation opens, for new research to investigate whether strategic intensity can be useful as a peer selection dimension for performance assessment or in comparable valuation by providing strategic flexibility-relatedness in reflection of variation in implied decision-making among firms.

The contributions in this thesis also provide some practical implications. The peer selection approach based on strategic choice and operationalised using business model dimensions in this study offers a complement to the toolbox of analysts, private equity or venture capital investors and entrepreneurial teams for assessment and valuation of firms specifically in earlier stages of development where short financial history presents problems for the application of standard valuation methods, but where business models and industry sectors can be effectively identified. Moreover, the findings in this study also suggest that strategic intensity provide an effective lens that could be applied as an alternative econometric method to answer questions relating to firm-level management-decision activity in future research in strategic management as it offers an unbiased and comparable approach that has been lacking in the literature. In addition, as the results reveal that it is not likely that all firms will be successful in achieving positive outcomes or significant levels of strategic flexibility due to firm-level differences, analysts and managers could consider strategic intensity as an alternative methodical lens for performance analysis, or as a factor in peer selection of firms based on their ability to realise strategic flexibility.

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