Digital transformation, economic success, and regional impact of the German Mittelstand

DISSERTATION

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Preface

This dissertation would not have been possible without the help of my supervisors, my colleagues, and my family. Therefore, I would like to dedicate the following words to all the people who have accompanied me on my journey as a doctoral student over the past three and a half years and who have supported me in the development of my dissertation.

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List of abbreviations

AG	Aktiengesellschaft
AVE	Average variance extracted
B2B	Business-to-Business
B2C	Business-to-Consumer
BBSR	Bundesinstitut für Bau-, Stadt- und Raumforschung
BRIC	Brasil, Russia, India, and China
BvD	Bureau van Dijk
CA	Cronbach's alpha
CATI	Computer aided telephone interviews
CEO	Chief executive officer
CR	Composite reliability
d	Dummy variable(s)
DAX	Deutscher Aktienindex
EBT	Earnings before taxes
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EPO	European Patent Office
e.g.	Exempli gratia (for example)
et al.	et alii (and others)
GDP	Gross domestic product
H	Hypothesis
HC	Hidden Champion
i.e.	id est (that is)
IfM	Institut für Mittelstandsforschung
int.	Intensity
log.	logarithmized
Max	Maximum
Min	Minimum

NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
NPD	New product development
NUTS	Nomenclature des unités territoriales statistiques
OLS	Ordinary least squares
R&D	Research and development
ROA	Return on assets
ROE	Return on equity
ROS	Return on sales
RQ	Research question
SD	Standard deviation
SE	Standard error
SEW	Socioemotional wealth
SME	Small and medium-sized enterprise
VC	Venture capital
VIF	Variance inflation factor

Zusammenfassung

Der deutsche *Mittelstand* ist ein wichtiger Faktor für den Erfolg der deutschen Wirtschaft. Mittelständische Unternehmen, darunter zahlreiche Familienbetriebe, erwirtschaften einen Großteil des Umsatzes der Unternehmen in Deutschland und tragen als bedeutende Arbeitgeber und Innovatoren maßgeblich zu Beschäftigung und technologischem Fortschritt bei. *Hidden Champions* wird in diesem Zusammenhang aufgrund ihrer führenden Wettbewerbspositionen in internationalen Nischenmärkten eine besondere Bedeutung zugeschrieben. Nichtsdestotrotz stellt die voranschreitende Digitalisierung mittelständische Unternehmen aktuell vor komplexe Herausforderungen, deren Bewältigung als Voraussetzung für ihren künftigen Erfolg und letztlich den der deutschen Wirtschaft gilt. Um neue Wertschöpfungspotenziale nutzen und mithilfe digitaler Technologien wachsen zu können, müssen mittelständische Unternehmen ihre Produkte, Prozesse und Geschäftsmodelle grundlegend transformieren. Ob und inwiefern sie zu einer solchen Transformation in der Lage sind, unterscheidet sich jedoch und hängt von verschiedenen Faktoren, insbesondere auch auf organisationaler Ebene, ab. Zur Erlangung eines besseren Verständnisses der besonderen Anforderungen und Einflussfaktoren einer erfolgreichen Digitalisierung mittelständischer Unternehmen untersucht der erste Teil dieser Dissertation anhand von zwei Studien auf Basis einer umfangreichen Unternehmensbefragung die Rolle organisationaler Fähigkeiten und Merkmale im Zuge der digitalen Transformation. Demgegenüber betrachtet der zweite Teil auf Basis von zwei weiteren quantitativen Studien den wirtschaftlichen Erfolg und regionalen Einfluss von Hidden Champions.

Im Anschluss an Kapitel 1, das die Motivation dieser Dissertation erläutert, die zugrundeliegenden Forschungsfragen ausführt und die Struktur dieser Dissertation beschreibt, untersucht Kapitel 2 die Beziehung zwischen dynamischen Fähigkeiten und der digitalen Transformation des Geschäftsmodells in mittelständischen Unternehmen. Kapitel 2 geht der Fragestellung nach, wie sich dynamische Fähigkeiten auf den Digitalisierungsgrad des Geschäftsmodells auswirken und wie diese Beziehung durch die Beteiligung der Eigentümerfamilie oder die Beteiligung der Unternehmensgründerin beziehungsweise des

Unternehmensgründers beeinflusst wird. Dabei wird angenommen, dass organisationale Merkmale, wie etwa die Eigentumsstruktur, im Zuge der digitalen Transformation des Geschäftsmodells mit den dynamischen Fähigkeiten von Unternehmen interagieren. Um dies zu überprüfen, wird eine Stichprobe von 525 deutschen Unternehmen des produzierenden Mittelstandes untersucht, darunter sowohl familien- als auch gründergeführte Unternehmen. Die Ergebnisse der empirischen Auswertungen zeigen, dass dynamische Fähigkeiten den Digitalisierungsgrad des Geschäftsmodells signifikant erhöhen. Sie zeigen jedoch auch, dass die förderliche Wirkung von dynamischen Fähigkeiten auf die digitale Transformation des Geschäftsmodells durch die Beteiligung der Gründerin beziehungsweise des Gründers, nicht aber durch die Beteiligung der Familie abgeschwächt wird.

Kapitel 3 untersucht die Beziehung zwischen Familieneigentum und der Verfolgung von Wachstumszielen mit der Digitalisierung in mittelständischen Unternehmen. Dabei wird zunächst zwischen wachstums- und effizienzorientierten Digitalisierungszielen unterschieden, ehe die besonderen Eigenschaften von Familienunternehmen in Bezug auf strategische Zielsetzungen und Entscheidungsprozesse erläutert werden. Aufgrund des Einflusses der Familie im Unternehmen – der sich primär aus der Tatsache ergibt, dass Familienmitglieder Unternehmensanteile halten – verfolgen Familienunternehmen neben wirtschaftlichen Zielsetzungen auch nicht-wirtschaftliche, familiäre Belange, wie zum Beispiel die erfolgreiche Weitergabe des Unternehmens an die nächste Generation. Kapitel 3 untersucht vor diesem Hintergrund den Einfluss von Familieneigentum auf die Verfolgung von Wachstumszielen mit der Digitalisierung sowohl auf Ebene des Unternehmens als auch auf Ebene der Eigentümerinnen und Eigentümer. Die Ergebnisse der empirischen Analysen des bereits genannten Datensatzes zeigen, dass Familienunternehmen mit der Digitalisierung mit geringerer Wahrscheinlichkeit Wachstumsziele verfolgen als Nicht-Familienunternehmen. Die Ergebnisse aus Kapitel 3 verdeutlichen jedoch auch, dass eine starke emotionale Bindung der Eigentümerinnen und Eigentümer von Familienunternehmen die Verfolgung von Wachstumszielen mit der Digitalisierung fördert und Familienunternehmen folglich dabei unterstützen kann, Wachstumsbarrieren zu überwinden.

Während sich Kapitel 2 und 3 mit der digitalen Transformation des deutschen Mittelstandes befassen, konzentriert sich Kapitel 4 auf eine besondere Subgruppe mittelständischer Unternehmen, die Hidden Champions. Trotz ihrer enormen Praxisrelevanz und des wachsenden Forschungsinteresses, existieren bis dato kaum wissenschaftliche Belege über den wirtschaftlichen Erfolg der Hidden Champions. Kapitel 4 untersucht vor diesem Hintergrund die finanzielle Leistungsfähigkeit der Hidden Champions auf Unternehmensebene.

Indem es die Profitabilität von Hidden Champions im Vergleich zu anderen mittelständischen Unternehmen analysiert, geht Kapitel 4 der Fragestellung nach, wann und inwieweit Hidden Champions andere mittelständische Unternehmen finanziell übertreffen. Die Ergebnisse der empirischen Auswertungen eines Paneldatensatzes von 4.677 deutschen Unternehmen des produzierenden Mittelstandes, darunter 617 Hidden Champions, zeigen, dass Hidden Champions eine signifikant höhere Rentabilität gemessen an ihrer Gesamtkapitalrendite aufweisen. Verglichen mit anderen mittelständischen Unternehmen, weisen Hidden Champions im Durchschnitt eine um 1,7 Prozentpunkte höhere Gesamtkapitalrendite auf. Dieser Effekt nimmt jedoch mit steigender Unternehmensgröße ab und verschwindet bei Unternehmen mit mehr als 900 Beschäftigten. Neben der finanziellen Leistung vergleicht Kapitel 4 Hidden Champions mit anderen mittelständischen Unternehmen hinsichtlich der typischen Merkmale, die ihnen zugeschrieben werden. Die Ergebnisse unterstreichen, dass Hidden Champions über überdurchschnittliche Exportquoten, ausgeprägte Innovationsaktivitäten und gesunde Kapitalstrukturen verfügen.

Desweiteren analysiert Kapitel 5 die wirtschaftliche Bedeutung von Hidden Champions auf regionaler Ebene. Dabei werden die Auswirkungen der regionalen Hidden Champion Intensität, das heißt der Anzahl an Hidden Champions pro 100.000 Einwohner in einem Kreis, auf eine Reihe von regionalen Entwicklungsdimensionen untersucht. Die empirischen Auswertungen eines Datensatzes von 1.645 Hidden Champions aus 401 deutschen Kreisen im Hinblick auf sieben verschiedene regionalökonomische Indikatoren zeigen, dass Hidden Champions die regionale Entwicklung maßgeblich beeinflussen. Regionen mit einer höheren Hidden Champion Intensität weisen eine starke regionale Wirtschaftsleistung in Bezug auf das Medianeinkommen auf. Darüber hinaus beeinflusst die Hidden Champion Intensität die regionale Arbeitslosen- und Ausbildungsquote sowie die regionale Innovativität in Bezug auf Patente. Weiterführende Analysen berücksichtigen zudem räumliche Wechselwirkungen und potenzielle Ausstrahlungseffekte auf benachbarte Kreise und verdeutlichen, dass die Wirkung der Hidden Champions nicht auf ihren jeweiligen Standort beschränkt ist, sondern über regionale Grenzen hinausgeht.

Die Ergebnisse dieser Dissertation liefern wichtige Forschungsbeiträge und bieten zahlreiche Implikationen für die Praxis. Dem zweiteiligen Aufbau dieser Dissertation entsprechend, leisten die in den Kapiteln 2 bis 5 vorgestellten Studien wertvolle Beiträge zum wachsenden Forschungsfeld der digitalen Transformation mittelständischer Unternehmen und ergänzen die bis dato knappe wissenschaftliche Literatur zu Hidden Champions. Kapitel 2 und 3 erweitern bestehende Kenntnisse über die Rolle von dynamischen Fähigkeiten und

Eigentümerverhältnissen als wichtige Einflussfaktoren der digitalen Transformation mittelständischer Unternehmen. Kapitel 4 und 5 hingegen liefern quantitative empirische Belege für den wirtschaftlichen Erfolg sowie den regionalen Einfluss der Hidden Champions. Indem gezeigt wird, dass die Strategie der Hidden Champions zu finanzieller Überlegenheit führt und somit auch die wirtschaftliche Entwicklung ganzer Regionen vorantreibt, trägt der zweite Teil dieser Dissertation zu einem besseren Verständnis des Hidden Champion Phänomens sowohl auf Unternehmens- als auch auf Kreisebene bei. Die vorliegende Dissertation liefert demzufolge wichtige praktische Implikationen für unternehmerische sowie auch politische Entscheidungsträgerinnen und Entscheidungsträger. Die Implikationen der Ergebnisse, bestehende Limitationen und mögliche Ansätze für zukünftige Forschungsvorhaben werden in Kapitel 6 näher beschrieben.

Executive Summary

The German *Mittelstand* is closely linked to the success of the German economy. Mittelstand firms, thereof numerous *Hidden Champions*, significantly contribute to Germany's economic performance, innovation, and export strength. However, the advancing digitalization poses complex challenges for Mittelstand firms. To benefit from the manifold opportunities offered by digital technologies and to defend or even expand existing market positions, Mittelstand firms must transform themselves and their business models. This dissertation uses quantitative methods and contributes to a deeper understanding of the distinct needs and influencing factors of the digital transformation of Mittelstand firms. The results of the empirical analyses of a unique database of 525 mid-sized German manufacturing firms, comprising both firm-related information and survey data, show that organizational capabilities and characteristics significantly influence the digital transformation of Mittelstand firms. The results support the assumption that dynamic capabilities promote the digital transformation of such firms and underline the important role of ownership structure, especially regarding family influence, for the digital transformation of the business model and the pursuit of growth goals with digitalization. In addition to the digital transformation of German Mittelstand firms, this dissertation examines the economic success and regional impact of Hidden Champions and hence, contributes to a better understanding of the Hidden Champion phenomenon. Using quantitative methods, it can be empirically proven that Hidden Champions outperform other mid-sized firms in financial terms and promote regional development. Consequently, the results of this dissertation provide valuable research contributions and offer various practical implications for firm managers and owners as well as policy makers.

Chapter 1

Introduction

The introduction of this dissertation proceeds as follows: Section 1.1 presents the motivation of this thesis and its relation to prior research. Section 1.2 outlines the research questions explored in the following chapters, and Section 1.3 describes the structure of this thesis.

1.1 Motivation

> *"The myriad companies in its Mittelstand could remain the bedrock of Germany's economic strength if they embraced the digital challenge."* (The Economist, 2022)

In the wake of the ongoing war in Ukraine, in August 2022 the British newspaper *The Economist* headlined "Thanks to Vladimir Putin, Germany has woken up". The article argues that the war presents a remarkable opportunity for Germany to become the leader of a more united Europe through reforms in security and energy policy. However, it is above all Germany's strong *Mittelstand* that needs to master current challenges, such as the advancing digitalization, to preserve Germany's economic strength and lay the foundation for resilience and leadership. But what constitutes German Mittelstand firms and how do they approach the digital transformation?

Mittelstand firms can be classified based on three criteria: firm size, owner-management, and a sense of belonging to the Mittelstand (Pahnke et al., 2023). While firm size refers to quantitative metrics, the remaining criteria distinguish Mittelstand firms from other firms in qualitative terms. Applying a quantitative criterion, Mittelstand firms include both small and medium-sized enterprises (SMEs) (Institut für Mittelstandsforschung (IfM) Bonn, 2016) and midcaps (Röhl, 2018). When applying qualitative criteria, however, Mittelstand firms are characterized by the unity of ownership and management which is why most of them are family firms and thus share typical characteristics, including long-term orientation, regional embeddedness, and flat hierarchies (e.g., Berghoff, 2006; Block & Spiegel, 2013). Furthermore, many large family firms, such as *Henkel* or *Bosch*, consider themselves part of the Mittelstand, leading to the term 'Mittelstand by perception' or identity (Pahnke & Welter, 2019).

Ever since, Mittelstand firms have been closely linked to the success of the German economy (e.g., Kayser & Wallau, 2002; Muzyka et al., 1997). Their relevance becomes particularly evident when looking at economic key figures.[1] In 2020, Mittelstand firms accounted for 99.3% of all businesses in Germany and generated around 34% of total revenues. Moreover, they produced 16.8% of Germany's export revenues and were responsible for 60.1% of the total net value added. Besides their economic impact, Mittelstand firms represent important employers and significantly contribute to the development of innovations and technological progress. In this regard, the role of the so-called *Hidden Champions* (HCs) is of

[1] Key figures for the German Mittelstand refer to the year 2020 and are based on the IfM Bonn (2023a).

particular interest. Defined as (world) market leaders in niche markets, HCs are an important part of the German Mittelstand.

While Mittelstand firms have been quite successful in the last decades (i.e., they have overcome the Great Recession of the years 2008/2009 and used globalization for further growth; Berlemann et al., 2022), they have recently faced enormous, hitherto unprecedented challenges. In particular, the COVID-19 pandemic and the Russia-Ukraine war have had far-reaching consequences for society, politics, and the economy, leading, for example, to disrupted supply chains, increased energy costs, and persistent price increases. *Digitalization*, generally referred to as the use of digital technologies (e.g., Verhoef et al., 2021), represents one of the greatest challenges currently faced by Mittelstand firms, and at the same time one of the most promising opportunities for future success (e.g., Soluk & Kammerlander, 2021). As combinations of information, computing, communication, and connectivity technologies (Bharadway et al., 2013), digital technologies are unique in terms of their re-programmability, homogeneity of data, and self-referential nature, and thus substantially differ from traditional information technologies (e.g., Yoo et al., 2010). Consequently, digital technologies not only change the production and supply chain processes of a firm and thereby affect its cost structure but also lead to entirely new opportunities for value creation (e.g., Kreuzer et al., 2022; Steininger et al., 2022a) and value capture (e.g., Nambisan et al., 2019; Teece & Linden, 2017). However, to seize such opportunities and benefit from digital technologies, firms need to adapt and transform their business models (e.g., Berman, 2012; Rachinger et al., 2019). Although digital technologies are an important driver of organizational transformation (Besson & Rowe, 2012), firms face numerous challenges, such as new demands on managerial and organizational capabilities (Nadkarni & Prügl, 2021).

Mittelstand firms face specific challenges when it comes to digital transformation. Compared to large corporations, Mittelstand firms lack financial and human resources which, for example, limits their ability to invest in new technologies and develop radical innovations (e.g., De Massis et al., 2018). In addition to size-related constraints, Mittelstand firms may struggle to transform due to the involvement of family members in the business. In particular, they may be confronted with intergenerational conflicts (König et al., 2013), resistance to change (Batt et al., 2020), and higher risk aversion (e.g., Gómez-Mejia et al., 2007; Naldi et al., 2007). Accordingly, Mittelstand firms appear reluctant to place strategic emphasis on venturing outside the firm's boundaries regarding digital transformation (i.e., via alliances with start-ups; Prügl & Spitzley, 2021). In fact, both observations from business practice and prior research indicate that digital technologies are far from being used in all Mittelstand firms, let alone

exploiting their enormous potential. While some Mittelstand firms seem to master digital transformation despite limited resources and deep roots in traditional industries, most of them lag ominously behind (e.g., de Groote et al., 2023; IfM Bonn, 2022; Süddeutsche Zeitung, 2022). Given the large number and economic relevance of Mittelstand firms in Germany, however, this is astonishing. But what are the reasons for the reluctance of the German Mittelstand to embrace digital transformation? And even more importantly, how can Mittelstand firms overcome these challenges to seize arising entrepreneurial opportunities and stay competitive in the digital era?

Surprisingly, the research on the digital transformation of Mittelstand firms is still in its infancy. The few existing studies have mainly adopted a capabilities perspective, examining which organizational competences and skills are required for digital transformation. Although *dynamic capabilities* have already been identified as an important driving force of digital transformation (e.g., Soluk & Kammerlander, 2021; Witschel et al., 2022), we lack evidence for the role of organizational characteristics, such as ownership structure. From strategic management literature, however, we know that important interactions between organizational characteristics and a firm's capabilities (e.g., Schilke et al., 2018) as well as its goals and strategies (e.g., Thomsen & Pedersen, 2000) exist. Therefore, it can be assumed that organizational characteristics also affect the digital agendas of firms and their actual transformation activities. Besides the need for further research on the digital transformation of the German Mittelstand, little is known about those Mittelstand firms leading the way, the HCs. Although the HC phenomenon has received considerable interest in practice, only few academic studies on this issue exist. Prior research has investigated the characteristics of HCs and their firm strategies (e.g., Audretsch et al., 2020; Rammer & Spielkamp, 2015). Yet, so far, we lack empirical insights on the economic success and regional impact of HCs.

Given the high practical relevance and growing academic interest in the German Mittelstand and its many HCs, this dissertation sheds light on how Mittelstand firms approach digital transformation and contributes to a better understanding of the HC phenomenon.

1.2 Research questions

1.2.1 Digital transformation of Mittelstand firms (Chapters 2 and 3)

First, this dissertation relates to the emerging field of research on the digital transformation of Mittelstand firms. As outlined in the previous section, scholars are particularly interested in the role of organizational characteristics, such as ownership structure. Nevertheless, little is known about the effects of family and/or founder ownership on digital transformation and how they are linked to organizational capabilities and goals in this context. This dissertation aims to contribute to existing literature by answering two research questions that address yet unexplored aspects of the digital transformation of Mittelstand firms.

Dynamic capabilities refer to a firm's ability to successfully adapt to changing environmental conditions (e.g., Teece et al., 1997) and are therefore considered an important driving force of digital transformation. Indeed, research has shown that dynamic capabilities promote digital transformation, especially in terms of business model innovation (e.g., Soluk & Kammerlander, 2021; Witschel et al., 2022). Yet, so far, we lack evidence about the conditions or influence factors that strengthen or hinder the effect of dynamic capabilities as a driver of digital transformation at the organizational level. In particular, little is known about how firm ownership interacts with dynamic capabilities in the transformation of a firm's business model. Although initial research by Soluk et al. (2021a) suggests specific dynamic capabilities to mediate the relationship between family ownership and digital business model innovation, it deviates from the original dynamic capabilities dimensions (e.g., Teece, 2007) and neglects possible interactions between organizational characteristics and capabilities. This thesis therefore aims to reduce this gap and extend existing research by focusing on family and founder ownership as organizational factors and investigating their interaction effects with dynamic capabilities in the digital transformation of the business model. Chapter 2 thus addresses the following research question:

RQ 1: *How do dynamic capabilities influence the digital transformation of the business model, and how is this relationship affected by family and founder ownership?*

Apart from interactions between organizational characteristics and capabilities, strategic management literature links ownership structure to organizational goals and strategies (e.g., Thomsen & Pedersen, 2000). Specifically, family-owned firms are often associated with a clear tendency towards efficiency goals, as research links them to increased risk-aversion (e.g., Naldi et al., 2007), incremental innovation (e.g., Bergfeld & Weber, 2001; Nieto et al., 2015), and

conservative harvest strategies (e.g., Le Breton-Miller & Miller, 2008). To exploit new opportunities for value creation and capture, however, firms need to use digital technologies for organizational growth rather than operational efficiency. Although it seems likely that family ownership hinders the pursuit of growth goals, surprisingly, we lack evidence in the context of digitalization. Apart from possible differences between family and non-family-owned firms in general, little is known about the role of the owners of family firms in particular. To reduce this gap, Chapter 3 deals with the following research question:

RQ 2: *How do family-owned firms and the socioemotional characteristics of family owners influence the use of digitalization to pursue growth goals?*

1.2.2 Economic success and regional impact of Hidden Champions (Chapters 4 and 5)

In addition to the field of research on the digital transformation of Mittelstand firms, this dissertation adds to the small and emerging stream of HC literature. Although HCs are an important part of the German Mittelstand and have received much interest in practice, academic research on the topic is scarce. So far, research has focused on the characteristics of HCs and their firm strategies (e.g., Audretsch et al., 2018). However, we lack quantitative empirical evidence of their economic success and regional impact. Therefore, this dissertation aims to enhance existing knowledge on the HC phenomenon by answering two research questions that address the financial performance of HCs relative to other Mittelstand firms as well as their regional economic significance.

HCs make considerable contributions to the performance of the German economy (e.g., Lehmann et al., 2019). Contemporary research, however, lacks evidence of the superiority of HCs at the firm level. Specifically, quantitative empirical insights on the financial performance of HCs relative to other firms are missing. Although anecdotal evidence from the media (e.g., BBC, 2017; The Economist, 2012) and popular sciences (e.g., Langenscheidt & Venohr, 2014; Simon, 2012; Venohr & Meyer, 2007) suggests that HCs outperform other firms, no study has quantified these differences in economic and statistical terms. Consequently, Chapter 4 aims to close this gap and investigates the profitability of HCs compared to other firms, thus addressing the following research question:

RQ 3: *When and to what extent do HCs outperform other Mittelstand firms?*

Besides their performance relative to other firms, little is known about the role of HCs at the regional level. HCs are regionally connected and not only located in agglomerated but also peripheral areas (e.g., Audretsch et al., 2008; Lang et al., 2019). Due to the different

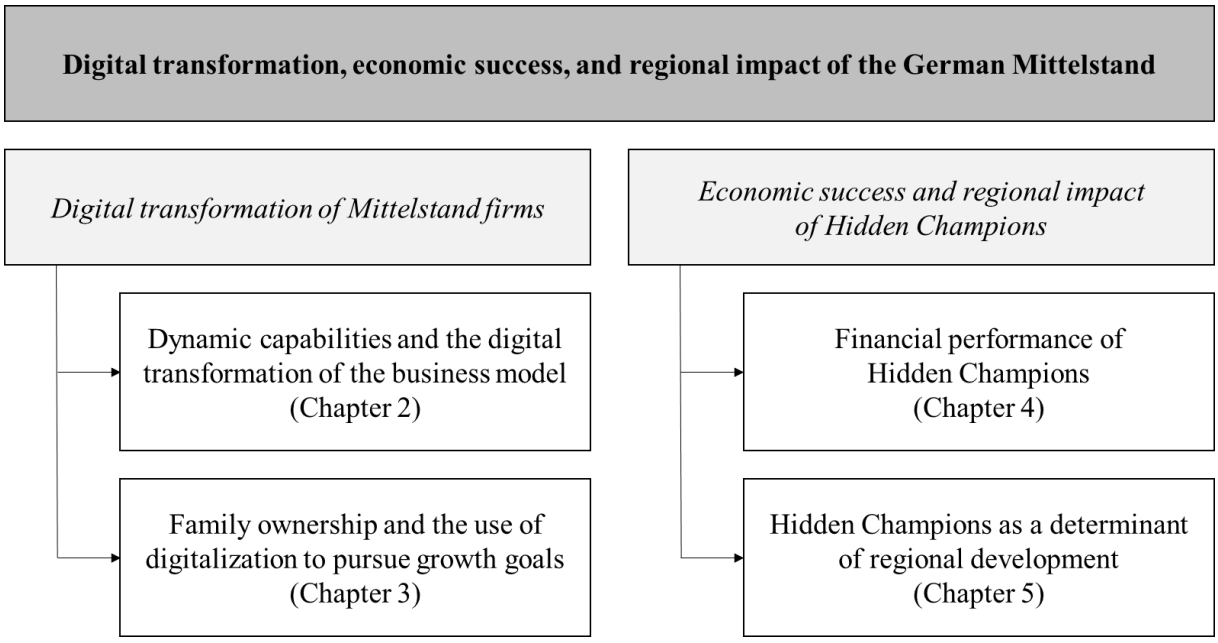
characteristics of HCs, it is important to learn about their influence at the district level and uncover how they affect regional development dimensions, such as performance, employment, or innovation. Given their export strength, regional embeddedness, and strong vertical integration, it is assumed that HCs significantly affect regional development. Although a few studies have examined related firm types, such as family or Mittelstand firms, and their impact on different regional development dimensions (e.g., Block & Spiegel, 2013; Memili et al., 2015), so far, no study has distinguished HCs from them and analyzed HCs separately at the regional level. Accordingly, research lacks empirical evidence on how HCs contribute to regional development. To address this gap, Chapter 5 answers the following research question:

RQ 4: *What impact does regional HC intensity have on regional development?*

1.3 Structure of the dissertation

This dissertation consists of six chapters and discusses four quantitative empirical studies. Two of these studies (Chapters 2 and 3) investigate the digital transformation of Mittelstand firms, while the other two studies (Chapters 4 and 5) relate to the economic success and regional impact of HCs. *Figure 1.1* provides an overview of the structure of this dissertation.

Figure 1.1: Structure of the dissertation



Source: Own illustration.

Chapter 2 addresses the question of how dynamic capabilities influence the digital transformation of the business model, and how this relationship is affected by family and founder ownership. Based on a concise review of existing academic literature on the digital

transformation of family and founder firms, Chapter 2 uses the theoretical lens of dynamic capabilities (e.g., Teece et al., 1997) to develop three hypotheses. It is assumed that family and founder ownership as organizational factors interact with dynamic capabilities in the transformation of a firm's business model. To test the hypotheses and answer the research question, Chapter 2 examines a sample of 525 mid-sized German manufacturing firms with varying levels of family and founder ownership and combines firm-related information from the Bureau van Dijk (BvD) database *Orbis* with unique survey data. The results of the empirical analyses show that dynamic capabilities facilitate the digital transformation of the business model, which is in line with prior research findings (e.g., Witschel et al., 2019, 2022). Regarding the moderating effects of ownership structure, however, Chapter 2 reveals that the positive effect of dynamic capabilities on the digital transformation of the business model is significantly weakened by founder but not by family ownership. With this result, Chapter 2 contributes to a better understanding of how dynamic capabilities and firm ownership interact in the digital transformation of Mittelstand firms and their business models.

Chapter 3 investigates the relationship between family ownership and the pursuit of growth goals with digitalization. After a literature-led comparison of growth goals with efficiency goals in the context of digitalization, the particularities of family-owned firms in terms of goalsetting and strategic decision-making are described. In this regard, Chapter 3 refers to the concept of *socioemotional wealth* (SEW; Gómez-Mejia et al., 2007) and develops hypotheses for the effect of family ownership in general, as well as each of the three SEW dimensions (identification with the firm, emotional attachment, and renewal of family bonds through dynastic succession; Gerken et al., 2022; Hauck et al., 2016) in particular, on the pursuit of growth goals with digitalization. Chapter 3, in turn, goes beyond the firm level and additionally considers the owners of family firms. The results of the empirical analyses of a dataset of 525 mid-sized German manufacturing firms show that family ownership reduces the importance of growth goals with digitalization. Family firms indeed seem to be less likely to use digital technologies to pursue a growth agenda, at least compared to non-family firms. However, strong emotional attachment of family owners is positively related to the pursuit of growth goals with digitalization and can thus help family firms overcome growth barriers.

While Chapters 2 and 3 deal with the digital transformation of Mittelstand firms, **Chapter 4** focuses on a particular subgroup of the German Mittelstand, the HCs, and examines their economic success at the firm level. Specifically, Chapter 4 analyzes the financial performance of HCs relative to other mid-sized firms, thus addressing the question of when and to what extent HCs outperform. Accordingly, the German Mittelstand and its characteristics as

well as the HC phenomenon form the theoretical background of the study. Using a panel dataset of 4,677 German manufacturing firms, of which 617 are HCs, results of the empirical analyses show that HCs have significantly higher profitability regarding *return on assets* (ROA) but less so regarding *return on equity* (ROE). The HC performance effect on ROA is valued at 1.7 percentage points. Interestingly, the HC performance effect decreases with firm size and disappears for firms with more than 900 employees. Apart from financial performance, HCs are compared to non-HCs regarding the typical characteristics attributed to HCs, namely, above-average export ratios, pronounced innovation activities, and healthy capital structures.

In contrast to Chapter 4, **Chapter 5** analyzes the economic significance of HCs at the regional level. Based on a comprehensive literature review, Chapter 5 investigates the impact of *HC intensity*, the number of HCs per 100,000 inhabitants per district, on a variety of regional development dimensions. Analyzing a German dataset of 1,645 HCs located in 401 German districts regarding seven different indicators of regional development provides valuable insights on how HC intensity affects regional economic performance, regional employment, and regional innovation. Results indicate that HCs are not equally distributed across regions and influence regional development. Regions with a higher number of HCs show strong regional economic performance in terms of median income. Moreover, HC intensity affects regional unemployment and trainee rates as well as regional innovation in terms of patents. Further analyses consider spatial interactions and potential spillover effects (i.e., changes in the above-mentioned regional development dimensions in neighboring districts), revealing that the effect of HCs is indeed not limited to their respective location but spreads beyond district borders which has important implications for regional policy makers.

Finally, **Chapter 6** summarizes the main results of each chapter. Furthermore, Chapter 6 discusses implications for theory and practice, names limitations of this thesis, and derives recommendations for future research.

Chapter 2

Dynamic capabilities and the digital transformation of the business model: The role of family and founder firms

Digital technologies enable new opportunities for value creation and capture. However, to seize such opportunities, firms often need to transform and change their business model. Dynamic capabilities are considered an important driver of digital transformation. Yet, we lack evidence on the conditions under which dynamic capabilities influence the digital transformation of the business model. Our study introduces family and founder ownership as two important factors that influence the relationship between dynamic capabilities and the digital transformation of the business model. Analyzing a dataset of 525 German manufacturing firms, we find that dynamic capabilities indeed boost the digital transformation of the business model. This positive effect is significantly weakened by founder but not by family ownership. Our study contributes to the literature on the digital transformation of the business models through a better understanding of how dynamic capabilities and firm ownership interact in the transformation.

2.1 Introduction

Digital technologies are an important and constant driver for change in the economy and society. As combinations of information, computing, communication, and connectivity technologies (Bharadway et al., 2013) they do not only change a firm's cost structure and production and supply chain processes but open up entirely new opportunities for value creation (e.g., Kreuzer et al., 2022; Steininger et al., 2022a) and value capture (e.g., Nambisan et al., 2019; Teece & Linden, 2017). Yet to seize such opportunities and benefit from digital technologies, firms often need to adapt and transform their business models (e.g., Berman, 2012; Rachinger et al., 2019; Zott & Amit, 2017). Such an adaptation and transformation are difficult and impose high demands on organizational and managerial capabilities (Nadkarni & Prügl, 2021). In this regard, dynamic capabilities play an important role (e.g., Li et al., 2017; Yeow et al., 2018). Defined as a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997, p. 516), they put firms into the position to identify and exploit arising entrepreneurial opportunities (e.g., Daniel & Wilson, 2003; Teece et al., 1997) and to adapt their business models accordingly (e.g., Heider et al., 2021; Witschel et al., 2019, 2022). Prior research has shown that dynamic capabilities promote the digital transformation of products, services, and business models (e.g., Soluk & Kammerlander, 2021; Witschel et al., 2022).

Yet, so far, we lack evidence about the conditions or influence factors that strengthen or hinder the effect of dynamic capabilities as a driver of digital transformation. From dynamic capabilities research we know that the effects of dynamic capabilities should not be regarded in isolation (e.g., Schilke et al., 2018) but that important interactions with other organizational characteristics and capabilities exist. Hence, it is likely that these interactions also exist with the effect of dynamic capabilities on the digital transformation of a firm's products, services, and business model. Our study aims to reduce this gap and introduces two important but so far neglected organizational factors into the literature on how dynamic capabilities influence the digital transformation. We focus on family and founder ownership as organizational factors[2] and investigate how they interact with dynamic capabilities in the transformation of a firm's business model. Our research question is: *How do dynamic capabilities influence the digital transformation of the business model, and how is this relationship affected by family and founder ownership?*

[2] In the following, we refer to family-owned firms as family firms for better comprehensibility and readability. Analogously, we refer to founder-owned firms as founder firms.

Family and founder-owned firms differ from other firms in that their owners are typically closely tied to the history and development of the firm and that they possess important intangible and sticky knowledge and information about the firm's processes, products, and customers (e.g., Sirmon & Hitt, 2003). We argue that this particularity of family and founders as firm owners has an impact on the organizational learning capabilities, reducing the effect of dynamic capabilities on digital transformation. We suggest that a substitutive relationship exists between dynamic capabilities as an organizational capability and family or founder ownership as an important organizational characteristic. To understand this interactive relationship better is important not only from a digital transformation and dynamic capabilities perspective but also from a perspective of family or founder firms. Family and founder firms often face particular challenges in transformation processes. Family firms, for example, may suffer from intergenerational conflicts (e.g., regarding technology adoption; König et al., 2013), resistance to change due to less external managers and experts (Batt et al., 2020) and long family chief executive officer (CEO) tenures, as well as higher risk aversion (Naldi et al., 2007) due to the dominance of non-economic goals (e.g., Gómez-Mejía et al., 2007). Founder firms, in turn, may be confronted with liabilities of newness and smallness, for example, including resource constraints or the lack of strategic networks (e.g., Powell & Baker, 2014; Zahra, 2021). Our study can help family and founder firms to better understand the factors that promote or hinder the digital transformation and thereby help to improve their competitiveness in dynamic markets and environments.

To answer our research questions, we use a dataset of 525 German Mittelstand manufacturing firms, of which 302 are family firms and 48 are founder firms. Our results show that dynamic capabilities are indeed positively related to the digital transformation of the business model. This positive effect is, however, significantly weakened by founder ownership, but not by family ownership.

Our study contributes to three strands of literature. First, this work contributes to a better understanding of dynamic capabilities (e.g., Eisenhardt & Martin, 2000; Teece et al., 1997) and shows that they can indeed boost digital transformation. Specifically, we provide valuable insights on the consequences of dynamic capabilities for digital business model transformation as well as relevant organizational moderators of the effects of dynamic capabilities (e.g., Schilke et al., 2018). Second, our study contributes to the ongoing debate in the literature on the differences between family and founder ownership and how they affect strategic behavior and capabilities development (e.g., Le Breton-Miller & Miller, 2008). Our results contribute to this discussion by indicating that founder firms are less dependent on dynamic capabilities to

master digital transformation, at least compared to family firms. Finally, with this result, we also add to the literature on the digital transformation of family-owned firms (e.g., Ceipek et al., 2021; Soluk et al., 2021a).

2.2 Digital transformation of family and founder firms

Our study relates to the emerging literature stream on the digital transformation of family and founder firms. Given their overall peculiarities and economic relevance, interest in the digital transformation of such firms has increased rapidly in both theory and practice. Indeed, a growing body of literature investigates how family ownership affects firms' digitalization efforts, offering mixed results. On the one hand, family firms struggle to embrace digital transformation as they show, for example, a lower application of digital technologies (Batt et al., 2020) and tend to follow a pragmatic-incremental, rather reactive approach (Bouncken & Schmitt, 2022). On the other hand, family firm idiosyncrasies (i.e., long-run mindset, community embeddedness; De Massis et al., 2013, 2018) lead to potential advantages for digital transformation. In particular, family firms can use their unique resources and strong relationships with employees and external partners to cope with technological change (de Groote et al., 2021, 2023). Moreover, a few studies examine the digital transformation of family firms in the context of the COVID-19 pandemic, revealing that exogenous shocks can cause both cultural and behavioral changes in family firms and foster the utilization of digital technologies (Kraus et al., 2020; Soluk et al., 2021b; Soluk, 2022).

Surprisingly, research on the digital transformation of the business model in family and founder firms is still very limited, and the few results obtained vary substantially. Existing studies focus on the question of what it takes to transform in a digital way for such firms. Besides a digital mindset (Rashid & Ratten, 2020) and families' willingness to transform (Heider et al., 2022a), digital transformation increasingly requires activities located outside firm boundaries, such as start-up alliances (Prügl & Spitzley, 2021; de Groote et al., 2023). Furthermore, dynamic capabilities are considered an important prerequisite for digital transformation. Following Soluk and Kammerlander (2021), the digital transformation of family-owned Mittelstand firms is a process consisting of three stages,[3] including several operational and dynamic capabilities. Representing the most advanced stage of this process, digital business model transformation is accompanied by dynamic capabilities enabling the creation of holistic digital solutions and the continuous renewal of the firm. Accordingly, Soluk

[3] Soluk and Kammerlander (2021) differentiate between process digitalization, product and service digitalization, and business model digitalization.

et al. (2021a) find specific dynamic capabilities to mediate the positive relationship between family ownership and digital business model innovation. Similarly, Cucculelli et al. (2022) examine the relationship between family influence and innovating a firm's business model towards integrating *industry 4.0*. Results show that family influence is positively related to the adoption of digital business models only in terms of family ownership. By contrast, family management even lowers the likelihood of adopting a digital business model. In a similar vein, focusing on the development of exploratory *Internet of Things* innovations, Ceipek et al. (2021) also finds family management to be negatively related to firms' digital innovation output. Given the lack of empirical evidence on what drives the digital transformation of family and founder firms, our study aims to enrich prior research and provide quantitative results on the relationship between dynamic capabilities and the digital transformation of the business model.

2.3 Theory and hypotheses

2.3.1 Dynamic capabilities

To develop our hypotheses, we use the theoretical lens of dynamic capabilities. The concept of dynamic capabilities was introduced by Teece et al. (1997) as an extension of the *resource-based view* to dynamic markets (Helfat & Peteraf, 2003). At its core, dynamic capabilities aim to explain why some firms outperform others under changing environmental conditions. Eisenhardt and Martin (2000, p. 1107) refer to dynamic capabilities as the "organizational and strategic routines by which firms achieve new resource configurations". Similarly, Teece et al. (1997) define dynamic capabilities as a firm's ability to successfully adapt to rapidly changing environments, enabling the identification and exploitation of entrepreneurial opportunities. Dynamic capabilities are conceptualized as three enterprise level capabilities: *Sensing* new opportunities (and threats), *Seizing* opportunities, and *Reconfiguring* their organizations (e.g., Teece, 2007). These higher-level capabilities embedded in the firms' skills, processes, and structures facilitate continued renewal of firms' intangible assets and are thus considered a source of sustained competitive advantage.

Although existing typologies may differ, scholars agree that capabilities occur at different levels, assuming a hierarchical order (e.g., Ambrosini et al., 2009). At a higher level of abstraction, research differentiates between so-called first- and second-order dynamic capabilities (Schilke, 2014). *First-order dynamic capabilities* refer to routines that reconfigure the organizational resource base, including new product development (NPD) or innovation-related activities, such as research and development (R&D). *Second-order dynamic*

capabilities, however, are those routines that reconfigure first-order dynamic capabilities, or in other words, enable the development and modification of first-order dynamic capabilities (e.g., adaptations to NPD). Research suggests learning and knowledge management to guide the development, evolution, and use of dynamic capabilities (Eisenhardt & Martin, 2000). Accordingly, organizational learning routines are considered a particularly relevant type of second-order dynamic capabilities. Zollo and Winter (2002), for example, investigate the mechanisms through which organizations develop dynamic capabilities, addressing the role of experience accumulation as well as knowledge articulation and codification. They argue that (first-order) dynamic capabilities are shaped by the coevolution of these learning mechanisms. Interestingly, second-order dynamic capabilities not only shape first-order dynamic capabilities but also function as substitutes in affecting performance outcomes. Schilke (2014) examines how first- and second-order dynamic capabilities jointly affect performance and finds them to substitute rather than complement each other.

2.3.2 Dynamic capabilities and the digital transformation of the business model

Current research agrees that dynamic capabilities are an important driver of digital transformation, especially regarding business model innovation (Soluk & Kammerlander, 2021; Soluk et al., 2021a; Witschel et al., 2022). Since dynamic capabilities are conceptualized as three enterprise level capabilities, we apply this differentiated perspective to elaborate on the link between each capability and digital business model transformation. In particular, we refer to their microfoundations considering the particularities of digital technologies.

First, we argue that the capability to sense new opportunities (and threats) is an essential prerequisite for the digital transformation of the business model, as it allows firms to stay up to date with the current market situation and recognize disruptive trends early on. As digital information exchange and digital value creation have almost no limits in speed, scale, and scope, competition has become more global and increased in intensity (Verhoef et al., 2021). New digital technologies, such as artificial intelligence, cloud computing or platforms have disrupted markets as new entrants utilized their potentials to substitute analogue value creation pursued by industry incumbents (Vial, 2019). Furthermore, consumer behavior has changed, shifting purchases to online stores, increasing the importance of digital touchpoints, and enabling customer co-creation (e.g., by designing and customizing products; Verhoef et al., 2021). Hence, digital technologies not only lead to a higher number of competitors but a significant change in the way firms compete. Strong sensing capabilities, however, enable firms to better cope with technological change. In particular, systematically searching for market

information and monitoring the external environment (i.e., competitors) enables firms to identify new technologies at an early stage and develop a better understanding of changing customer needs (e.g., Teece, 2007, 2018). Second, firms must not only be capable of sensing new opportunities but also of seizing them. Seizing refers to the evaluation of relevant information and their translation into innovative solutions, thus requiring the efficient use of relevant resources and competences and deliberate investment decisions (e.g., Kump et al., 2019). Accordingly, strong seizing capabilities enable firms to quickly relate to external knowledge and decide on its usefulness and applicability. As a result, such firms can manage digital technologies appropriately, better assess new opportunities for value creation and capture, and estimate necessary adaptations to their business models.

Finally, and perhaps most importantly, firms must have sufficient reconfiguring capabilities to pursue arising opportunities and transform accordingly. While sensing and seizing capabilities are primarily needed to identify and evaluate opportunities, reconfiguring capabilities are needed for their actual exploitation, enabling necessary organizational changes. Reconfiguring capabilities initiate transformative actions, including restructuring measures, managerial and cultural adaptations, and the development of new competences (e.g., Teece, 2007, 2018). Strong reconfiguring capabilities, for example, promote the development of digital skills required for the implementation of new technologies, enabling firms to quickly react to changing market conditions and take advantage of digital potentials. Hence, reconfiguring capabilities enable external partnerships and collaborations (i.e., start-up alliances, ecosystems; e.g., Witschel et al., 2019) which increase firms' transformation skills and ultimately facilitate digital business model transformation. Given these reasons, in line with previous research, we assume dynamic capabilities to be positively related to the digital transformation of the business model.

H1: *Dynamic capabilities are positively related to the digital transformation of the business model.*

2.3.3 Founder ownership effects

To develop our hypotheses on the moderating effects of ownership structure, we refer to the substitutive relationship between first- and second-order dynamic capabilities (Schilke, 2014). Specifically, we expect firms with strong second-order dynamic capabilities, as exhibited by strong learning routines, to be less dependent on their first-order dynamic capabilities to transform their business model in a digital way.

To assimilate knowledge and learn, firms need to process new information appropriately (e.g., Nonaka, 1994). Following von Hippel's (1994) concept of *sticky information*, information processing heavily depends on information stickiness, which refers to the organizational actors who possess relevant information. Information stickiness therefore not only defines the locus of information but has important implications for the diffusion of information as well as the strategic behavior of firms. In particular, information stickiness affects organizational problem-solving and capabilities development, and thus also organizational learning routines. In founder firms, relevant information sticks with the founder(s) and therefore resides within a single person or a few unrelated individuals. As a result, organizational learning routines occur at the level of the founder(s) and substantially differ from other firms. We assume that founder ownership leads to particularly strong organizational learning routines which strengthen founder firms' digital transformation skills and reduce their need for first-order dynamic capabilities for several reasons.

First, founder ownership is associated with superior firm growth and performance. Research suggests founder firms to outperform other firms (Miller et al., 2007, 2011), linking them to both greater risk-taking (e.g., Le Breton-Miller & Miller, 2008) and innovativeness (Block, 2012; Block et al., 2013). Likewise, strong organizational learning routines are considered an important driver of innovation and technological progress (e.g., Lopez et al., 2005; Migdadi, 2019). Furthermore, founders follow an entrepreneurial logic, perceiving themselves as the "builder or creator" (Miller et al., 2011, p. 4) of the business. Since their main motivation is to build and grow a business (e.g., Le Breton-Miller & Miller, 2008), it can be assumed that founders acquire necessary expertise on their own and develop strong organizational learning routines, as well in the context of digital transformation. In line with this reasoning, research suggests founders to be closely connected to their business, know the history inside out, and typically refers to them as the main source of knowledge. In particular, their deep levels of business-related knowledge are believed to reduce decision-making uncertainties, providing them with the confidence needed to initiate change (Le Breton-Miller & Miller, 2008). Finally, founder firms' centricity on a single individual or a small team of founders enables them to be quicker and more independent in both problem-solving and decision-making. Most notably, neither information processing nor organizational learning routines are constrained by conflicts of interest with other stakeholders (i.e., non-financial interests of family members) in founder firms. Consequently, we expect founder firms to be less dependent on their first-order dynamic capabilities to master digital transformation, as they can rely on strong organizational learning routines. We therefore assume that the positive

relationship between dynamic capabilities and the digital transformation of the business model is weakened by founder ownership.

H2: *The relationship between dynamic capabilities and the digital transformation of the business model is weakened by founder ownership.*

2.3.4 Family ownership effects

In family firms, however, relevant information sticks with family members. As information processing and knowledge management thus happen at the level of the owning family and its members, family firms have distinctive organizational learning routines that differ significantly from those of other firms.

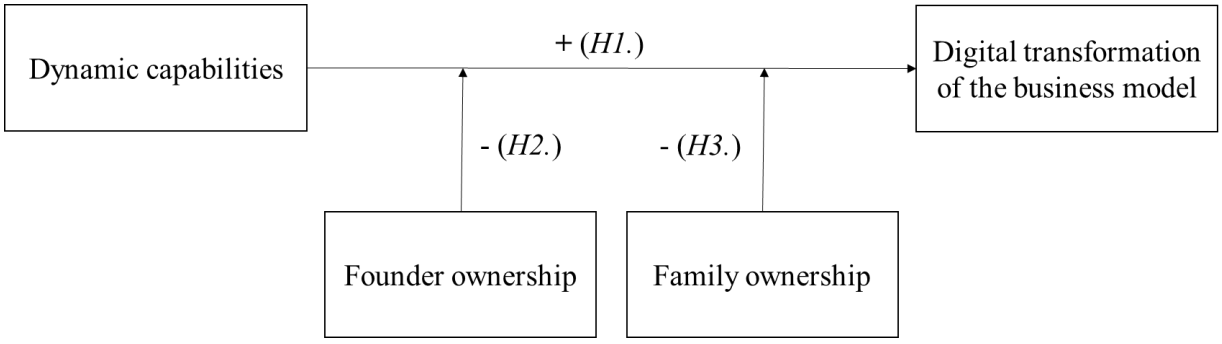
Family ownership shifts a firm's actions towards non-economic goals, subsumed under the SEW concept (e.g., Gómez-Mejía et al., 2011). Family firms are therefore associated with familial logics (i.e., as they may stress family interests even in a business context) and argued to be utility maximizers that pursue conservative harvest strategies (Le Breton-Miller & Miller, 2008). Accordingly, organizational learning routines are not just based on knowledge accumulation, integration, and codification (Zollo & Winter, 2002) but also on SEW preservation in family firms (e.g., Berrone et al., 2012; Gómez-Mejía et al., 2007). As family members are emotionally, economically, and socially attached to their business, they develop unique and difficult to replicate learning routines (Barros et al., 2016). Strong social ties, both inside and outside the firm, promote knowledge acquisition and sharing (e.g., Sirmon & Hitt, 2003; Yli-Renko et al., 2001; Zapata-Cantu et al., 2022). More precisely, the learning benefits that result from being family-owned, depend on family cohesiveness, the extent to which members of the owner family feel closeness, mutual solidarity, and the desire to stick together (Zahra, 2012). Transgenerational succession intentions strengthen the cohesion of family members leading to high levels of trust and proximity. Shared values and interests, common history as well as the use of private language further enhance communication between family members, facilitating information exchange and knowledge transfer (e.g., Chirico & Salvato, 2008). Consequently, family firms develop deep levels of firm-specific tacit knowledge which is accumulated and transferred over generations (Chirico & Nordqvist, 2010; Weimann et al., 2021). To overcome crises and transform their business, family firms can thus rely on unique organizational learning routines which we referred to as second-order dynamic capabilities. Given the substitutive relationship between first- and second-order dynamic capabilities, we expect family firms to also be less dependent on their first-order dynamic capabilities to master

digital transformation. We therefore assume family ownership to have a negative effect on the relationship between dynamic capabilities and the digital transformation of the business model.

H3: *The relationship between dynamic capabilities and the digital transformation of the business model is weakened by family ownership.*

Figure 2.1 shows our research model and thus gives an overview of our hypotheses.

Figure 2.1: Research model on the digital transformation of the business model



Source: Own illustration.

2.4 Data and method

2.4.1 Sample and data collection

To test our hypotheses, we used a unique database of German firms with varying levels of family and founder ownership. As no comparable database including information on the digital transformation of family and founder firms exists, we combined firm-related information from Orbis with survey data for a sample of German manufacturing firms. Given the large number and economic relevance of family-owned firms (e.g., De Massis et al., 2018), we chose Germany as our research context. Moreover, we focused on the manufacturing sector, which is home to many Mittelstand firms (Pahnke & Welter, 2019) and faces an increasing pressure to digitally transform (Jones et al., 2021). Established business models in manufacturing are increasingly at risk of being overtaken. However, the use of digital technologies can be particularly beneficial for manufacturing firms, following prior research (e.g., Björkdahl, 2020). Examples include the increasing relevance of *industry 4.0*, *servitization*, and *big data*. Growing competition and an increasing need to implement digital technologies therefore make the German manufacturing sector an ideal research context to study the relationship between dynamic capabilities and the digital transformation of the business model.

Sample

To generate a sample of mid-sized German manufacturing firms, we applied the following selection criteria using Orbis: (1) the firm was active as of September 2020; (2) it was located in Germany; (3) the firm operates in a research-intensive manufacturing sub-industry, thus following Gehrke et al. (2010), we selected firms with a primary industry classification according to NACE[4] codes 20 (chemicals and chemical products) to 30 (other transport equipment); (4) its number of employees was between 50 and 2,999;[5] (5) it was at least ten years old; and (6) it was not a subsidiary, foreign firm, non-profit firm or a public institution. Setting limits to firm age and employee number prevents including start-ups which reflects our focus on established, mid-sized firms (e.g., European Commission, 2003; IfM Bonn, 2016; Röhl, 2018). We in turn obtained a sample of 10,765 firms.

Data collection

For these firms, we collected several firm-specific key figures (e.g., information on financial and ownership structure) using Orbis. Additionally, primary data were collected via computer aided telephone interviews (CATI) with a questionnaire-based survey between October 2021 and March 2022. Trained professionals contacted the firms in our initial sample and targeted the firms' first or second management level, in particular managing directors and senior executives. For 52.3% of the firms an adequate respondent could be identified who was then contacted to ask for a personal interview based on our standardized questionnaire. This led to a final sample of 525 firms with varying levels of family and founder ownership, equalling a response rate of 9.3%, in line with comparable studies in family business literature (e.g., De Massis et al., 2021; Soluk et al., 2021a; Zellweger et al., 2012). We tested the representativeness of this sample for the industry distribution in our initial sample. Results of a Chi² test revealed no differences and showed that our final sample was indeed representative.

2.4.2 Measures

Besides variables that could be taken from secondary firm level data, we relied on pre-validated multi-item measures whenever available.

[4] NACE is the abbreviation for *nomenclature statistique des activités économiques dans la Communauté européenne* and refers to the statistical classification of economic activities in the European Union.

[5] The number of employees was within the specified range for at least one of the years 2017, 2018, and 2019.

Dependent variable

To capture the *digital transformation of the business model*, we asked the question "How digitalized is your business model?" in our survey. Respondents had to rate the actual digital transformation level of their firm's business model on a five-point scale (1 = not digitalized at all; 5 = fully digitalized).

Independent variable

To capture a firm's *dynamic capabilities* regarding the sensing, seizing, and transforming of business opportunities, we used 14 items based on Kump et al. (2019) (Cronbach's alpha (CA) = 0.88). Respondents had to rate the extent to which the individual statements applied to their firm on a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree).

Moderating variables

Founder ownership is a binary variable where one indicates a (lone) founder's involvement. Founder firms are defined as those in which at least one individual is one of the firm's founders with no other family members involved. Likewise, *family ownership* is a binary variable where one indicates involvement of the family. This means that either family members from second or later generation alone or together with the founder(s) hold shares of the firm. Firms where the founder is involved alongside other family members are categorized as family firms. Thus, in line with others, we consider family and founder ownership as mutually exclusive (e.g., Block et al., 2011, 2013; Jaskiewicz et al., 2017; Miller et al., 2007; Wang et al., 2023). A founder firm, by our definition, cannot be a family firm, nor vice versa. Both variables were manually coded based on ownership information available in Orbis. In total, 9.14% of the firms in our sample are founder firms and 57.52% are family firms.

Control variables

We control for several variables that were previously shown to determine digital transformation and/or business model innovation (e.g., Ceipek et al., 2021; Soluk et al., 2021a). First, we control for *firm age* which refers to the number of years since the founding of the firm. Second, the effect of *firm size* measured as the number of employees of the firm was controlled. Both firm age and size were collected from Orbis and logarithmized for multivariate analyses. Third, we controlled for the *innovativeness* of the firm. This variable refers to a binary variable equal to one if the firm owns patents. Patent information is taken from the worldwide patent statistical database *Patstat* of the European Patent Office (EPO). Finally, we also include dummy variables for German federal states and for two-digit NACE codes.

Table 2.1 provides an overview of the main variables used in our study. Additionally, *Table A2.1* in the appendix shows the variables that were collected with the survey and the corresponding questionnaire items.

Table 2.1: Description of all the variables used in the analyses

Variable	Description
Digital transformation of the business model	"How digitalized is your business model?" on a five-point scale from *1 = not digitalized at all* to *5 = fully digitalized*. Source: Survey
Dynamic capabilities	Average dynamic capabilities of the firm regarding sensing, seizing, and transforming capabilities, measured by 14 items on a five-point Likert-type scale (*1 = strongly disagree* to *5 = strongly agree*). Source: Survey
Founder ownership (d)	Equals one if founder(s) hold(s) shares, no relatives involved. Source: Orbis
Family ownership (d)	Equals one if family holds share, i.e., either family members from second or later generation alone or together with founder(s) hold shares. Source: Orbis
Firm age (log.)	Number of years since the founding of the firm (in 2022, logarithmized). Source: Orbis
Employees (log.)	Number of employees of the firm (in 2018, logarithmized). Source: Orbis
Patents (d)	Equals one if the firm owns patents, otherwise zero. Source: Patstat
Industry (d)	Equals one if the firm operates within the respective NACE primary code (20 to 30), otherwise zero. Source: Orbis
Federal state (d)	Equals one if the firm is located in the respective German federal state (*Bundesland*), otherwise zero. Source: Orbis

Notes: d = dummy variable(s); log. = logarithmized.

2.4.3 Assessment of survey biases

Non-response bias

We referred to different measures to check for potential sample biases. First, regarding non-response bias, we conducted several Chi² tests to compare the 525 firms that took part in our survey to 3,887 non-respondents. Results show that both groups do not differ in terms of industry distribution. Regarding further firm characteristics, including firm age and size, t-tests for the equality of means revealed no differences between respondents and non-respondents.

Late response bias

Next, we also checked for late response bias by comparing the 10% of the firms in our final sample that last participated in the survey (53 late respondents) with the remaining 90% (472 early respondents) regarding their responses to our dependent variable. Results of a Chi² test reveal no significant differences between early and late respondents regarding the digital transformation of the business model. Late response bias thus seems not to be an issue.

Common method bias

To reduce the risk of common method bias, we used different measures (e.g., MacKenzie & Podsakoff, 2012; Podsakoff et al., 2012). First, to obtain optimal respondent fit, only members of the firms' first or second management level were surveyed. We incentivized the participation in the survey by offering respondents an individual management summary for the firm and inviting them to a workshop about the survey results. Second, we assured participants that their data were only processed anonymously and used for scientific purposes. In this regard, we also guaranteed confidentiality, thus decreasing the risk of social desirability bias. Third, we ordered the questions in the survey in such a way that participants would not notice a direct link between the constructs. Fourth, we tried to mitigate the risk of common method bias by variating the measurement scales of the survey questions on which our variables are based. The correlation between the dependent variable (digital transformation of the business model) and the independent variable (dynamic capabilities) lies at 0.31 (see *Table 2.2*). Also, the moderator variables family ownership and founder ownership originate from another data source. Furthermore, we applied marker variable technique as we included two marker variables in our survey which we correlated with our independent variable (dynamic capabilities) afterwards.

Since we only find rather low correlations (-0.07 and 0.07), we can again rule out possible biases.[6]

2.4.4 Sample description

Comparison of family and founder firms

To examine whether family and founder firms in our sample significantly differ regarding certain characteristics, we report mean and median values, standard deviations, and t-tests for the equality of means and Wilcoxon rank-sum-tests for the equality of medians. For the digital transformation of the business model, we find almost identical mean and median values for family and founder firms. The digital transformation of the business model (on a five-point scale ranging from "1 = not digitalized at all" to "5 = fully digitalized") of founder firms lies at 2.74 (median: 3) versus 2.72 (median: 3) for family firms. Similarly, family and founder firms differ only marginally regarding dynamic capabilities. While the average level of dynamic capabilities of founder firms is 3.70 (median: 3.79), family firms score 3.55 (median: 3.58). Not surprisingly, differences between family and founder firms are neither significant for our dependent nor independent variable. *Table A2.2* of the appendix provides descriptive statistics for our main variables distinguishing between family and founder firms.

Industry distribution

Furthermore, we compare family and founder firms regarding their industry distribution (see *Table A2.3* of the appendix). Across all industries, family firms have an average share of 54.35% versus 9.57% for founder firms. Family firms are present in all industries, founder firms also except NACE 21 (pharmaceutical products and preparations). However, both family and founder firms are not distributed equally across industries. For example, the lowest share of family firms is found in NACE 21 (pharmaceutical products and preparations; 33.33%) whereas their largest share is found in NACE 30 (other transport equipment; 87.50%).

Regional distribution

Likewise, we consider the regional distribution of family and founder firms (see *Table A2.4* of the appendix). Across all German federal states, family firms have an average share of 53.77% versus 13.07% for founder firms. As for industries, both family and founder firms are not distributed equally across federal states. Family firms are present in all federal states except

[6] Marker variables refer to the impact of COVID-19 on the firm (measured on a five-point scale from 1 = "Our firm was not affected by the COVID-19 crisis at all" to 5 = "Our company was affected very strongly by the COVID-19 crisis") and assessing the significance of environmental concerns (on a five-point Likert-type scale from 1 = "strongly disagree" to 5 = "strongly agree").

Bremen, being particularly well represented in Hamburg and Thuringia (both 100%) as well as Rhineland-Palatinate (65.38%), and least in Saarland (16.67%). Similarly, founder firms are present in all states except the city states Bremen and Hamburg. The lowest share of founder firms is found in Hesse (4.88%) whereas their largest share is found in Mecklenburg-Western Pomerania (22.22%).

2.5 Results

2.5.1 Correlations

Table 2.2 presents the correlations among the variables included in our analyses. Overall, correlations are weak to moderate, ranging from -0.39 to 0.31. For example, there is a negative correlation between our two mutually exclusive ownership measures, founder ownership and family ownership (-0.39). Our focal variable dynamic capabilities, however, shows a moderate positive correlation with our dependent variable, the digital transformation of the business model (0.31). The variance inflation factors (VIFs) of our independent and control variables are relatively low, ranging from 1.02 (dynamic capabilities) to 1.21 (founder ownership). As the average VIF is 1.11, multicollinearity is unlikely to be a major concern.

Table 2.2: Correlations and VIFs

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**VIF**
(1) Digital transformation of the business model							
(2) Dynamic capabilities	0.31						1.02
(3) Founder ownership (d)	0.00	0.07					1.21
(4) Family ownership (d)	-0.03	-0.05	-0.39				1.19
(5) Firm age (log.)	0.06	0.03	-0.20	0.12			1.09
(6) Employees (log.)	0.05	0.12	-0.10	-0.06	0.21		1.11
(7) Patents (d)	-0.02	0.04	-0.02	-0.02	0.09	0.21	1.05

Notes: N = 492; VIF = variance inflation factor; d = dummy variable; log. = logarithmized.

2.5.2 Multivariate results

Direct effect

Our main analysis investigates the direct effect of dynamic capabilities on the digital transformation of the business model. We run an ordered logistic regression analysis for our sample of 525 German manufacturing firms, including family and founder firms. We find a statistically significant positive effect of dynamic capabilities on the digital transformation of the business model ($\beta = 1.02$, $p < 0.01$). Thus, dynamic capabilities indeed promote digital business model transformation which is in support of our first hypothesis. To conclude, stronger dynamic capabilities favor holistic digital transformation attempts, embodied by the business model.

Interaction effects

Next, we analyze whether and to what extent ownership structure affects the positive relationship between dynamic capabilities and the digital transformation of the business model. Specifically, we refer to the moderating effects of each family and founder ownership. Therefore, we calculate the interaction effects between founder (family) ownership and dynamic capabilities and perform separate ordered logistic regressions using the digital transformation of the business model as dependent variable. Regarding founder ownership, we find a statistically significant interaction effect ($\beta = -1.18$, $p < 0.01$). As the effect is negative, founder ownership significantly weakens the beneficial effect of dynamic capabilities on the digital transformation of the business model, thus supporting our second hypothesis. Regarding family ownership, however, we do not find a statistically significant interaction effect ($\beta = -0.22$, $p > 0.10$). Although family ownership rather weakens the beneficial effect of dynamic capabilities on digital business model transformation, this effect is not statistically significant. Thus, we reject our third hypothesis. To conclude, interaction analyses reveal clear differences regarding the effects of ownership structure on the positive relationship between dynamic capabilities and the digital transformation of the business model. While we find a significant negative effect of founder ownership, we find none for family ownership. *Table 2.3* summarizes our multivariate results, including the direct effect as well as the interaction effects, referring to family and founder ownership respectively.

Table 2.3: Ordered logistic regression results

Variables	**Digital transformation of the business model**		
	H1.	H2.	H3.
Dynamic capabilities	1.02***	1.16***	1.17***
	(0.15)	(0.16)	(0.25)
Founder ownership (d)	-0.06	4.38***	-
	(0.32)	(1.66)	
Family ownership (d)	-0.17	-	0.64
	(0.20)		(1.09)
Founder ownership (d) x Dynamic capabilities	-	-1.18***	-
		(0.45)	
Family ownership (d) x Dynamic capabilities	-	-	-0.22
			(0.30)
Firm age (log.)	0.19	0.17	0.20
	(0.15)	(0.15)	(0.14)
Employees (log.)	0.02	0.03	0.02
	(0.12)	(0.12)	(0.12)
Patents (d)	-0.20	-0.02	-0.21
	(0.18)	(0.18)	(0.18)
NACE (d)	Yes	Yes	Yes
Federal states (d)	Yes	Yes	Yes
Pseudo *R*-squared	0.06	0.06	0.06
Chi-square	74.94	81.22	75.46
Prob > *Chi*-square	0.0000	0.0000	0.0000
Akaike crit. (AIC)	1310.92	1304.644	1310.401
Bayesian crit. (BIC)	1453.66	1447.392	1453.149
Observations	492	492	492

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

2.5.3 Further analyses and robustness checks

In addition to our main analyses, we conduct several further analyses and robustness checks. As a first additional analysis, we perform the above-described ordered logistic regression for both family and founder firms individually. Besides subsample regressions, we also perform regressions using alternative digital transformation measures as dependent variables to test our first hypothesis. Accordingly, we refer to an alternative moderating variable at ownership level to test hypotheses 2 and 3. Finally, we test for the robustness of results by conducting mediation analyses, thus clarifying the interrelations between founder (family) ownership, dynamic capabilities, and the digital transformation of the business model.

Subsample regressions

The first subsample consists of founder firms only. Running ordered logistic regression for our founder firm sample, we do not find a statistically significant effect of dynamic capabilities and the digital transformation of the business model ($\beta = 0.94$, $p > 0.10$). Consequently, dynamic

capabilities do not promote digital business model transformation in founder firms. The second subsample, however, consists of family firms only. Again, we run ordered logistic regression to analyze the relationship between dynamic capabilities and the digital transformation of the business model. In contrast to the results for our founder firm sample, we find a statistically significant positive effect of dynamic capabilities on the digital transformation of the business model ($\beta = 1.07$, $p < 0.01$). This is in line with the results of our main analysis using our whole sample. Dynamic capabilities also promote the digital transformation of the business model in family firms. As we find dynamic capabilities to be relevant for digital business model transformation in family but not founder firms, results of our subsample regressions also support those of our interaction analyses. *Table A2.5* of the appendix shows the results of the subsample regressions.

Using alternative dependent variables

As another analysis, we perform our main analysis using alternative digital transformation measures as dependent variables. We refer to twelve different measures of digital transformation that were either collected directly by the survey[7] or aggregated from it.[8] We then run regressions, using each digital transformation measure as dependent variable in separate models. *Table A2.6* of the appendix provides an overview of the results using alternative digital transformation measures as dependent variables for our whole sample as well as our family and founder firm sample respectively. We find clear support for the facilitating effect of dynamic capabilities on digital transformation. Although effect sizes vary depending on the dependent variable used, we find statistically significant positive effects of dynamic capabilities on all digital transformation measures, particularly in case of our whole sample and the family firm sample. In case of our founder firm sample, significances are partly weaker or not present at all. However, effects of dynamic capabilities on firms' overall digital transformation level are statistically significant and positive for each of the samples used (All firms: $\beta = 0.40$, $p < 0.01$; Family firms: $\beta = 0.39$, $p < 0.01$; Founder firms: $\beta = 0.61$, $p < 0.05$). To sum up, the results using alternative digital transformation measures as dependent variables support those of our main analysis.

[7] Analogous question and scale used as for digital business model transformation.
[8] Aggregated digital transformation measures are indicated in *Table A2.6* and explained in its legend.

Using an alternative moderator

To further check our results for robustness and test whether the weakening moderation effect on the link between dynamic capabilities and digital transformation is indeed exclusively due to founder ownership, we conduct our interaction analysis using an alternative moderating variable at ownership level. Specifically, we refer to *later generation family ownership* as a binary variable equal to one if family members from the second or a later generation hold shares. This applies to 276 firms (52.57%) in our sample. In contrast, to family ownership we cut off first generation family members, thus separating family members even sharper from founders. In other words, we exclude founders from the family category. Using later generation family ownership as alternative moderating variable, we do not find a statistically significant interaction effect ($\beta = -0.10$, $p > 0.10$). This corresponds to our findings for family ownership and again indicates that the negative moderation effect can be attributed to founder ownership. *Table A2.7* of the appendix shows the results of our ordered logistic regression using later generation family ownership as moderating variable.

Mediation analyses

Next, we also performed mediation analyses to examine the relations between dynamic capabilities, founder (family) ownership, and the digital transformation of the business model from a different perspective and test whether our assumed moderation model indeed fits best. As some scholars find dynamic capabilities to mediate the positive relationship between family ownership and digital business model transformation (Soluk et al., 2021a), we use structural equation modelling to replicate their results. However, we do not find significant effects of family ownership on the digital transformation of the business model, neither directly ($\beta = -0.06$, $p > 0.10$) nor indirectly ($\beta = -0.03$, $p > 0.10$). The same applies to founder ownership. Based on our data, we find no evidence of a mediation effect as proposed in prior studies, and thus suggest that organizational factors, such as ownership structure, rather moderate the relationship between dynamic capabilities and the digital transformation of the business model. *Tables A2.8* and *A2.9* of the appendix summarize the results of the mediation analyses using either founder or family ownership.

2.6 Discussion

2.6.1 Summary of main results

The results of our empirical analyses support some of the earlier evidence on dynamic capabilities and their beneficial role for digital transformation (e.g., Witschel et al., 2019, 2022).

For example, our results show that dynamic capabilities facilitate the digital transformation of the business model. Firms with strong dynamic capabilities also have more digitalized business models. Regarding the moderating effects of ownership structure, our regressions show that founder ownership weakens the positive relationship between dynamic capabilities and digital business model transformation. In contrast, we do not find statistically significant interaction effects using family ownership. Moreover, our results point to possible intra-industry differences within the manufacturing sector which should be further addressed in future research. What do these results mean for theory and practice?

2.6.2 Implications for theory

Our study contributes to prior research on the determinants of digitalization and particularly work on the link between dynamic capabilities and digital business model transformation (e.g., Soluk et al., 2021a). The question of which capabilities facilitate digital transformation has been an integral part of digitalization literature ever since (e.g., Annarelli et al., 2021; Steininger et al., 2022b). Given their exceptional role for organizational change and superior performance, scholars were particularly interested in dynamic capabilities. As a result, research has identified dynamic capabilities relevant to digital transformation (e.g., Daniel & Wilson, 2003; Ellström et al., 2021; Warner & Wäger, 2019) and indicated their beneficial role for both digital capabilities development (e.g., Karimi & Walter, 2015; Konopik et al., 2022) and digital strategy alignment (e.g., Canhoto et al., 2021; Yeow et al., 2018). Although research has also demonstrated the importance of dynamic capabilities for business model innovation in the context of digitalization (e.g., Witschel et al., 2022), we are among the first to empirically analyze the effect of dynamic capabilities on the actual digital transformation level of the business model. Based on quantitative data, our results confirm that dynamic capabilities can facilitate the digital transformation of the business model and thus validate existing assumptions. In this way, we contribute to research on the relationship between organizational capabilities and digital transformation, suggesting dynamic capabilities as an important determinant of digital business model transformation.

In addition to contributing to the broader digitalization literature, our study contributes to a better understanding of contextual factors at the organizational level, namely, ownership structure. Separately analyzing how family and founder ownership affect the relationship between dynamic capabilities and the digital transformation of the business model, we extend research on the moderating role of ownership structure (e.g., Witschel et al., 2022). We answer the question of whether and to what extent both family and founder ownership influence the

positive effect of dynamic capabilities on digital business model transformation. While we find a significant negative interaction effect using founder ownership, we find none for family ownership. Our results indicate that (compared to family firms) founder firms are less dependent on dynamic capabilities to master digital transformation, thus corresponding to findings from research on the differences of family and founder firms (e.g., Jaskiewicz et al., 2017; Miller et al., 2007). Prior research suggests founder firms to outperform as they pursue growth strategies (e.g., Miller et al., 2007, 2011). Our study contributes to the controversy in literature about the differences between family and founder ownership and their implications for strategic behavior and capabilities development. We add valuable insights on how family and founder firms differ regarding the reliance on dynamic capabilities for digital business model transformation.

Consequently, our study also contributes to the emerging field of research on the digital transformation of family firms (e.g., Ceipek et al., 2021). Prior research has focused on the role of family ownership as potential facilitator or inhibitor of digital transformation, offering mixed results. Apart from that, research has dealt with the identification of relevant factors that influence the digital transformation of family firms, indicating that dynamic capabilities are crucial (e.g., Soluk & Kammerlander, 2021; Soluk et al., 2021a). Our results contribute to prior research on the link between dynamic capabilities and the digital transformation of family firms. As we do not find a significant interaction effect using family ownership and find significant positive effects of dynamic capabilities on a variety of different digital transformation measures using our family firm subsample, our results confirm the beneficial role of dynamic capabilities for the digital transformation of family firms. However, our results extend existing knowledge as they go beyond previous measurement approaches and relate the original dynamic capabilities dimensions (e.g., Teece, 2007) to the actual digital transformation level of the business model.

2.6.3 Implications for practice

The results of our study have practical implications for firm managers and owners in showing that dynamic capabilities can indeed boost the digital transformation of the business model. Strong dynamic capabilities seem to be an important enabler of digital business model transformation. Firms should emphasize building and continuously developing dynamic capabilities to take advantage of emerging opportunities and master digital transformation. However, the importance of dynamic capabilities for digital business model transformation seems to depend on ownership structure. While dynamic capabilities seem to be important for

the digital transformation of the business model in family firms, this seems not to be the case in founder firms. Since family and founder firms are an important part of the German Mittelstand, our study contributes to a better understanding of their success factors and capabilities-related differences in the context of digital transformation. Hence, our results should be interpreted with caution, depending on firm type and ownership structure. Similarly, firms should be aware of possible contextual factors, such as industry affiliation, which may lead to different digitalization dynamics and priorities. More research is needed to better understand why and under which conditions family and founder firms use digital technologies to change their value creation logic.

2.6.4 Limitations and future research directions

Our study has some limitations that offer promising directions for future research. First, our sample is limited to Germany and to the manufacturing sector. The German manufacturing sector is a strong, export-oriented industry dominated by Mittelstand firms (Bernard & Wagner, 1997). Our findings may not generalize to Mittelstand firms operating in industries that are less export-oriented, more business-to-consumer (B2C) focused or more service dominated. Furthermore, our sample does not cover the entire manufacturing sector but only a selected subset of mostly research-intensive industries. Accordingly, our findings may be transferable to non-research-intensive industries only to a limited extent. Future research could therefore investigate other countries or industries. Intra-industry differences might be of particular interest as our results give reason to believe that digital transformation pressure, and thus the need to change the business model using digital technologies, varies within the manufacturing sector. Follow-up studies could delve deeper into industry-specific drivers of digitalization and, for example, explore the reasons for this.

Second, apart from industry affiliation and location, we do not have any information about firms' environmental settings although considered to be important in the context of digitalization. Specifically, environmental dynamism refers to the "amount of uncertainty, complexity, and change emanating from the external environment" (Chirico & Baù, 2014, p. 212) and is therefore associated with the development of dynamic capabilities as well as the engagement in digital transformation (e.g., Soluk et al., 2021a). Since our study can be seen as a starting point for research on the digital transformation of family and founder firms and their determining factors, follow-up studies could further elaborate on the role of environmental settings. Moreover, future research could deepen our reasoning about learning routines as a substitute for (first-order) dynamic capabilities to achieve competitive advantage in the context

of digital transformation. For example, follow-up studies could collect data on organizational learning alongside dynamic capabilities and investigate its effect on digital business model transformation.

A third limitation concerns time lags between sampling and data collection. The criteria-based drawing of our initial sample of 10,765 mid-sized German manufacturing firms and the collection of firm-specific key figures took place in 2020, whereas the subsample of 525 firms was surveyed some months later. However, the implementation and unfolding of digital transformation projects, especially holistic ones tackling firms' value creation logic, takes some time, which makes time lags bearable and even quite reasonable. Finally, as with any cross-sectional study, we cannot claim causal effects. Nevertheless, we conducted a series of robustness checks to rule out possible alternative explanations. Future research could use longitudinal data to verify the validity and generalizability of our results.

Chapter 3

Family ownership and the use of digitalization to pursue growth goals

Digital technologies can be an important driver of organizational growth. However, often firms focus on achieving greater efficiency through digitalization rather than pursuing a growth agenda. Yet, we know little about which factors lead firms to pursue a growth agenda with digital technologies. This study introduces family ownership as a factor that influences the pursuit of growth goals with digitalization and investigates the role of different socioemotional characteristics at the owner level. Analyzing a dataset of 525 German manufacturing firms, we find that family ownership overall seems to reduce the importance of growth goals with digitalization. However, strong emotional attachment of family owners is shown to have a counteracting effect. Emotional attachment of owners seems to help family firms to overcome growth barriers and shows a positive relationship with the use of digitalization to pursue growth goals. Our study contributes to the literature on the digital transformation of family firms through a better understanding of how family ownership in general and socioemotional considerations of family owners in particular affect the pursuit of growth goals with digitalization.

3.1 Introduction

Digital technologies not only influence our everyday lives and society but transform economies worldwide and thus affect firms of all sizes and industries (e.g., Teece, 2018). As combinations of information, computing, communication, and connectivity technologies (Bharadway et al., 2013), digital technologies are unique in terms of their re-programmability, homogeneity of data, and self-referential nature, and therefore are different from many other technologies (e.g., Nambisan, 2017; Yoo et al., 2010). Digital technologies have the potential to fundamentally change how firms operate, changing existing production and supply chain processes with an impact on the firm's cost structure. However, digital technologies do not only have the potential to make a firm and its processes more efficient. They also open up entirely new opportunities for value creation (e.g., Kreuzer et al., 2022; Steininger et al., 2022a) and value capture (e.g., Nambisan et al., 2019; Teece & Linden, 2017) and thus offer firms hitherto untapped growth potentials (e.g., Björkdahl, 2020). For example, they enable firms to create new products and services, enter new markets and reach out to new customers, as well as to introduce new pricing and revenue models. By using digital technologies, firms can therefore grow along their value chain and innovate their business model accordingly (e.g., Bouncken et al., 2021).

Nevertheless, many firms, especially from manufacturing industries, largely ignore such opportunities as they use digital technologies primarily to increase efficiency rather than to achieve growth (e.g., Gebauer et al., 2020). This is surprising since the manufacturing sector faces an increasing pressure to digitally transform and is believed to benefit particularly from digital technologies (e.g., Jones et al., 2021). Björkdahl (2020, p. 24), in turn, stresses that "if manufacturing firms do not seize opportunities and do not transform themselves to embrace the growth opportunities offered by digitalization, they are likely to be outcompeted". Yet, so far, we lack empirical insights on the factors that promote or hinder the use of digital technologies to pursue a growth agenda. From prior research we know that organizational goals and the strategies firms pursue to achieve them are closely related to organizational characteristics, such as ownership structure (e.g., Thomsen & Pedersen, 2000). As a result, different types of firms have different goal sets, which also affect the likelihood of pursuing growth goals with digitalization. Family-owned firms are sometimes associated with a clear tendency towards efficiency goals as research links them to increased risk-aversion (e.g., Le Breton-Miller & Miller, 2008). Although it seems likely that family ownership hinders the pursuit of growth goals, surprisingly, we lack evidence in the context of digitalization. Given the economic relevance of family-owned firms and their overall particularities, our study aims to reduce this gap and addresses the following research question: *How do family-owned firms and the*

socioemotional characteristics of family owners influence the use of digitalization to pursue growth goals?

Family-owned firms differ from other firms in that they feature significant family influence (e.g., Chrisman & Patel, 2012). The influence of the family is typically reflected in the ownership structure of such firms, as family members hold shares (e.g., Anderson & Reeb, 2003; Miller et al., 2007). We argue that this particularity of family members as owners of the firm shapes organizational goals and, in turn, guides decision-making and risk-taking. More precisely, we suggest that family-owned firms pursue multiple goals and frame strategic decisions based on socioemotional considerations, leading to specific transformation challenges, and ultimately reducing the importance of growth goals with digitalization. However, to understand the relationship between family ownership and the pursuit of growth goals with digitalization, more detailed investigations are necessary which is why our study not only compares family with non-family-owned firms but additionally considers the socioemotional characteristics of the family firm owners. We believe that taking such a deep look at the socioemotional characteristics of the owners is necessary as family owners have been shown to be a very heterogenous group. Our study can support family firms to better understand the factors that promote or hinder the pursuit of growth goals with digitalization and thereby help to improve their competitiveness in dynamic markets and environments.

To answer our research question, we use a dataset of 525 German manufacturing firms, of which 350 are family-owned firms. We find that family ownership overall seems to reduce the importance of growth goals with digitalization. However, strong emotional attachment of family owners is shown to have a counteracting effect. Emotional attachment of owners seems to help family firms to overcome growth barriers and shows a positive relationship with the use of digitalization to pursue growth goals.

Our study contributes to prior research on the determinants of digital transformation. We add to a better understanding of which factors influence the pursuit of growth goals with digitalization (e.g., Björkdahl, 2020), taking a firm ownership perspective, which is so far lacking in this line of literature. Specifically, we provide valuable insights on the consequences of family ownership for the pursuit of growth goals with digitalization. In this way, our study also contributes to the literature on the differences between family and non-family firms and how these differences affect organizational goals (e.g., Williams Jr. et al., 2018). Our findings contribute to this discussion by indicating that family-owned firms overall seem to be less likely to use new technologies to pursue growth goals. However, our study also shows that a deeper

look at the socioemotional characteristics of the owners is necessary as emotional attachment by owners seems to counteract this overall effect. Finally, this study also adds to the growing literature on the digital transformation of family firms (e.g., Ceipek et al., 2021; Heider et al., 2022a; Soluk et al., 2021a). So far, the quantitative studies that exist in this literature have mostly seen digitalization as a goal in itself but have not investigated that digitalization can also be seen as a way and a tool to achieve overarching organizational goals that matter to family owners. This study can be seen as a first step in this direction.

3.2 Theoretical background

3.2.1 Growth through digitalization: What it means and what it takes

Observations from business practice show that firms often associate the benefits of digitalization with efficiency goals using digital technologies to make processes 'leaner' and realizing cost-saving potentials (e.g., Björkdahl, 2020). However, this is only one aspect of digital technologies. Firms can use digitalization to pursue growth goals exploiting new opportunities for value creation and capture leading to a sustainable competitive advantage. But what is meant by *growth through digitalization* and, even more importantly from a resource or capability perspective, what does it take?

Using digital technologies for achieving growth is significantly different from using digital technologies for achieving efficiency. While efficiency-oriented digitalization initiatives primarily aim at achieving excellence in specific functions, growth-oriented digitalization initiatives involve combining functions that require a good fit among internal activities across functions (Björkdahl, 2020). Such initiatives refer to, for example, the creation of new products or additional, often customized services (i.e., technical support, preventive maintenance). Research describes the shift towards the provision of integrated solutions enabled by digital technologies as *servitization* (e.g., Martín-Peña et al., 2020). Furthermore, firms can use digital technologies to enter new international markets (i.e., through digital sales channels) and to reach new customer segments (i.e., through digital communication channels). Growth through digitalization therefore goes far beyond the digitalization of individual processes and refers to the holistic use of digital technologies to exploit emerging entrepreneurial opportunities. Accordingly, growth through digitalization affects the entire value creation logic of a firm and is closely linked to business model innovation (e.g., Bouncken et al., 2021; Verhoef et al., 2021).

As a result, growth through digitalization places specific demands on firms and is more difficult to achieve than efficiency gains for several reasons.[9] First, growth through digitalization is characterized by higher (technological) complexity as it encompasses the use of cutting-edge technologies across different business functions. This requires technological expertise and appropriate cross-functional coordination. Second, growth through digitalization is accompanied by greater uncertainty and thus implies a particular degree of risk-taking. For example, investments in growth-oriented digitalization initiatives are difficult to estimate and their returns are uncertain. Furthermore, the pursuit of growth goals with digitalization requires managerial and cultural transitions as conventional, established approaches are no longer sufficient and organizational agility becomes more important. Finally, to grow through digitalization firms must possess (or build) distinct resources. Implementing growth-oriented digitalization initiatives not only takes time to deliver measurable results but requires both financial and human resources. Besides investing in new technologies and digital infrastructure, firms need to develop new technological skills, which presupposes knowledge creation and organizational learning (e.g., Annarelli et al., 2021). Given today's high pace and complexity of technological advances, firms rarely possess all the necessary competences and capabilities, which is why information exchange and knowledge transfer with other firms and institutions (i.e., through external cooperations or partnerships) is crucial to keep up with dynamic market trends (e.g., Bouncken et al., 2021). Consequently, firms must also adapt their strategies and make trade-offs between uncertain alternatives (Björkdahl, 2020; Matalamäki & Joensuu-Salo, 2022). Depending on the respective digitalization level of firms, prior research has already identified different digital growth strategies (e.g., Gebauer et al., 2020; Verhoef et al., 2021), for example, ranging from 'classic' product development strategies (based on Ansoff, 1957) to the use of digital platforms (e.g., Broekhuizen et al., 2021).

3.2.2 Family firm goals: The role of socioemotional wealth

Although the exact ownership share of the business family and its members may vary, some commonalities regarding motives and goals exist (e.g., Tagiuri & Davis, 1992). Given the interplay between the family and the business system (e.g., Habbershon et al., 2003), family-owned firms pursue multiple goals (Williams Jr. et al., 2019) and therefore represent a particularly interesting context to study organizational goals (Kotlar et al., 2018). Even though scholars have identified numerous goals of family-owned firms and developed different typologies, they agree that family-owned firms are special in that they pursue both economic

[9] Unless otherwise stated, the following explanations are primarily based on Björkdahl (2020).

and non-economic goals (e.g., Basco, 2017; Holt et al., 2017). Economic goals primarily refer to the preservation of financial wealth and profit increase. Non-economic goals, in turn, are reflected in the concept of SEW, first introduced by Gómez-Mejia et al. (2007) and defined as "non-financial aspects of the firm that meet the family's affective needs, such as identity, the ability to exercise family influence, and the perpetuation of the family dynasty" (Gómez-Mejia et al., 2007, p. 106). Further examples include preserving a positive family (firm) image as well as maintaining family values and traditions, taking social and regional responsibility, and fostering long-term relationships with both internal (employees) and external (e.g., customers, suppliers) stakeholders based on shared values (e.g., Sharma & Manikutty, 2005; Zellweger et al., 2013).

Family firms' unique goal set, however, does not only represent an important differentiator of family and non-family firms but functions as a key determinant of outcomes related to firm strategy and performance (e.g., Chrisman et al., 2013). Because non-economic goals play an outstanding role for family owners, they significantly influence their decision-making and strategic behavior (e.g., Berrone et al., 2012; Sharma et al., 1997). For family firms and their owners, the primary reference point is the loss of their SEW, which is why family owners frame strategic decisions with reference to non-financial aspects and affective endowments (Gómez-Mejia et al., 2007). For example, family firms and their owners are willing to accept significant business risks when SEW is at stake but at the same time avoid risky business decisions when this is not the case (Chrisman & Patel, 2012). Prioritizing non-economic over economic concerns therefore significantly affects their risk-taking preferences and distinguishes the strategic decision-making processes of family firms from those of their non-family counterparts (e.g., Gómez-Mejia et al., 2011).

SEW is a multi-dimensional concept (see the FIBER[10] conceptualization of Berrone et al., 2012). For our study, we focus on three important dimensions of SEW, namely identification of family members with the firm, emotional attachment, and renewal of family bonds through dynastic succession. We argue that these three dimensions have an influence on the use of digitalization to pursue growth goals and develop our hypotheses accordingly. The first hypothesis, however, concerns the overall effect of family ownership.

[10] Following Berrone et al. (2012, p. 259), FIBER stands for F*amily control and influence*, I*dentification of family members with the firm*, B*inding social ties*, E*motional attachment of family members*, and R*enewal of family bonds to the firm through dynastic succession.*

3.3 Hypotheses development

3.3.1 Family ownership and the pursuit of growth goals with digitalization

Family ownership affects several organizational outcomes, such as strategic behavior and (financial) performance (e.g., Chrisman et al., 2013). Likewise, family firms are assumed to "show some distinct characteristics and paths when it comes to digitalization" (Batt et al., 2020, p. 2). Given their ambivalent goal set and idiosyncratic decision-making process, we argue that family ownership increases risk aversion (e.g., Naldi et al., 2007) which, in turn, leads to specific transformation challenges and ultimately reduces the importance of growth goals with digitalization. There are at least two barriers to the pursuit of growth goals with digitalization that result from family owners' low risk-taking preferences.

First, family firms are more likely to develop incremental (rather than radical) innovations (e.g., Bergfeld & Weber, 2011; Nieto et al., 2015). Since family owners are primarily concerned with the loss of their SEW, they avoid risky innovation projects that pose a potential threat to their SEW and thus focus on incremental, less risky improvements. Growth-oriented digitalization initiatives, however, are more complex and uncertain due to their holistic nature and therefore require radical changes. Consequently, firms need to invest in R&D and engage in external partnerships (i.e., alliances with start-ups). Contemporary research, in contrast, indicates that family ownership decreases the level of R&D intensity (Block, 2012) and that family firms are also less likely to turn to search and acquire external technological resources or sources of innovation (e.g., Classen et al., 2012; Kotlar et al., 2013). In addition, Block et al. (2022) show that family firms are not producing more innovation output with less innovation input, refuting previous assumptions.

Second, family firms pursue conservative harvest strategies that seek to maximize utility for the owning family and its members. Following the strategy literature, harvest strategies aim to reap from the business rather than to grow it (e.g., Le Breton-Miller & Miller, 2008) and, in turn, contradict the pursuit of growth goals with digitalization. While growth-oriented digitalization initiatives aim at exploiting new opportunities for value creation and capture and thus achieving financial benefits, this is not a priority for family owners. Since family owners prioritize non-economic gains and family interests, harvest strategies help them to maintain control of the business and minimize risks (Le Breton-Miller & Miller, 2008). As a result, family firms strive for achieving operational efficiency rather than organizational growth which is further enhanced by their strong sense of tradition and willingness to preserve the established.

Consistent with this, research has only recently shown again that family ownership leads to higher efficiency (at least compared to non-family firms; Chen et al., 2023).

Taken together, we suggest that family ownership leads to higher risk aversion, in turn, promoting incremental innovations and conservative harvest strategies rather than radical improvements and growth ambitions. Consequently, we assume family ownership to be negatively related to the pursuit of growth goals with digitalization.

H1: *Family ownership is negatively related to the pursuit of growth goals with digitalization.*

3.3.2 Identification with the firm and the pursuit of growth goals with digitalization

In the following, we deepen our investigations to the level of the owners of family firms and develop hypotheses regarding their identification with the firm, emotional attachment, and succession intentions. We assume that each of these three SEW dimensions shapes the risk-taking preferences of family owners and thereby influences their propensity to pursue growth goals with digitalization for several reasons.

In family firms, the family system interacts closely with the business system. Accordingly, the business is inextricably linked to the family's identity and history and thus represents an essential component of family members' individual self-concepts (e.g., Deephouse & Jaskiewicz, 2013). Since the identity of the family often is equivalent to the identity of the firm, family members identify strongly with their business (Razzak, 2022). Identification with the firm serves family members as a classification mechanism as it distinguishes them from non-family members (e.g., Brinkerink & Bammens, 2018). Organizational identification therefore not only enhances family members' individual self-esteem but also their concerns for collective processes and outcomes which, in turn, helps to identify a common set of goals (e.g., Hoffman et al., 2006). In particular, strong identification of the family with the firm promotes the pursuit of family-specific goals related to non-financial or socioemotional concerns (e.g., Cabrera-Suárez et al., 2014; Zellweger et al., 2013). Given the congruence of family and firm identity, family members strive to maintain a positive, superior image of the firm and themselves, thus promoting business decisions that could protect their reputation and avoiding actions that could harm it (e.g., Berrone et al., 2012; Deephouse & Jaskiewicz, 2013). Indeed, research shows that stronger organizational identification of family firm decision-makers heightens their concern for upholding the firm's reputation and, for example, constrains their engagement in cooperative activities (i.e., external corporate venturing; Prügl & Spitzley, 2021) and new technology adoption (e.g., Souder et al., 2017).

Given these reasons, we argue that stronger identification with the firm enhances family owners' willingness to protect the family (firm) image and therefore reinforces their low risk-taking preferences which, in turn, hinder the realization of growth-oriented digitalization initiatives. Consequently, we assume that the owners' identification with the firm is negatively related to the pursuit of growth goals with digitalization.

H2: *Identification of the owners with the firm is negatively related to the pursuit of growth goals with digitalization.*

3.3.3 Emotional attachment and the pursuit of growth goals with digitalization

Strategic management literature consents to the fact that emotions influence decision-making and therefore have important implications for organizational outcomes. Research has shown that emotions have the potential to improve decision-making and increase firms' willingness to take risks (e.g., Brundin et al., 2022). Given the prevalence of emotions in family firms, we argue that strong emotional attachment of their owners leads to increased levels of affective commitment and causes emotional biases which, in turn, increase their risk-taking preferences and thus facilitate the pursuit of growth goals with digitalization. In the following, we further elaborate on our arguments.

Emotions are particularly strong in family firms as they, due to the influence of the owning family, guide strategic choices and affect operational decisions (e.g., De Massis & Foss, 2018; Razzak, 2022). In a family firm context, emotions are primarily reflected in the emotional attachment of its members (e.g., Berrone et al., 2012). Given their close ties, common beliefs, and shared experiences, family members are associated with high emotional attachment which, in turn, leads to increased levels of affective commitment, a form of commitment largely influenced by emotional reactions at work (Humphrey et al., 2021). Specifically, affective commitment captures an individual's emotional attachment to an organization as well as his or her level of organizational involvement (e.g., Allen & Meyer, 1990). Family members that feel emotionally attached not only to each other but also to their business, are willing to make the best possible decisions for their organization (and not just the family). To preserve their SEW and at the same time ensure the longevity and prosperity of the entire organization, they will increase their risk-taking, when necessary (i.e., during crises; Leppäaho & Ritala, 2021), even tolerating negative financial effects (e.g., Gómez-Mejia et al., 2007). Since digital technologies increasingly threaten established business models, family firms need to bear some risks and make courageous transformation decisions (i.e., increasing R&D spendings, engaging in external partnerships). Consequently, and in line with prior research that links greater affective

commitment to increased engagement and superior firm performance (Azoury et al., 2013), we assume greater affective commitment to promote the pursuit of growth goals with digitalization in family firms.

In a similar vein, the prevalence of emotions in family firms favors emotional biases which, in turn, bias decision-making (e.g., Dick et al., 2020). Family members' emotional attachment reinforces feelings of pride and belonging and thus strengthens cohesion but may also cause overconfidence (hubris), referred to as "the tendency for individuals to overestimate their abilities and chances for success" (Hiller & Hambrick, 2005, p. 302). Overconfidence, however, was found to have positive effects on risk-taking (e.g., Li & Tang, 2010) and innovation (e.g., Galasso & Simcoe, 2011; Tang et al., 2015) as well as digital transformation (Zhou et al., 2022) and thus stimulate rather than hinder the pursuit of growth goals with digitalization. Corresponding to these findings, research indicates that positive emotions, such as enthusiasm or pride, decrease decision-making uncertainties and lead to higher risk-taking whereas negative emotions have the opposite effect (e.g., Delgado-García et al., 2010; Fodor et al., 2016). Consequently, we assume that the emotional attachment of family owners is positively related to the pursuit of growth goals with digitalization.

H3: *Emotional attachment of the owners is positively related to the pursuit of growth goals with digitalization.*

3.3.4 Succession intentions and the pursuit of growth goals with digitalization

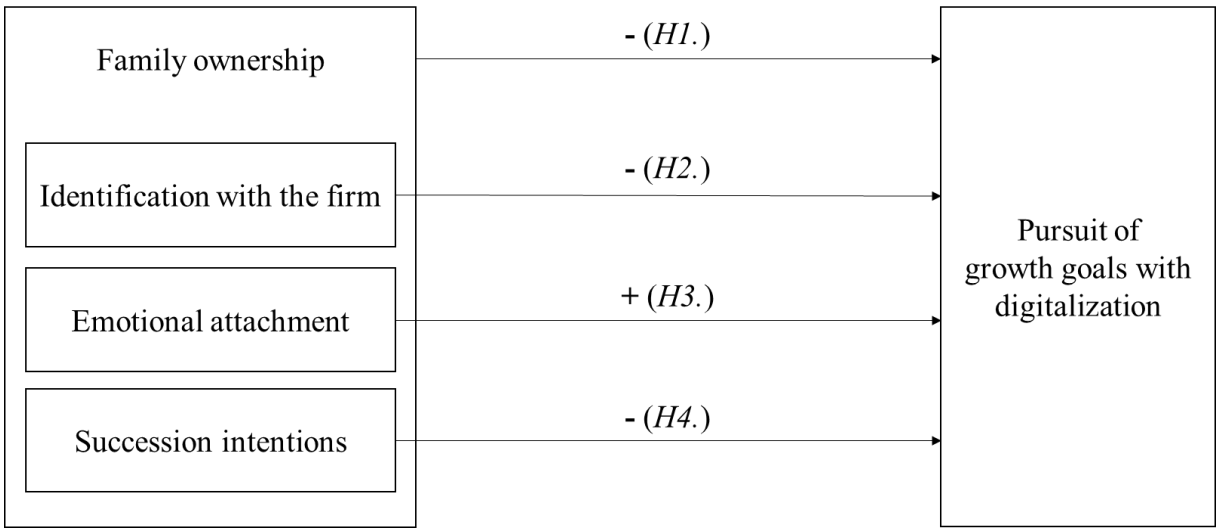
Family ownership shifts a firm's actions towards non-economic goals, making the perpetuation of the family dynasty a top priority. Family owners aim to renew their bonds to the firm by successfully transferring the business to future generations (e.g., Gómez-Mejia et al., 2007). Dynastic succession intentions therefore play an important role in the decision-making of family firms and significantly affect their time horizons (e.g., Berrone et al., 2012; Zellweger, 2007). As the owners of family firms are primarily concerned with preserving the family legacy in the long term, long-term orientation becomes *the* leitmotif of strategic decisions (e.g., Lumpkin & Brigham, 2011; Lumpkin et al., 2010). Drawing on stewardship theory (e.g., Davis et al., 1997), Le Breton-Miller and Miller (2006, p. 732) define long-term orientation as "priorities, goals, and most of all, concrete investments that come to fruition over an extended time period" and point out that reducing risks is one of its main purposes. Research has repeatedly shown that long-term orientation leads to lower risk-taking preferences in family firms (e.g., Seyed Kalali, 2022), for example, expressed by conservative, risk averse strategic decision-making (Gentry et al., 2016) and investment behavior (Zellweger, 2007). Similarly, it

has been argued that CEOs of family firms with longer tenures are less likely to make risky decisions and thus promote continuity rather than (disruptive) change (Zahra, 2005). Furthermore, family owners' succession intentions and pronounced long-term orientation may trigger intergenerational conflicts (i.e., regarding technology adoption; König et al., 2013) and resistance to change due to less external managers and experts (Batt et al., 2020). Given these reasons, and line with previous findings, we argue that dynastic succession intentions further intensify family owners' long-term orientation which, in turn, decreases their willingness to make risky decisions. Consequently, we assume that the renewal of owners' bonds to the firm through dynastic succession is negatively related to the pursuit of growth goals with digitalization.

H4: *Renewal of the owners' bonds to the firm through dynastic succession is negatively related to the pursuit of growth goals with digitalization.*

Figure 3.1 shows our research model and thus gives an overview of our hypotheses.

Figure 3.1: Research model on the pursuit of growth goals with digitalization



Source: Own illustration.

3.4 Data and method

3.4.1 Sample and data collection

Sample

Given the large number and economic relevance of family-owned firms, especially in Germany (e.g., De Massis et al., 2018), as well as the increasing pressure to digitally transform in the manufacturing sector (e.g., Jones et al., 2021), our study utilized a sample of 10,765 mid-sized German manufacturing firms. To generate our sample, we applied the following criteria using

Orbis (BvD): (1) the firm was active as of September 2020; (2) it was located in Germany; (3) the firm operates in a research-intensive manufacturing sub-industry, thus following Gehrke et al. (2010), we selected firms with a primary industry classification according to the NACE code between 20 and 30; (4) its number of employees was between 50 and 2,999;[11] (5) it was at least ten years old; and (6) it was not a subsidiary, foreign firm, non-profit firm or a public institution. Setting limits to firm age and employee number prevents including start-ups, focusing on established, mid-sized firms (e.g., European Commission, 2003; IfM Bonn, 2016; Röhl, 2018).

Data collection

To test our hypotheses, we combined firm-related information from the Orbis database with survey data. Therefore, we first collected firm-specific key figures (e.g., key financial indicators and ownership structure) for our initial sample of 10,765 firms from the database. Additionally, primary data were collected via CATI with a questionnaire-based survey between October 2021 and March 2022. Trained professionals contacted the firms in our initial sample and targeted the firms' first or second management level, in particular managing directors and senior executives. For 52.3% of the firms an adequate respondent could be identified. These were then contacted to ask for a personal interview based on our standardized questionnaire. Eventually, this led to 525 completed surveys, equalling a response rate of 9.3%, in line with comparable studies in family business literature (e.g., De Massis et al., 2021; Soluk et al., 2021a; Zellweger et al., 2012). We tested the representativeness of our sample in comparison to the target population through Chi² tests of the distribution of the NACE and the size categories, yielding no significant differences.

3.4.2 Measures

Besides variables that could be taken from secondary firm level data, we relied on pre-validated multi-item measures whenever available. *Table 3.1* provides an overview of the variables used in our study. Additionally, *Table A3.1* of the appendix shows the items underlying the main variables of interest. We assessed the psychometric properties of the multi-item scales. Composite reliability (CR) values greater than 0.80 for all constructs substantiated high internal consistency. Convergent validity was given as all constructs achieved an average variance extracted (AVE) of at least 0.50. As these values also exceeded the highest squared inter-construct correlations, discriminant validity according to the Fornell-Larcker criterion could be confirmed.

[11] The number of employees was within the specified range for at least one of the years 2017, 2018, and 2019.

Dependent variable

To capture the *pursuit of growth goals with digitalization*, we asked for six different strategic growth options of a firm. The respondents had to rate how important these goals of digitalization are to their firm on a five-point scale (1 = not important at all; 5 = very important). We conducted a principal component analysis with varimax rotation on the six items and aggregated them into a unifying variable. The variable captures the extent to which firms use digital technologies to pursue growth goals, for example, entering new markets or developing new products.

Independent variables

Following our hypotheses, we separately analyze four different independent variables at the firm (*H1.*) and owner level (*H2.*, *H3.*, and *H4.*). Our first independent variable *family ownership* is a binary variable equal to one if the founder and/or the family holds shares of the firm and was manually coded based on ownership data available in the Orbis database. In line with the literature, we use a rather broad family firm definition, including family members from either first or later generations (e.g., Andres, 2008). Accordingly, 66.67% of the firms in our sample are family firms.

The characteristics of the owners were measured using the recently developed and extensively validated FIBER scale by Gerken et al. (2022). Assessed with a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree), we utilize nine items belonging to three characteristics of the owners; identification of the owners with their firm (*identification with the firm*), emotional attachment of the owners (*emotional attachment*), and renewal of the owners' bonds to the firm through dynastic succession (*succession intentions*). The configuration of these constructs was assessed in a principal component analysis.[12]

Control variables

We control for several variables that were previously shown to determine digitalization activities of family firms (e.g., Ceipek et al., 2021; Soluk et al., 2021a). First, we control for *dynamic capabilities* which were repeatedly shown to promote organizational transformation and business model innovation (e.g., Witschel et al., 2022). To capture a firm's dynamic capabilities regarding the sensing, seizing, and reconfiguring (transforming) of entrepreneurial opportunities, we used 14 items based on Kump et al. (2019).[13] The respondents had to rate the

[12] We surveyed all four SEW dimensions from Gerken et al. (2022), including binding social ties. However, this construct was not discriminant in our principal component analysis and was therefore omitted.
[13] See *Table A2.1* of the appendix for comparison.

extent to which the individual statements applied to their firm on a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree). Next, we control for a firm's current digitalization level as well as its innovativeness. Assessed with a five-point scale (1 = not digitalized at all; 5 = fully digitalized) in our survey, respondents rated the *digitalization level* of their firm regarding its primary activities (based on Porter, 2001): production, logistics, marketing, and customer service. *Innovativeness* was captured by a binary variable equal to one if a firm owns patents. Patent information is taken from the worldwide patent statistical database *Patstat* of the EPO. Furthermore, we control for *firm age* and *firm size* which were both collected from Orbis and logarithmized for multivariate analyses. While firm age refers to the number of years since the founding of the firm, firm size was measured as the number of employees of the firm. Finally, we include dummy variables for German federal states and for two-digit NACE codes.

Table 3.1: Description of all the variables used in the analyses

Variable	Description
Pursuit of growth goals with digitalization	Average importance assigned to growth goals with digitalization, measured by six items on a five-point scale (*1 = not important at all* to *5 = very important*). Source: Survey
Family ownership (d)	Equals one if the founder and/or the family holds shares of the firm, otherwise zero. Source: Orbis
Identification with the firm	Average level of identification of the owners with the firm, measured by four items on a five-point Likert-type scale (*1 = strongly disagree* to *5 = strongly agree*). Source: Survey
Emotional attachment	Average level of emotional attachment of the owners, measured by two items on a five-point Likert-type scale (*1 = strongly disagree* to *5 = strongly agree*). Source: Survey
Succession intentions	Average level of renewal of the owners' bonds to the firm through dynastic succession, measured by three items on a five-point Likert-type scale (*1 = strongly disagree* to *5 = strongly agree*). Source: Survey
Dynamic capabilities	Average dynamic capabilities of the firm regarding sensing, seizing, and transforming capabilities, measured by 14 items on a five-point Likert-type scale (*1 = strongly disagree* to *5 = strongly agree*). Source: Survey
Digitalization level (in primary activities)	Average digitalization level of the firm regarding its primary activities (e.g., Porter, 2001): production, logistics, marketing, and customer service (*1 = not digitalized at all* to *5 = fully digitalized*). Source: Survey
Patents (d)	Equals one if the firm owns patents, otherwise zero. Source: Patstat
Firm age (log.)	Number of years since the founding of the firm (in 2022, logarithmized). Source: Orbis
Employees (log.)	Number of employees of the firm (in 2018, logarithmized). Source: Orbis
Industry (d)	Equals one if the firm operates within the respective NACE primary code (20 to 30), otherwise zero. Source: Orbis
Federal state (d)	Equals one if the firm is located in the respective German federal state (*Bundesland*), otherwise zero. Source: Orbis

Notes: d = dummy variable(s); log. = logarithmized.

3.4.3 Assessment of survey biases

Non-response bias

To identify and mitigate potential sample biases, we used different measures. First, to check for non-response bias, we conducted several statistical tests. We compared those 3,887 non-respondents who intentionally rejected a participation in our survey to the 525 firms in our sample. Results of Chi² tests showed that both groups do not differ in terms of industry distribution. Regarding further firm characteristics, including firm age and size, t-tests for the equality of means revealed no differences between respondents and non-respondents.

Late response bias

Besides non-response bias, we also checked for late response bias. To do so, we compared the 10% of the firms in our final sample that last participated in the survey (53 late respondents) with the remaining 90% (472 early respondents) regarding their responses to our dependent variable. Results of a Chi² test reveal no significant differences between early and late respondents regarding the pursuit of growth goals which is why late response bias seems also not to be an issue.

Common method bias

We applied several ex ante and post hoc measures to reduce the risk of common method bias (e.g., MacKenzie & Podsakoff, 2012; Podsakoff et al., 2012). Prior to the interviews, we tried to ensure optimal respondent fit by exclusively surveying members of the firms' first or second management level, thus guaranteeing sufficient experience with the survey topic. Furthermore, we increased their motivation to participate in the survey by providing incentives. Respondents were offered an individual management summary for the firm, and they were invited to a workshop about the survey results. We assured participants that their data were processed anonymously and for scientific reasons only, thus decreasing the risk of social desirability bias. Apart from that, the questions were organized in a way that participants would not notice a direct relationship between the constructs. For example, the questions relating to the dependent and independent variable were positioned in different survey sections. Also, we tried to mitigate the risk of common method bias by variating the measurement scales of the survey questions on which our variables are based. The correlations between the dependent variable (pursuit of growth goals with digitalization) and the independent variables at owner level (identification with the firm, emotional attachment, and succession intentions) lie below 0.1 (see *Table 3.2*). Furthermore, our independent variable at firm level (family ownership) originates from another

data source. Lastly, we applied marker variable technique. We integrated a theoretically unrelated marker (i.e., "I feel that environmental issues are among the greatest challenges of our society", measured on a five-point Likert-type scale, ranging from "1 = strongly disagree" to "5 = strongly agree") as a control variable to a partial correlation analysis of our survey variables. After partialling out the effect of this variable, all zero-order correlations remained consistent regarding their size and significance. Thus, common method bias does not seem to be a serious issue.

3.4.4 Methods

Our analysis proceeds in three steps. First, we conduct descriptive analyses. In addition to running correlations, we compare the means and medians of selected variables of family and non-family firms. Second, we run multivariate regressions to investigate whether family firms are less likely to pursue growth goals with digitalization than non-family firms. To capture the influence of the family on the firm, we first look at how family ownership affects the pursuit of growth goals with digitalization. Considering family firm heterogeneity (e.g., Chua et al., 2012; Daspit et al., 2021), we then conduct an analysis for the family firm subsample and investigate the owners' effect on the pursuit of growth goals with digitalization. Third, we conduct several robustness checks.

3.5 Results

3.5.1 Descriptive results

Correlations

Table 3.2 presents the correlations among the variables included in our analyses. There are moderate correlations between our independent variables at the owner level. For example, the correlation between identification with the firm and succession intentions is 0.48. Our independent variables show only weak correlations with the dependent variable. Correlations with the pursuit of growth goals with digitalization range from -0.00 (succession intentions) to 0.08 (emotional attachment) for the owner variables. For our focal variable at firm level, family ownership, there is a weak negative correlation (-0.11) with our dependent variable. Moreover, the pursuit of growth goals with digitalization shows positive correlations with a firm's dynamic capabilities (0.23) and its digitalization level (in primary activities) (0.24). The VIFs of our independent and control variables are relatively low, ranging from 1.05 (e.g., patents) to 1.43

(identification with the firm). As the average VIF is 1.20, multicollinearity is unlikely to be a major concern.

Comparison of family and non-family firms

Table 3.3 provides descriptive statistics for our main variables distinguishing between family and non-family firms. We conducted t-tests for the equality of means and Wilcoxon rank-sum-tests for the equality of medians. For the pursuit of growth goals with digitalization, we find significantly higher mean and median values for non-family firms than for family firms. The mean importance that non-family firms attach to growth goals is 3.56 (median: 3.67) versus 3.31 (median: 3.33) for family firms. Thus, family firms on average attach less importance to the pursuit of growth goals than non-family firms. As assumed, family firm owners show significantly higher levels of the SEW dimensions: identification with the firm (4.52 versus 4.07, $p < 0.01$), emotional attachment (3.02 versus 2.78, $p < 0.01$), and succession intentions (4.29 versus 3.62, $p < 0.01$). Family and non-family firms do not differ significantly regarding dynamic capabilities, their current digitalization level, patents, firm age, and firm size.

Table 3.2: Correlations and VIFs

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	VIF
(1) Pursuit of growth goals with digitalization										
(2) Family ownership (d)	-0.11									1.17
(3) Identification with the firm	0.06	0.27								1.43
(4) Emotional attachment	0.08	0.14	0.20							1.06
(5) Succession intentions	-0.00	0.33	0.48	0.13						1.41
(6) Dynamic capabilities	0.23	-0.01	0.22	-0.04	0.10					1.27
(7) Digitalization level (in primary activities)	0.24	-0.05	0.03	-0.03	-0.07	0.39				1.21
(8) Patents (d)	0.03	-0.05	0.00	-0.00	0.04	0.02	0.00			1.05
(9) Firm age (log.)	0.05	0.01	0.07	-0.01	0.09	0.02	0.03	0.10		1.05
(10) Employees (log.)	0.14	-0.09	-0.03	-0.01	0.05	0.10	0.06	0.22	0.20	1.11

Notes: N = 477; VIF = variance inflation factor; d = dummy variable; log. = logarithmized.

Table 3.3: Descriptive statistics

	Family firms			Non-family firms			t-stat.	z-stat.
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**		
Pursuit of growth goals with digitalization	3.31	0.86	3.33	3.56	0.82	3.67	3.15***	3.09***
Identification with the firm	4.52	0.67	4.75	4.07	0.96	4.25	-5.99***	-4.95***
Emotional attachment	3.02	0.90	3.00	2.78	0.96	3.00	-2.75***	-2.70***
Succession intentions	4.29	0.77	4.58	3.62	1.19	4.00	-7.50***	-6.00***
Dynamic capabilities	3.57	0.65	3.64	3.60	0.57	3.63	0.54	0.11
Digitalization level (in primary activities)	3.14	0.64	3.25	3.24	0.70	3.25	1.49	1.38
Patents (d)	0.45	0.50	0.00	0.48	0.50	0.00	0.66	0.67
Firm age (in 2022)	49.61	34.29	38.00	50.14	44.50	32.00	0.15	-1.23
Employees (in 2018)	171.21	283.67	99.00	212.50	330.17	113.50	1.45	2.29**
Number of firms	350			171			521	

Notes: Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable.

3.5.2 Multivariate results

Main analysis

Our main analysis investigates the effect of family ownership on the pursuit of growth goals with digitalization. To assess whether family firms are less likely to use digital technologies to achieve organizational growth, we run ordinary least squares (OLS) regressions for our full sample of 525 German manufacturing firms. Model 1 examines the relationship between family ownership and the dependent variable pursuit of growth goals with digitalization, model 2 then includes the owner characteristics. Control variables show significant effects in case of emotional attachment, dynamic capabilities, digitalization level, firm size, and a few federal states. Both dynamic capabilities (both: $\beta = 0.19$, $p < 0.01$) and a firm's current level of digitalization (model 1: $\beta = 0.24$, $p < 0.01$; model 2: $\beta = 0.21$, $p < 0.01$) have a significant positive relationship with the pursuit of growth goals. Also, the larger a firm is (in terms of employees), the more likely it is to use digitalization for growth (both: $\beta = 0.11$, $p < 0.05$). The models show statistically significant negative effects of family ownership on the pursuit of growth goals in both models (model 1: $\beta = -0.17$, $p < 0.05$; model 2: $\beta = -0.19$, $p < 0.05$), supporting our first hypothesis. *Table 3.4* summarizes the results of our main analysis.

Subsample analysis

Next, we investigate the owners' effects on the pursuit of growth goals for family firms only. We run OLS regressions to analyze the effects of each of the three owner characteristics (identification with the firm, emotional attachment of owners, and succession intentions) on the pursuit of growth goals – first individually (models 1 to 3), then in combination (model 4). Controlling for the same variables as in our main analysis, we again find significant effects of dynamic capabilities (model 2: $\beta = 0.15$, $p < 0.10$; model 3: $\beta = 0.13$, $p < 0.10$). The current level of digitalization of family firms has a statistically significant positive relationship with the pursuit of growth goals in each model, effect sizes (β) ranging from 0.33 (in models 2 and 4, $p < 0.01$) to 0.35 (model 1, $p < 0.01$). Our results show statistically significant positive effects of emotional attachment (both models 2 and 4: $\beta = 0.12$, $p < 0.05$) on the pursuit of growth goals in family firms, supporting our third hypothesis. However, we find no significant effects of the identification with the firm and the succession intentions on the pursuit of growth goals. *Table 3.5* summarizes the results of our subsample analysis.

Table 3.4: Linear regression results (main analysis)

Variables	**Pursuit of growth goals with digitalization**	
	Model 1	Model 2
Family ownership (d)	-0.17**	-0.19**
	(0.08)	(0.09)
Identification with the firm		0.07
		(0.06)
Emotional attachment		0.10**
		(0.04)
Succession intentions		-0.01
		(0.05)
Dynamic capabilities	0.19***	0.19***
	(0.07)	(0.07)
Digitalization level (in primary activities)	0.24***	0.21***
	(0.06)	(0.06)
Patents (d)	-0.04	-0.01
	(0.08)	(0.08)
Firm age (log.)	0.03	0.04
	(0.06)	(0.07)
Employees (log.)	0.11**	0.11**
	(0.05)	(0.05)
NACE (d)	Yes	Yes
Federal states (d)	Yes	Yes
R-squared	0.15	0.16
F-test	2.83	2.63
Prob > F	0.00	0.00
Observations	506	477

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table 3.5: Linear regression results for family firms (subsample analysis)

Variables	**Pursuit of growth goals with digitalization**			
	Model 1	Model 2	Model 3	Model 4
Identification with the firm	0.08			0.06
	(0.07)			(0.08)
Emotional attachment		0.12**		0.12**
		(0.05)		(0.05)
Succession intentions			0.05	0.00
			(0.06)	(0.07)
Dynamic capabilities	0.10	0.15*	0.13*	0.13
	(0.08)	(0.08)	(0.08)	(0.08)
Digitalization level (in primary activities)	0.35***	0.33***	0.34***	0.33***
	(0.08)	(0.08)	(0.08)	(0.08)
Patents (d)	-0.06	-0.06	-0.03	-0.03
	(0.10)	(0.10)	(0.10)	(0.10)
Firm age (log.)	0.09	0.10	0.09	0.10
	(0.08)	(0.80)	(0.80)	(0.08)
Employees (log.)	0.09	0.09	0.80	0.08
	(0.07)	(0.07)	(0.07)	(0.07)
NACE (d)	Yes	Yes	Yes	Yes
Federal states (d)	Yes	Yes	Yes	Yes
R-squared	0.19	0.21	0.20	0.21
F-test	2.48	2.75	2.44	2.48
Prob > F	0.00	0.00	0.00	0.00
Observations	339	338	333	330

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

3.5.3 Robustness checks

We conduct several additional analyses to assess the robustness of our results.

Using alternative family firm definitions

In line with other studies (e.g., Andres, 2008; Villalonga & Amit, 2006), we first test alternative family firm operationalizations. *Table A3.2* of the appendix provides an overview of the family firm definitions, the respective family firm share in the sample, and the OLS regression coefficients. In total, we used four different definitions, with the first being the one from our main analysis for comparison. Across the different analyses, we consistently find negative effects of family ownership on the pursuit of growth goals, mostly statistically significant. We further examine the effect of family management on the pursuit of growth goals. We therefore manually coded an additional variable measuring if at least one family member is present in the management board of the company (1 = yes). Again, we find significant negative effects (model 1: $\beta = -0.19$, $p < 0.05$; model 2: $\beta = -0.22$, $p < 0.05$). To conclude, the use of alternative family firm definitions supports the results of our main analysis and reinforces our statement that family influence is an impediment to the pursuit of growth goals.

Subsample analysis for non-family firms

To investigate the robustness of our results regarding the significant positive effect of the owners' emotional attachment on the pursuit of growth goals in family firms, we run the same OLS regressions for non-family firms. In contrast to the results obtained for family firms, we find no significant positive effect of emotional attachment on the dependent variable using our non-family firm subsample. Our comparison reveals that both groups indeed differ regarding the considered relationship. *Table A3.3* provides the results.

Using an alternative independent variable at the owner level

Last, we use an alternative independent variable at the owner level. To capture the owners' commitment, we aggregated our nine items referring to the three characteristics of the owners (identification with the firm, emotional attachment, and succession intentions) into a unifying variable. The variable captures the extent to which owners feel committed to their business. Running the same OLS regression for our family firm subsample, we find a significant positive effect of the owners' commitment on the pursuit of growth goals in family firms ($\beta = 0.17$, $p < 0.05$). Thus, we again find support for the results of our subsample analysis, which showed a positive effect for the emotional attachment of family firm owners (*H3.*). *Table A3.4* shows the results of our OLS regression for our family firm subsample using *ownership commitment*.

3.6 Discussion

3.6.1 Summary of main results

The results of our empirical analyses support some of the earlier evidence on the digital transformation of family firms, indicating that they are somehow reluctant to take full advantage of the many opportunities offered by digital technologies (e.g., Batt et al., 2020; Ceipek et al., 2021). Specifically, our results show that family ownership impedes the pursuit of growth goals with digitalization. Family firms are indeed less likely to follow a growth agenda with digitalization, at least compared to non-family firms. However, we also find reason to believe that the owners of family firms themselves have the power to overcome such growth barriers. Our regressions show that stronger emotional attachment of family owners facilitates the pursuit of growth goals with digitalization. In contrast, we find statistically significant effects neither for their identification with the firm nor succession intentions. Accordingly, the emotions prevalent in family firms, although often viewed as potential disadvantage (e.g., Zellweger & Astrachan, 2008), can help family owners drive digital transformation and organizational growth. What do these results mean for theory and practice?

3.6.2 Implications for theory

Several implications for theory arise from our results that are worth discussing. First and foremost, our study contributes to prior research on the determinants of digital transformation and particularly the link between firm ownership and the pursuit of growth goals with digitalization. Scholars have always been concerned with the question of which factors influence digital transformation (e.g., Nadkarni & Prügl, 2021; Verhoef et al., 2021). To identify potential facilitating and inhibiting factors and thus explain differences in the digital transformation of firms, extant literature has focused on organizational characteristics, placing specific emphasis on firms' resources and capabilities. In particular, dynamic capabilities, referred to as a firm's ability to successfully adapt to changing environmental conditions (e.g., Teece et al., 1997), were found to be crucial for digital transformation (e.g., Daniel & Wilson, 2003; Warner & Wäger, 2019). So far, however, research has largely neglected the role of firm ownership as another influencing factor at the organizational level, and the few results obtained in the context of family firms vary substantially. Although research has already linked family ownership to digital business model innovation (Cucculelli et al., 2022; Soluk et al., 2021a), we are among the first to empirically analyze the effect of family ownership on the pursuit of growth goals with digitalization. Based on quantitative empirical research, we show that family

ownership reduces the importance of growth goals with digitalization and thus extend existing knowledge on the digital transformation of family firms. We therefore contribute to research on the relationship between firm ownership and digital transformation, suggesting family ownership as an inhibitor of the pursuit of growth goals with digitalization. In this way, we also add to the ongoing debate in the literature on the differences between family and non-family firms and how they affect organizational outcomes. Although research has repeatedly shown that family ownership affects the goals and strategies of firms (e.g., Williams Jr. et al., 2018, 2019), our study reveals that this remains true in the context of digitalization.

Besides contributing to research on the determinants of digital transformation at the firm level, our study enables a better understanding of relevant factors at the owner level. Specifically, we investigate how SEW considerations of the owners of family firms, namely, their identification with the firm, emotional attachment, and succession intentions, influence the pursuit of growth goals with digitalization. In doing so, we answer the question of whether family owners themselves can counteract the hindering effect of family ownership. Our results indicate that stronger emotional attachment indeed has the potential to increase family owners' tendency to pursue growth goals with digitalization. Following our theoretical arguments, family firms' pursuit of growth goals with digitalization seems to be driven by affective concerns and emotional biases which, in turn, increase their risk-taking preferences and thus enable strategic decisions geared towards transformation and growth. Considering family firm heterogeneity, however, we know that family firms differ regarding the emphasis on SEW and therefore the impact of emotions on decision-making and goalsetting (e.g., Humphrey et al., 2021; Picone et al., 2021). In showing that the emotional attachment of family owners can serve as a driving force of growth goals, we also contribute to research on the heterogeneity of family firms from a digital transformation perspective.

3.6.3 Implications for practice

The results of our study have practical implications for decision makers, in particular the owners of family firms. Because we find family ownership to impede the pursuit of growth goals with digitalization, we point out to firm ownership as a relevant determinant of organizational goals, especially in the context of digitalization. Firms should consider the influential role of firm ownership when setting goals and making strategic decisions and, if necessary, align ownership structure with organizational goal sets and strategies. They should be aware that family ownership can be a barrier to the pursuit of growth goals with digitalization. However, this hindering effect appears to be influenceable by the owners of family firms themselves.

According to our findings, family owners can build on their emotional attachment to drive digital transformation. Family owners should therefore allow emotion-based arguments to affect strategic decision-making in the context of digitalization and, for example, listen to their gut feelings when pursuing organizational growth. Apart from that, since family firms are an important part of the German Mittelstand, our study contributes to a better understanding of which organizational factors influence their digital transformation.

3.6.4 Limitations and future research directions

Our study has some limitations that offer promising directions for future research. First, as we focus exclusively on German manufacturing firms, our sample is limited in terms of country and industry coverage. Since the German manufacturing industry is dominated by Mittelstand firms with a strong export orientation (Bernard & Wagner, 1997), our findings may not generalize to Mittelstand firms operating in industries that are less export-oriented, more B2C focused or more service dominated. Furthermore, our sample does not cover the entire manufacturing sector but only a selected subset of mostly research-intensive industries, in turn limiting the transferability of our findings to non-research-intensive industries. Therefore, we encourage future research to extend our analyses considering other countries or industries.

Apart from that, future research could investigate further contextual factors in the context of digitalization. Regarding a firm's external environment, research suggests environmental dynamism to be an important influencing factor of digital transformation (e.g., Soluk et al., 2021a). Defined as the "amount of uncertainty, complexity, and change emanating from the external environment" (Chirico & Baù, 2014, p. 212), environmental dynamism may affect firms' ability and willingness to transform, and ultimately the pursuit of growth goals with digitalization. Since our study, unfortunately, lacks information about firms' environmental settings, follow-up studies could close this gap and thus enrich our findings.

Finally, as with any cross-sectional study, we cannot claim causal effects. Future research could use longitudinal data to verify the validity and generalizability of our results. Nevertheless, we conducted a series of robustness checks to rule out possible alternative explanations.

Chapter 4

Financial performance of Hidden Champions: Evidence from German manufacturing firms

HCs are market leaders in niche markets and are an important part of the German Mittelstand. Although the HC phenomenon has received considerable interest in practice, few academic studies on this issue exist. We especially lack evidence on the financial performance of HCs. Our study addresses this gap and investigates the profitability of HCs. In analyzing a panel dataset of 4,677 German manufacturing firms, of which 617 are HCs, we find that HCs have significantly higher profitability with regard to return on assets but less so regarding return on equity. The HC performance effect on return on assets is valued at 1.7 percentage points. Furthermore, the HC performance effect decreases with firm size. This study therefore contributes to the literature on the effect of firm strategy on firm profitability and adds to a better understanding of the HC phenomenon.

This chapter is based on

Johann, M., Block, J., & Benz, L. (2022). Financial performance of hidden champions: Evidence from German manufacturing firms. *Small Business Economics, 59*(3), 873-892.

4.1 Introduction

HCs are market leaders in niche markets and are an important part of the German Mittelstand. Such entities are associated with the success of the German Mittelstand and the German economy. HCs follow a strategy based on the combination of two paradigms: niche market focus and international expansion. HCs focus on narrowly defined (niche) markets and provide high-quality products. To increase sales and achieve scale economies, HCs expand internationally (e.g., Audretsch et al., 2020; Rammer & Spielkamp, 2015). Although the HC phenomenon has received much interest in practice, academic research on the topic is scarce. Prior research has investigated the characteristics of HCs and their firm strategies. HCs have higher export ratios than other firms (Rammer & Spielkamp, 2015) and often enter foreign markets through fully owned subsidiaries (Audretsch et al., 2018). HCs employ a highly skilled workforce, which they constantly educate and train (Lehmann et al., 2019; Voudouris et al., 2000). HCs are effective (incremental) innovators and often also technology leaders (Audretsch et al., 2020; Rammer & Spielkamp, 2015; Voudouris et al., 2000). However, while we already have an understanding of the characteristics of HCs and of their strategies, we know little about their economic performance. In particular, we lack quantitative empirical evidence on the financial performance of HCs relative to other firms. Although anecdotal evidence from the media (e.g., BBC, 2017; The Economist, 2012) and popular sciences (e.g., Langenscheidt & Venohr, 2014; Simon, 2012; Venohr & Meyer, 2007) suggests that HCs outperform other firms, no study has quantified these differences in economic and statistical terms. Our study aims to close this gap and investigates the profitability of HCs compared to other firms.

We use a panel dataset of 4,677 German Mittelstand manufacturing firms, of which 617 are HCs, for a period of ten years. Our results show that HCs have a significantly higher *return on assets* (ROA) but that this is not the case for *return on equity* (ROE). The HC performance effect on ROA is valued at 1.7 percentage points. Furthermore, the HC performance effect decreases with firm size and disappears for firms with more than 900 employees.

Our study contributes to three strands of literature. First, this work contributes to a better understanding of the HC phenomenon (e.g., Audretsch et al., 2018; 2020; Benz et al., 2021; Lehmann et al., 2019) and shows that the HC strategy can indeed lead to stronger financial performance as measured by ROA. Second, as HCs are an important part of the German Mittelstand, our study also contributes to the broader literature on the (German) Mittelstand (e.g., Berghoff, 2006; Block & Spiegel, 2013), particularly its success factors (De Massis et al., 2018). We contribute to the literature on the strategies employed by successful Mittelstand firms

(e.g., De Massis et al., 2018; Pahnke & Welter, 2019). Third, our study contributes to the literature on the determinants of financial profitability, particularly the link between strategy and firm performance (e.g., Bowman & Helfat, 2001; Dess & Davis, 1984; Hansen & Wernerfelt, 1989; Spanos et al., 2004; White, 1986). Prior research on strategy typologies describes a focused niche market strategy (e.g., Porter, 1980; Dalgic & Leeuw, 1994; Teplensky et al., 1993) and recommends this approach as a good strategy for SMEs (e.g., De Massis et al., 2018; Franch Parella & Carmona Hernández, 2018; Gomes-Casseres, 1997; Lee et al., 1999; Muzyka et al., 1997) and family firms (e.g., Hennart et al., 2019; McCann et al., 2001). The results of our study contribute to this discussion by showing that such a strategy can indeed lead to financial outperformance and that the relative advantage of a HC strategy compared to other strategies decreases with firm size, making it a good strategy for SMEs. With this result, we also add to the literature on the role of firm size in the strategy-performance relationship (e.g., Lee, 2009; Leitner & Güldenberg, 2010; Serrasqueiro & Nunes, 2008; Shinkle et al., 2013; Thornhill & White, 2007; Wagner, 1995).

4.2 Theoretical background

4.2.1 The German Mittelstand and its characteristics

The term Mittelstand is associated with the success of the German economy. Since World War II and the German *Wirtschaftswunder*, the Mittelstand has been considered the backbone of the German economy and the engine of its industrial and economic growth (e.g., Kayser & Wallau, 2002; Muzyka et al., 1997). Applying a quantitative criterion, Mittelstand firms include both SMEs (IfM Bonn, 2016) and midcaps (Röhl, 2018). A qualitative criterion stresses the identity of ownership and management (IfM Bonn, 2023b), and the majority of Mittelstand firms are family firms. Many large family firms also consider themselves part of the Mittelstand, leading to the emergence of the term *Mittelstand by perception* or identity (Pahnke & Welter, 2019).

Because most Mittelstand firms are family-controlled and managed, they share some characteristics with family firms, including long-term orientation, regional embeddedness, and flat hierarchies (e.g., Berghoff, 2006; Block & Spiegel, 2013). Mittelstand firms have benefitted from globalization. They have internationalized and sell a significant share of their products abroad (Franch Parella & Carmona Hernández, 2018; Kraft et al., 2012). Despite limited resources, such firms often attach great importance to innovation (De Massis et al., 2018). However, while their long-term orientation and employee commitment positively influence innovation, the risk aversion of later family generations and resource constraints can pose a

challenge (Decker & Günther, 2017; Werner et al., 2018). Prior research has found that resource constraints and liabilities of smallness can hinder the formation of dynamic capabilities needed for business model innovation (Heider et al., 2021).

As the term Mittelstand is difficult to operationalize, little research exists on the financial performance of Mittelstand firms. However, number of studies have investigated the financial performance of German family firms. We identified five relevant studies. Andres (2008) finds that firms with an active founding family are more profitable than other firms. This result is confirmed by Audretsch et al. (2013), adding consideration of family monitoring to the literature. The authors argue that business families take an active monitoring role in the firm, protecting family wealth and positively influencing firm performance. Family influence also helps achieve a better strategic fit, which is closely linked to firm performance (Lindow et al., 2010). Other studies have examined the postsuccession performance of family firms and found that the involvement of the previous owner and his/her human capital significantly affects firm performance (Ahrens et al., 2018). Additionally, family membership of the new CEO improves postsuccession firm performance according to Ahrens et al. (2019).

While the performance of family firms as an important part of the German Mittelstand has been analyzed, we lack large-scale quantitative investigations of the performance of HCs.

4.2.2 The Hidden Champion phenomenon

HCs are referred to as the spearheading actors of the German Mittelstand. Simon (2012) defines HCs using three criteria. Market leadership is the first criterion. HCs are among the top three market-leading firms in the world or rank first on their continent. Second, HCs earn revenues of less than five billion Euros. Third, HCs are characterized by low public visibility. While market leadership and the amount of revenues can be quantified, low public visibility is difficult to measure and typically not included in the operational definition of HCs (e.g., Rammer & Spielkamp, 2015). HCs pursue the following two goals: market leadership and growth through internationalization. They achieve these goals through the use of a focused niche market strategy. HCs are focused on niche markets serving demanding customers with high-quality and premium-priced products. Selling their products internationally extends their market and increases their sales volume, enabling scale economies and profitable operations (e.g., Audretsch et al., 2018; Voudouris et al., 2000). The HC strategy resembles the focus strategy described by Porter's (1980) three generic competitive strategies. A focus strategy involves offering high-quality products to selected customers in narrowly defined market segments (Dalgic & Leeuw, 1994).

Toften and Hammervoll (2009) identify seven characteristics of niche market strategies, namely, market segmentation based on the firm's strengths, small thinking and acting, building long-term relationships, focusing on customer needs, appreciation of the firm's reputation, specialization and differentiation, and charging a price premium (Dalgic & Leeuw, 1994; Hamermesh et al., 1978). With the exception of 'thinking and acting small,' these characteristics fit with the HC strategy. While HCs operate in narrowly defined niche markets, they do not 'think and act small' but, on the contrary, have the ambitious goal of being the international market leader in their segment.

In addition to strategy research, entrepreneurship research has also analyzed the HC phenomenon, although the number of peer-reviewed articles is still low. Of the 94 studies identified by Schenkenhofer (2022), only a few studies are published in reputable academic journals. Audretsch et al. (2020) compare niche and scalable entrepreneurship across countries and identify Germany as the country where niche entrepreneurship is most prevalent. The authors' findings further show that country context and entrepreneurship strategies interact with each other and that country-specific institutions can explain the high prevalence of niche entrepreneurship in Germany. Focusing on the district level, Benz et al. (2021) examine the HCs' impact on various regional economic indicators in Germany. The results show that a high regional HC density has a positive effect on the regional economy, for example in terms of income level or unemployment rate. Regarding regional innovations, a positive effect on patent applications but no influence on R&D expenditures of the districts can be found. Germany's historical and traditional institutions of quality orientation and a strong engineering focus combined with a highly educated workforce provide good conditions for the Mittelstand and its HCs (Audretsch et al., 2018; Lehmann et al., 2019; Rammer & Spielkamp 2015). In particular, the dual apprenticeship system in Germany is often cited as a major advantage, as it combines the relevant theoretical and practical knowledge and skills needed for high-quality manufacturing. HCs are more likely than other firms to qualify their employees to develop specific skills and human capital (Voudouris et al., 2000). Prior research has also investigated the particularities of HCs with regard to internationalization. As HCs' products are of premium quality and require considerable explanation and service, HCs are more likely than other firms to enter foreign markets through a direct market entry strategy by means of foreign direct investments and wholly owned subsidiaries. HCs aim to retain control and ownership over their internationalization and foreign market entry strategies (Audretsch et al., 2018). With regard to innovation, it is suggested that HCs are strong in incremental innovation, as they strive to continuously improve their processes, products, and services (Lehmann et al., 2019). Close

interactions with demanding customers are suggested to be the main source of innovation for HCs (Voudouris et al., 2000).

Regarding the performance of HCs, Benz et al. (2020) compare DAX 30 firms to 99 HCs listed in the CDAX according to different financial metrics that refer to growth, profitability, liquidity, and stock market performance. The authors' results show that HCs achieve operating and stock market performance similar to that of DAX 30 firms but differ in terms of financial liquidity and capital structure. Rammer and Spielkamp (2015) show that HCs exceed their control group in terms of market share, sales growth, and *return on sales* (ROS). Nevertheless, most insights into the financial performance of HCs are based on anecdotal evidence. Little evidence from large-scale quantitative studies exists.

4.3 Data and method

4.3.1 Sample of German Mittelstand firms from the manufacturing sector

To compare the performance of HCs to that of other Mittelstand firms, we used the Orbis database to generate a sample of German manufacturing firms. The following criteria were applied: (1) the firm was active as of December 2020; (2) its primary NACE code was between 10 and 33; (3) its revenues were below five billion Euros[14] and its number of employees was between 50 and 2,999;[15] and (4) it was not a subsidiary, foreign firm, nonprofit firm or public organization. We in turn obtained a sample of 9,594 firms. For these firms, we collected data on financial performance for 2011 to 2020, yielding an unbalanced panel dataset of 4,677 firms (28,584 firm-years).

4.3.2 Identification and operationalization of Hidden Champions

Among the 4,677 firms, we were able to identify 617 HCs (3,958 firm-years). To identify HCs, we use the criteria of Simon (2012). HCs should be among the top three market leaders in the world or number one in Europe. We manually collected information on this criterion from the firms' websites or from other online and offline sources, such as press releases and Google alerts ("Weltmarktführer" and "Hidden Champion"). In addition, we checked publicly available lists such as those provided by WirtschaftsWoche (2020), Seibold et al. (2019), and Langenscheidt and Venohr (2014). We also checked lists of innovative (Mittelstand) firms published in Yogeshwar (2019) and Frankfurter Allgemeine Zeitung (2019). The share of HCs

[14] The revenues should be below five billion Euros for at least one of the last five years (2016 to 2020).
[15] This was measured for 2018.

included in our sample of Mittelstand firms amounts to 13.19%, which is similar to the share of 14.8% reported by Schlepphorst et al. (2016) for a comparable sample.

4.3.3 Variables and methods

Our dependent variable is financial performance measured by ROA and ROE. To calculate *ROA* (*ROE*), we divide a firm's earnings before tax (EBT) by assets (equity).[16] Our focal variable HC is a dummy variable. In line with prior research on (family) firm performance (Andres, 2008; Miller et al., 2007; Villalonga & Amit, 2006), we control for firm age, firm size (number of employees), capital (debt-to-equity ratio) and ownership structure. *Table 4.1* provides an overview of the main variables used in our study.

Our analysis proceeds in three steps. First, we conduct descriptive analyses (*Section 4.4.1*). In addition to running correlations, we compare the means and medians of selected variables of HCs and non-HCs. Second, we run multivariate regressions to investigate whether HCs show higher levels of profitability than non-HCs (*Section 4.4.2*). We run two separate clustered OLS regressions for ROA and ROE for the ten-year period of 2011 to 2020. Third, we conduct several further analyses, subsample investigations and robustness checks, as detailed in *Section 4.4.3*.

[16] We also used other earnings measures such as EBIT and EBITDA. The corresponding results are described in *Section 4.4.3* and displayed in *Tables A4.9* and *A4.10* of the appendix.

Table 4.1: Description of all the variables used in the analyses

Variable	Description
ROA (%)	Percentage ratio based on EBT divided by total assets of the firm. Source: Orbis
ROE (%)	Percentage ratio based on EBT divided by shareholder funds. Source: Orbis
HC (d)	Equals one if the firm is a market leader, zero if not. Source: Own research
Firm age (log.)	Number of years since the founding of the firm (logarithmized). Source: Orbis
Employees (log.)	Number of employees of the firm (logarithmized). Source: Orbis
Patents per employee	Number of patents granted per employee of the firm calculated based on the Orbis data for the firm's number of granted publications in 2020 and the firm's average number of employees between 2011 and 2020. Source: Orbis
Patents (d)	Equals zero if patent data is available in Orbis, otherwise one. If patent data is not available in Orbis, we perform a missing value imputation by replacing missings with zero (for multivariate analyses only).
Export intensity (%)	Percentage ratio based on export revenue divided by operating revenue of the firm. Source: Orbis
Export (d)	Equals zero if export intensity data is available in Orbis, otherwise one. If export intensity data is not available in Orbis, we perform a missing value imputation by replacing missings with zero (for multivariate analyses only).
Liquidity ratio	Ratio of the current assets minus stocks to current liabilities of the firm. Source: Orbis
Debt-to-equity ratio (%)	Percentage ratio based on debt divided by equity of the firm. Source: Orbis
Blockholder (d)	Equals one if the firm has a recorded shareholder with a direct ownership of over 50% (BvD independence indicator D), otherwise zero. Classification is based on the BvD independence indicator which characterizes the degree of independence of a firm with regard to its shareholders. If the BvD independence indicator is not available in Orbis, we perform a missing value imputation by replacing missings with zero. Source: Orbis
Stock market listing (d)	Equals one if the firm is listed on the stock market, otherwise zero. Classification is based on Orbis data for the firm's IPO date and delisting date (if available). Source: Orbis
Industry diversification (d)	Equals one if the firm is active in more than one industry, otherwise zero. Classification is based on Orbis data for the firm's NACE primary code and NACE secondary code (if available). Source: Orbis
ROA volatility (%)	Standard deviation of the firm's ROA between 2011 and 2020 calculated based on the Orbis data for the firm's ROA between 2011 and 2020. Source: Orbis
Industry (d)	Equals one if the firm operates within the respective NACE primary code (10 to 33), otherwise zero.
Federal state (d)	Equals one if the firm is located in the respective German federal state (*Bundesland*), otherwise zero.
Year (d)	Equals one for the respective year (2011 to 2020), otherwise zero.

Notes: d = dummy variable(s); log. = logarithmized.

4.4 Results

4.4.1 Descriptive results

Correlations

Table 4.2 presents the correlations among the variables included in our multivariate analyses. Not surprisingly, there is a strong correlation between our two performance measures, ROA and ROE (0.64). Surprisingly, our focal variable HC shows only weak correlations with the performance variables. The correlation with ROA (ROE) is 0.04 (0.01). The VIFs of our independent and control variables are relatively low, ranging from 1.02 (liquidity ratio) to 3.17 (export dummy). The average VIF is 1.42. Hence, multicollinearity is unlikely to be a major concern.

Comparison of HCs to non-HCs

Table 4.3 provides descriptive statistics for our main variables distinguishing between HCs and non-HCs. We report mean and median values, standard deviations, and t-tests for the equality of means and Wilcoxon rank-sum-tests for the equality of medians. In this way, we examine whether the HCs in our sample have the typical characteristics attributed to HCs, namely, above-average export ratios, pronounced innovation activities, and healthy capital structures.

For *export intensity*, we find significantly higher mean and median values for HCs than for non-HCs. The mean export intensity is 54.78% for HCs versus 42.16% for non-HCs. HCs also show significantly higher levels of patent output. On average, HCs have 0.44 *patents per employee* (non-HCs: 0.29). The absolute numbers are even more impressive. HCs possess on average 264 (median: 86) granted patents, whereas non-HCs have only a mean of 85 (median: 18). Overall, our findings are consistent with prior research showing a stronger export orientation and higher innovation output for HCs compared to non-HCs (Lehmann et al., 2019; Rammer & Spielkamp, 2015; Voudouris et al., 2000).

We also find significantly lower *ROA volatility* (6.20% versus 6.73%, $p < 0.01$) and *debt-to-equity ratio* (117% versus 125%, $p < 0.01$) values for HCs than for non-HCs, which is in line with HCs having healthy capital structures and revenue streams (Benz et al., 2020). In addition, the HCs' *liquidity ratio* is slightly lower than that of the other firms (2.55 versus 2.68, $p < 0.10$).

Regarding financial performance, we find that HCs have a mean ROA of 9.31% (median 7.98%), whereas non-HCs have a mean of 8.00% (median: 6.80%). This difference is

statistically significant at the 1% level. Moreover, HCs have a higher ROE (mean: 25.10%, median: 18.06%) than non-HCs (mean: 24.09%, median: 16.68%).

Significant differences between HCs and non-HCs also exist regarding firm age and firm size. HCs are on average larger (in terms of employees) and older than non-HCs. Differences are statistically significant at the 1% level. The mean *firm age* of HCs is 59.47 years (non-HCs: 39.99), and the mean number of *employees* is 598 (non-HCs: 300).

Industry distribution

Table 4.4 shows the industry distribution of HCs and non-HCs. Across all industries, HCs have a share of 10.20%. Except for NACE 12 (tobacco products), HCs are present in all industries. However, HCs are not distributed equally across industries. The lowest share of HCs is found in NACE 18 (printing and reproduction of recorded media) (1.22%); the largest shares of HCs are found in NACE 28 (machinery and equipment; 22.12%), NACE 32 (other manufacturing; 20.74%), NACE 27 (electrical equipment; 19.34%), NACE 26 (computer, electronic and optical products; 17.85%), and NACE 13 (textiles; 17.28%).

Table 4.2: Correlations and VIFs

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	VIF
(1) ROA (%)															
(2) ROE (%)	0.64														
(3) HC (d)	0.04	0.01													1.19
(4) Firm age (log.)	0.05	0.03	0.15												1.12
(5) Employees (log.)	-0.05	-0.02	0.30	0.17											1.29
(6) Patents per employee	-0.01	-0.00	0.10	0.05	0.02										1.05
(7) Patents (d)	-0.01	0.03	-0.22	-0.19	-0.27	-0.19									1.18
(8) Export intensity (%)	-0.01	0.00	0.17	0.07	0.24	0.06	-0.17								3.16
(9) Export (d)	0.03	0.01	-0.12	-0.08	-0.27	-0.02	0.14	-0.82							3.17
(10) Liquidity ratio	0.12	-0.02	-0.01	0.02	-0.05	0.05	-0.02	0.00	0.02						1.02
(11) Debt-to-equity ratio (%)	-0.18	0.09	-0.02	-0.06	0.04	-0.01	0.04	-0.02	0.00	-0.11					1.02
(12) Blockholder (d)	-0.02	0.01	-0.11	-0.19	-0.09	0.00	0.02	0.04	-0.03	0.01	0.03				1.08
(13) Stock market listing (d)	-0.06	-0.04	0.19	0.07	0.15	0.05	-0.07	-0.11	0.13	-0.03	-0.05	-0.17			1.13
(14) Industry diversification (d)	0.01	0.02	0.00	-0.03	0.03	0.00	-0.00	0.01	-0.02	0.02	0.02	0.05	-0.10		1.02
(15) ROA volatility (%)	0.01	0.02	-0.03	-0.17	-0.13	0.05	-0.03	-0.00	0.02	0.01	0.04	0.12	0.01	-0.02	1.06

Notes: N = 28,584; SD = standard deviation; VIF = variance inflation factor; d = dummy variable.

Table 4.3: Descriptive statistics

	HCs			Non-HCs			t-stat.	z-stat.
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**		
ROA (%)	9.31	11.88	7.98	8.00	12.45	6.80	-6.41***	-7.52***
ROE (%)	25.10	59.91	18.06	24.09	75.34	16.68	-0.95	-4.43***
Firm age	59.47	56.63	43	39.99	40.00	27	-20.82***	-26.43***
Employees	598.15	524.84	416	299.63	373.53	181	-34.41***	-50.11***
Patents [a]	264.19	618.93	86	85.37	300.96	18	-17.14***	-41.40***
Patents per employees [a]	0.44	0.94	0.20	0.29	0.92	0.08	-9.13***	-26.14***
Export intensity (%) [b]	54.78	22.42	57.02	42.16	24.45	41.17	-22.38***	-21.41***
Liquidity ratio	2.55	4.00	1.57	2.68	5.03	1.29	1.87*	-11.68***
Debt-to-equity ratio (%)	116.92	138.98	68.30	124.53	155.85	68.66	3.14***	-1.75*
ROA volatility (%)	6.20	4.88	4.85	6.73	5.42	5.25	6.26***	6.22***
Number of firm-years	3,958			24,626			28,584	
Number of firms	617			4,060			4,677	

Notes: Means, standard deviations (SD), medians, and tests of differences in means and medians between HCs and non-HCs for selected variables. The sample comprises 28,584 firm-years from 4,677 firms. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level.
[a] As we only consider available patent data, we refer to 19,724 firm-years from 3,177 firms, thereof 3,714 firm-years from 577 HCs.
[b] As we only consider available export intensity data, we refer to 10,638 firm-years from 2,424 firms, thereof 2,020 firm-years from 414 HCs.

Table 4.4: Industry distribution of HCs and non-HCs

NACE Code	Industry description	All Firms	HCs	Non-HCs	HCs in Industry (%)
10	Manufacture of food products	346	19	327	5.49
11	Manufacture of beverages	72	5	67	6.94
12	Manufacture of tobacco products	11	0	11	0
13	Manufacture of textiles	81	14	67	17.28
14	Manufacture of wearing apparel	45	3	42	6.67
15	Manufacture of leather and related products	24	2	22	8.33
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	78	10	68	12.82
17	Manufacture of paper and paper products	124	9	115	7.26
18	Printing and reproduction of recorded media	82	1	81	1.22
19	Manufacture of coke and refined petroleum products	20	2	18	10
20	Manufacture of chemicals and chemical products	319	31	288	9.72
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	122	11	111	9.02
22	Manufacture of rubber and plastic products	346	34	312	9.83
23	Manufacture of other non-metallic mineral products	183	15	168	8.20
24	Manufacture of basic metals	208	23	185	11.06
25	Manufacture of fabricated metal products, except machinery and equipment	585	62	523	10.60
26	Manufacture of computer, electronic and optical products	409	73	336	17.85
27	Manufacture of electrical equipment	274	53	221	19.34
28	Manufacture of machinery and equipment n.e.c.	886	196	690	22.12
29	Manufacture of motor vehicles, trailers and semi-trailers	154	13	141	8.44
30	Manufacture of other transport equipment	62	4	58	6.45
31	Manufacture of furniture	44	3	41	6.82
32	Other manufacturing	135	28	107	20.74
33	Repair and installation of machinery and equipment	67	6	61	8.96
Total		4,677	617	4,060	13.19

Notes: Number and percent of firms by primary two-digit NACE code. HCs are defined according to the criteria described in the text. The sample comprises 4,677 firm observations.

4.4.2 Multivariate results

Our multivariate regressions investigate the performance effect of HCs using ROA and ROE as dependent variables. We run clustered OLS regressions for an unbalanced panel dataset spanning ten years. With regard to ROA, we find an economically and statistically significant effect. Being an HC has a positive relationship with ROA ($\beta = 1.73$, $p < 0.01$). With regard to ROE, we do not find a statistically significant HC performance effect ($\beta = 2.56$, $p > 0.10$).

Our control variables show significant industry effects. Interestingly, industries with a high HC share (*Section 4.4.1*) show a significantly higher profitability. For example, NACE 26 (computer, electronic and optical products) and NACE 27 (electrical equipment) have a significant positive relationship with ROA (NACE 26: $\beta = 2.78$, $p < 0.01$; NACE 27: $\beta = 2.12$, $p < 0.01$) and ROE (NACE 26: $\beta = 9.14$, $p < 0.05$; NACE 27: $\beta = 8.24$, $p < 0.10$). The same is true for NACE 28 (machinery and equipment), which shows a positive relationship with ROA ($\beta = 1.31$, $p < 0.05$). To conclude, the HC performance effect observed in practice may at least be partially attributed to industry effects. Innovation as measured by a firm's patents per employee shows a negative relationship with ROA ($\beta = -0.33$, $p < 0.10$) but no relationship with ROE. *Table 4.5* summarizes the results of the main analyses. An extended version showing the detailed industry effects can be found in *Table A4.1* of the appendix.

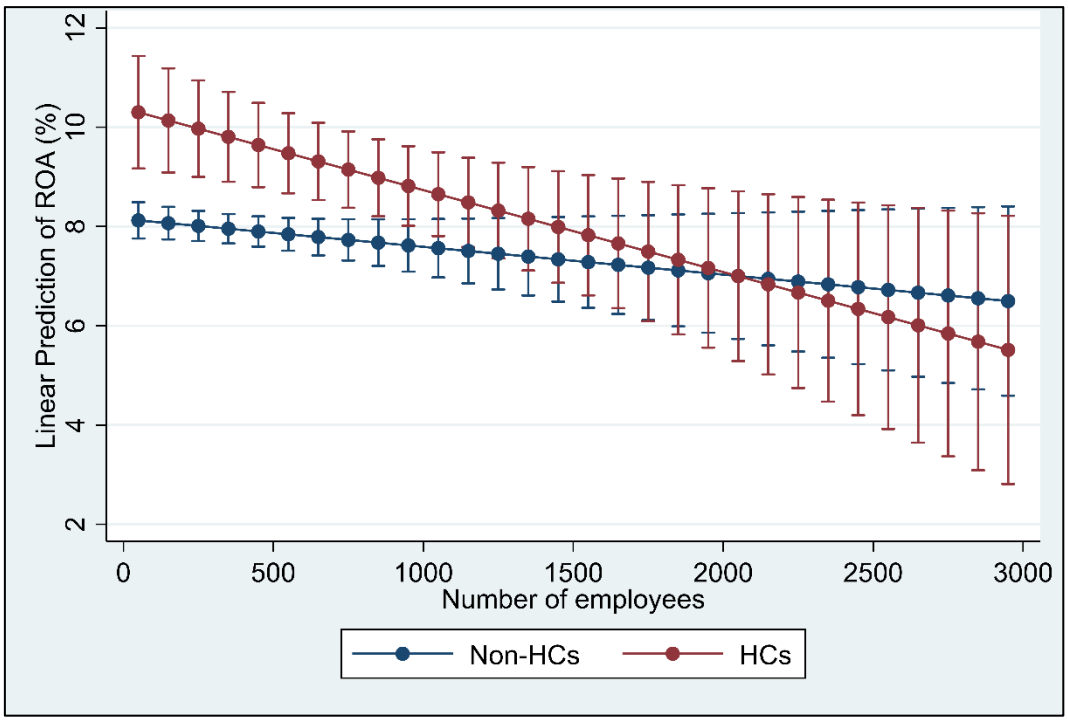
Table 4.5: Clustered OLS regressions for our main sample

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.73***	2.56
	(0.45)	(2.41)
Firm age (log.)	0.71***	4.33***
	(0.17)	(0.99)
Employees (log.)	-0.46***	-1.08
	(0.18)	(1.02)
Patents per employee	-0.33*	-0.39
	(0.17)	(1.25)
Patents (d)	0.67*	6.60***
	(0.36)	(2.19)
Export intensity (%)	0.01	0.09
	(0.01)	(0.06)
Export (d)	1.34***	5.51*
	(0.46)	(2.89)
Liquidity ratio	0.21***	-0.24***
	(0.03)	(0.09)
Debt-to-equity ratio (%)	-0.01***	0.04***
	(0.00)	(0.01)
Stock market listing (d)	-6.50***	-19.03***
	(0.95)	(3.16)
Blockholder (d)	-0.57	0.38
	(0.36)	(1.76)
Industry diversification (d)	0.02	1.59
	(0.29)	(1.69)
ROA volatility (%)	0.03	0.21
	(0.04)	(0.24)
Constant	9.80***	7.21
	(1.48)	(8.52)
Observations	28,584	28,584
R-squared	0.07	0.02

Notes: Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 28,584 firm-year observations from 4,677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

We next calculate the interaction effects between HC status and firm size (as measured by the number of employees). Our empirical model is a clustered OLS regression using ROA as the dependent variable. In calculating and plotting margins with 95% confidence intervals, we find support for the statistically significant HC performance effect with regard to ROA. The effect, however, decreases with firm size and loses its statistical significance for firms with 900 employees or more. *Figure 4.1* shows the interaction effects graphically.

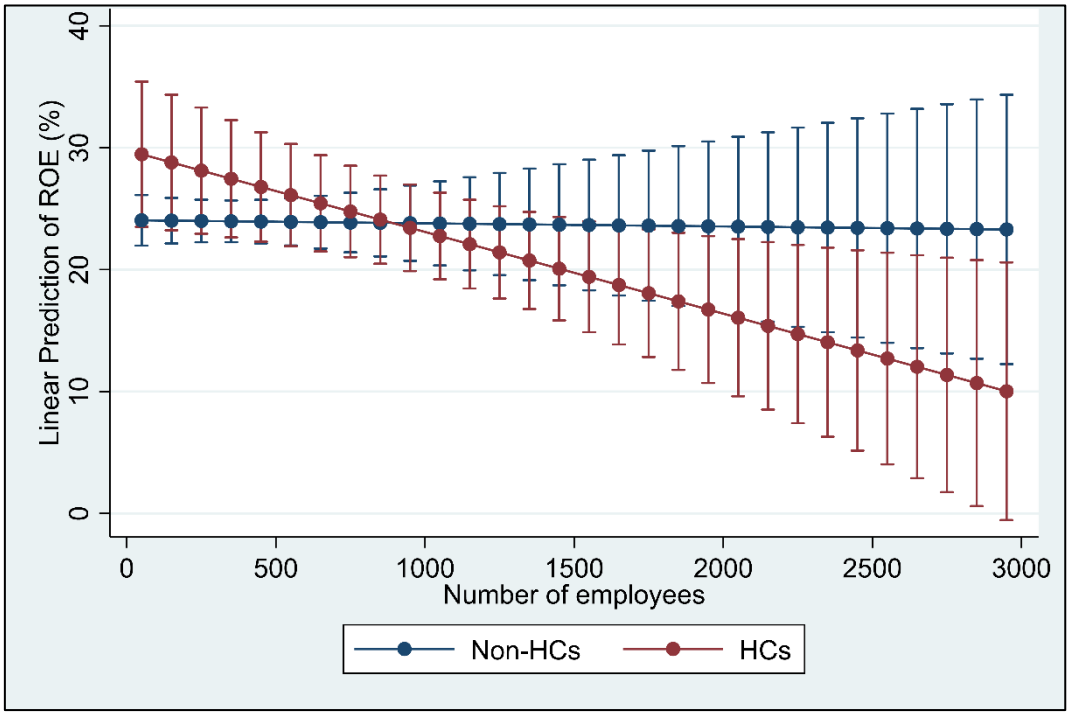
Figure 4.1: Predictive margins of HC with 95% confidence intervals for ROA



Notes: Marginsplot based on a clustered OLS regression of ROA on HC and further firm characteristics, including the interaction effect between HC and a firm's number of employees. The sample comprises 28,584 firm-year observations from 4,677 firms.
Source: Own illustration, created via Stata.

With regard to ROE, we neither find a statistically significant HC performance effect nor evidence for an interaction effect with firm size. *Figure 4.2* shows the interactions analysis for ROE.

Figure 4.2: Predictive margins of HC with 95% confidence intervals for ROE



Notes: Marginsplot based on a clustered OLS regression of ROE on HC and further firm characteristics, including the interaction effect between HC and a firm's number of employees. The sample comprises 28,584 firm-year observations from 4,677 firms.
Source: Own illustration, created via Stata.

4.4.3 Further analyses and robustness checks

In addition to our main analyses, we conduct several further analyses and robustness checks. As a first additional analysis, we perform the above-described clustered OLS regressions for four subsamples based on firm size, age, or revenue. *Table A4.2* of the appendix provides an overview of the main sample and the subsamples. We also perform a seemingly unrelated and median regression as well as a clustered OLS regression using *ROS* as the dependent variable. Finally, we test for the robustness of the results by winsorizing our dependent variables ROA and ROE.

Subsample regressions

The first subsample consists of firms with a maximum of 499 employees, often referred to as medium-sized enterprises (IfM Bonn, 2016). Our subsample regression using a sample of firms with between 50 and 499 employees shows an economically and statistically significant effect

of HCs on both ROA ($\beta = 2.33$, $p < 0.01$) and ROE ($\beta = 5.78$, $p < 0.10$). The second subsample includes firms with a minimum of 500 employees and a maximum of 2,999 employees, thus including midcaps but excluding MEs (IfM Bonn, 2016; Röhl, 2018). The second subsample regression does not show a significant performance effect of HCs. In line with our analysis of interaction effects in the main analyses (*Section 4.4.2*), it seems that the HC performance effect exists for medium-sized Mittelstand firms but not for large Mittelstand firms. The third subsample is based on our main sample but excludes firms operating for less than ten years to exclude startups. Our third subsample regression confirms our main results. Significances and effect sizes resemble those of the main analyses. While we find a significant effect of HCs on ROA ($\beta = 1.80$, $p < 0.01$), we do not find one for ROE. *Tables A4.3, A4.4,* and *A4.5* of the appendix show the results of the analyses.

We also perform a subsample regression for firms with revenues of less than three billion Euros. The HC criteria have slightly changed over time with regard to the upper threshold of revenues. Simon (2012) raised the threshold from three billion Euros to five billion Euros in 2012 to account for changing market conditions and firm growth. In analyzing 24,817 firm-years from 4,630 firms (616 HCs), we can confirm the results of our main analyses (*Section 4.4.2*). While HC has an economically and statistically significant effect on ROA ($\beta = 1.68$, $p < 0.01$), it is insignificant with regard to ROE ($\beta = 2.57$, $p > 0.10$).

Seemingly unrelated and median regressions

As noted above, there is a strong correlation between our two dependent variables ROA and ROE ($r = 0.64$), which may lead to a correlation in the error terms across the two regressions. When using a seemingly unrelated regression, accounting for such a correlation of error terms yields a positive significant relationship between HC and ROA ($\beta = 1.73$, $p < 0.01$) and a positive effect on ROE ($\beta = 2.56$, $p < 0.10$). *Table A4.6* of the appendix provides the results.

Additionally, we perform median regressions for ROA and ROE to account for the skewness of the dependent variables. This time, we find positive significant effects of HC on both ROA ($\beta = 0.83$, $p < 0.01$) and ROE ($\beta = 1.75$, $p < 0.01$). It seems that the insignificant relationship between HC and ROE found in the main analyses is at least partly due to the skewness of the dependent variable.

Using alternative dependent variables

As another analysis, we perform a clustered OLS regression using ROS as a performance measure. ROS is calculated as EBT divided by the operating revenue of the firm. Using an unbalanced panel dataset of 24,778 firm-years for 4,630 firms (616 HCs), we find an

economically and statistically significant performance effect of HCs ($\beta = 1.03$, $p < 0.01$). This result is in line with Rammer and Spielkamp (2015). *Table A4.7* of the appendix shows the regression results obtained when using ROS as the dependent variable.

Furthermore, we also performed regressions with winsorized dependent variables. To take into account outlier effects (Yale & Forsythe, 1976), we transform the top (bottom) 1% and 5% of ROA and ROE, respectively; 1% (5%) of the lowest values are recoded to the value of the 1st (5th) percentile, while 1% (5%) of the highest values are recoded to the value of the 99th (95th) percentile. The results are as follows: Winsorizing at the 1% level yields a significant relationship between HC and ROA of $\beta = 1.65$ ($p < 0.01$). The relationship between HC and ROE is $\beta = 3.37$ ($p < 0.10$). Winsorizing at the 5% level yields similar results. *Table A4.8* of the appendix displays detailed results.

Finally, we also performed regressions using other earnings measures such as earnings before interest and taxes (EBIT) and earnings before interest, taxes, depreciation, and amortization (EBITDA). To calculate our dependent variables based on EBIT (EBITDA), we divided a firm's EBIT (EBITDA) by assets in case of ROA, and by equity in case of ROE.[17] Our results are in line with those of our main analysis (*Section 4.4.2*). Using ROA and ROE based on EBIT, we again find an economically and statistically significant performance effect of HCs on ROA ($\beta = 1.59$, $p < 0.01$), but not on ROE ($\beta = 2.65$, $p > 0.10$). Likewise, for our analyses using ROA and ROE based on EBIT (ROA: $\beta = 1.18$, $p < 0.05$; ROE: $\beta = 1.27$, $p > 0.10$). *Tables A4.9* and *A4.10* of the appendix show the regression results using ROA and ROE respectively based on EBIT and EBITDA as dependent variables.

4.4.4 Limitations

Our study has some limitations. First, our sample is limited to Germany and to the manufacturing sector. The German manufacturing sector is a strong, export-oriented industry dominated by Mittelstand firms (Bernard & Wagner, 1997). Our findings may not generalize to HCs and Mittelstand firms operating in industries that are less export-oriented, more B2C focused or more service dominated. A second limitation concerns the large number of missing values affecting our profitability measures, which could lead to sample selection bias. Third, as our sample firms are mostly privately owned, we do not have information on the firms' market values and market-based performance measures. Finally, as our focal variable HC is constant

[17] Accordingly, we adjusted our control variable ROA volatility (%) so that it refers to the ROA based on either EBIT or EBITDA in the respective regressions.

over time, we cannot run fixed-effects regressions, which limits the interpretation of our findings, as we cannot claim causal effects.

4.5 Discussion and implications

4.5.1 Summary of main results

The results of our empirical analyses support some of the earlier evidence on HCs (Audretsch et al., 2018; Rammer & Spielkamp, 2015; Voudouris et al., 2000). For example, our results show that HCs have higher export ratios and higher patent output levels than other Mittelstand firms. Moreover, they are older, have less performance risk and have higher equity ratios. Regarding performance, our regressions show that HCs have a higher ROA but not a higher ROE. The HC performance effect on ROA is 1.7 percentage points and is therefore not only of statistical but also of practical significance. We also find that the HC performance effect is very heterogeneous and varies greatly. In particular, an interaction exists, and the effect seems to decrease with firm size. What do these results mean for theory and practice?

4.5.2 Implications for theory and future research

Our study contributes to prior research on the determinants of financial profitability and particularly work on the link between strategy and performance (e.g., Bowman & Helfat, 2001; Dess & Davis, 1984; Hansen & Wernerfelt, 1989; Spanos et al., 2004; White, 1986). The question of which strategy leads to competitive advantage has been an integral part of the strategic management literature since such research began (e.g., Campbell-Hunt, 2000; Spanos et al., 2004). As a result, research has identified different strategic orientations of firms and examined their effects on performance. For example, the typologies developed by Porter (1980) and Miles and Snow (1978) are among the most prominent strategic frameworks to date (Campbell-Hunt, 2000; Ramos-Rodríguez & Ruíz-Navarro, 2004). Both authors define strategic archetypes that firms follow to gain a competitive advantage. While Porter (1980) distinguishes between three generic strategies (cost leadership, differentiation, and focus), Miles and Snow (1978) divide firms into defenders, prospectors, and analyzers according to their strategic orientation. Empirical evidence suggests that a firm's strategy indeed influences its performance (e.g., Bowman & Helfat, 2001; Leitner & Güldenberg, 2010; Spanos et al., 2004). For SMEs (De Massis et al., 2018; Franch Parella & Carmona Hernández, 2018; Gomes-Casseres, 1997; Lee et al., 1999; Muzyka et al., 1997) and family firms (e.g., Hennart et al., 2019; McCann et al., 2001), prior research has identified a focused niche market strategy as particularly suitable and profitable. Taking into account SMEs' resource constraints, Lee et al.

(1999), for example, show that a niche market strategy allows SMEs to successfully compete with larger firms. Moreover, Hennart et al. (2019) find the adoption of a global niche business model to be a fruitful path for family-managed SMEs to overcome internationalization limitations and increase foreign sales. Our results confirm that a niche market strategy can lead to superior financial performance and that such a strategy fits well with the characteristics of small and mid-sized firms. In this way, our study also contributes to research on the relationship between firm size and firm performance (e.g., Lee et al., 2009; Leitner & Güldenberg, 2010; Serrasqueiro & Nunes, 2008; Shinkle et al., 2013; Thornhill & White, 2007; Wagner 1995), suggesting a niche strategy as an important moderator variable.

In addition to contributing to the broader strategy literature, our study contributes to a better understanding of the HC phenomenon. This is the first study to analyze the performance of HCs in a large-scale quantitative study. By evaluating the accounting performance of HCs in terms of ROA and ROE, we extend research on the characteristics of HCs (e.g., Audretsch et al., 2018, 2020; Benz et al., 2021; Lehmann et al., 2019) and Mittelstand firms (Berghoff, 2006; Berlemann & Jahn, 2016; Pahnke & Welter, 2019). We answer the question of whether and to what extent HCs outperform other Mittelstand firms. While we can generally confirm outperformance (at least with regard to ROA), we also find substantial performance heterogeneity *within* the group of HCs. This result parallels findings from research on the performance of family firms. Miller et al. (2007) and Andres (2008) show that family firm performance depends very much on the definition of family firm and on the type of family firm considered. Some researchers even go so far as to completely reject the idea of comparing the performance of family and nonfamily firms and suggest focusing only on performance differences *among* family firms instead.

Our study can be seen as a starting point for research on the performance of HCs and their determining factors. More research is needed to better understand why and under which conditions HCs outperform other firms. When does a focused niche market strategy create economic value and when does it not? What internal and external factors interact with the HC strategy leading to (out-)performance? Potential external factors include country and regional level institutions (Audretsch et al., 2020; Lehmann et al., 2019; Pahnke & Welter, 2019), competitive factors (Porter, 1980), and technological and industry environments (Spanos et al., 2004). Potential internal factors include a firm's resources and capabilities, such as its absorptive capacity, ambidexterity, and dynamic capabilities. Such a resource-based perspective of the HC strategy is missing thus far in the literature on HCs. Such a perspective would also extend the strategic fit literature (Bingham et al., 2011; Geiger et al., 2006; Lindow

et al., 2010; Zajac et al., 2000). A final direction would be to investigate the relationship between firm ownership and HC strategy. For example, are family owners, due to their long-term focus, the ideal owners to pursue a HC strategy (Le Breton-Miller & Miller, 2006; Lumpkin et al., 2010)?

4.5.3 Implications for practice

The results of our study have practical implications for firm managers and owners in showing that a HC strategy can lead to superior firm performance, particularly for firms with fewer than 900 employees. Focusing on niche markets with a strong international and export orientation seems to be a profitable strategy. Our results should be interpreted with caution, however. Notable performance differences exist *within* the group of HCs, and by far, not all HCs are successful. It is also difficult for other Mittelstand firms to imitate an HC strategy. Hence, it is questionable whether HCs can truly serve as a role model for other firms. More research is needed to better understand when and under which conditions an HC strategy leads to superior performance and should be employed.

Chapter 5

Hidden Champions as a determinant of regional development: An analysis of German districts

HCs are defined as market leaders in niche markets. They represent the success of the German Mittelstand like no other group of firms. However, little is known on how HCs contribute to regional development. Given their export strength, regional embeddedness, and strong vertical integration we expect HCs to have a profound effect on regional development. Using a German dataset of 1,645 HCs located in 401 German districts, we analyze the effect of HCs on a variety of regional development dimensions. Our results show that HCs are not equally distributed across regions and influence regional development. Regions with a higher number of HCs show strong regional economic performance in terms of median income. Moreover, HC intensity affects regional unemployment and trainee rates as well as regional innovation in terms of patents. Surprisingly, we did not find an effect of regional HC intensity on regional R&D levels and gross domestic product (GDP). We can further conclude that the effect of HCs is not limited to the particular region in which they are located but that sizable spillover effects exist. Besides its contribution to the regional development literature, our study adds to a better understanding of the HC-phenomenon. Implications for regional policy makers are discussed.

This chapter is based on

Benz, L., Block, J., & Johann, M. (2021). Hidden champions as a determinant of regional development: an analysis of German districts. *ZFW–Advances in Economic Geography*.[18]

[18] The values in this chapter slightly differ from those in Benz et al. (2021) due to an update of the HCs dataset.

5.1 Introduction

Defined as (world) market leaders in a niche market, HCs are a successful subgroup of the German Mittelstand. Discovered as a phenomenon in the 1990s by Hermann Simon, the concept of the HC is now widespread. Though HCs partly overlap with the German Mittelstand, comprising many family businesses, the hidden (world) market leaders clearly stand out as they possess distinct characteristics. Their formula for success includes, among other things, the combination of a niche market focus and intense internationalization as well as superior technological capabilities and a specialized workforce (e.g., Audretsch et al., 2018; Rammer & Spielkamp, 2015, 2019; Simon, 2012).

HCs and the German Mittelstand in general make considerable contributions to the performance of the German economy and its status as a dominant export nation. In a country comparison study, Audretsch et al. (2020) identify Germany as the nation with the largest number of world market leaders per capita, which might be one reason for the success of the German economy. In addition to their importance at the national level, the impact of HCs on the regional economy is undeniable. Indeed, regional studies have examined related firm types such as family firms or members of the German Mittelstand in general and have found evidence of an impact on different regional development dimensions (e.g., Stough et al., 2015). For instance, previous studies analyzed the impact of these firm types on regional innovativeness (Berlemann & Jahn, 2016; Block & Spiegel, 2013), regional economic growth (Memili et al., 2015) and regional resources such as human resources (Basco, 2015).

Although the three groups partly overlap, considerable differences exist, which are crucial for a separate analysis of HCs at the regional level. HCs are, for example, defined by market leadership in a niche market (Simon, 2012) and not by firm ownership as family firms. An analysis of the regional impact of HCs provides the opportunity to gain deeper insights into the HC phenomenon, which is especially interesting from a policy perspective at the regional level. HCs make considerable contributions to the performance of the German economy (e.g., Lehmann et al., 2019) and they represent major employers (e.g., Pahnke & Welter, 2019). Also, HCs are regionally connected and not only located in agglomerated but also peripheral areas (e.g., Audretsch et al., 2008; Lang et al., 2019). Due to the different characteristics of HCs, it is important to learn about their influence at the district level and uncover how they affect regional development dimensions such as performance or employment. Accordingly, HCs can attract the attention of policy makers and thus receive more support for the further development of the

regions in which they are located. These considerations lead to the following research question: *What impact does regional HC intensity have on regional development?*

To answer this research question, we combine a dataset covering 1,645 German HCs with a dataset covering the 401 German districts. The former serves as the basis for our independent variable *HC intensity*. The latter consists of data on regional development dimensions and regional level control variables. After combining both datasets, the final dataset with 401 observations emerges, representing the 401 German districts. Conducting linear regression analyses, we examine the influence of HC intensity on a wide range of regional development dimensions, i.e., regional economic performance, employment, and innovation, to obtain comprehensive insights into how regional HC intensity affects regional development.

The findings show that HC intensity significantly influences each of the regional development dimensions examined in our study. We find only partial support for the anticipated effects on the dimensions of regional economic performance and regional innovation, showing that HC intensity significantly affects these two dimensions only to a limited extent. In terms of regional employment, we find a significant influence of HC intensity on both variables capturing this regional development dimension, fully supporting the expected relationships. These results have to be considered in light of potential reverse causality which is a common limitation of geographic studies that are unable to use historical data. In our case, we lack past information on the HC dataset.

Consequently, our study contributes to the small and emerging stream of HC literature, which has been rather scant so far, with few scientifically published academic studies (e.g., Audretsch et al., 2018, 2020; Johann et al., 2022; Lehmann et al., 2019). Our findings contribute to a better understanding of HC functionality by looking at how these firms affect several regional development dimensions. Hence, we uncover the impact of HCs on economic performance, employment, and innovation at the regional level, highlighting the key role of this group of firms in the districts in which they are located. By examining HCs on a regional level, we also contribute to the literature on determinants of regional development (e.g., Block & Spiegel, 2013; Fritsch & Müller, 2008; Vonnahme & Lang, 2019), showing that HCs are an influential group of actors in the regional economy. Subsequently, these findings also have practical implications, especially for policy makers at the regional level.

This study is structured as follows: *Section 5.2* provides deeper insights into the phenomenon of HCs, followed by an overview of the literature on the determinants and dimensions of regional development. *Section 5.3* contains the derivation of hypotheses on the

impact of HC intensity on selected regional development dimensions. The data and methodology of the study are explained in *Section 5.4*, further introducing the variables included in our examinations. *Section 5.5* presents the descriptive and multivariate analyses conducted, as well as a series of robustness checks and post hoc analyses. Finally, we discuss our findings in *Section 5.6*, reveal the implications and limitations of the study, and highlight arising avenues for future research.

5.2 Literature review

5.2.1 The Hidden Champion phenomenon

HCs represent a particularly successful subgroup of medium-sized firms. Simon first discovered the HC phenomenon in the 1990s. The following conceptual understandings of HCs therefore originate from Simon (1996, 2012, 2013), who defines HCs according to three criteria. First, HCs are among the top three market-leading firms in the global market or are number one in their domestic continent. Second, HCs earn revenues below five billion Euros, and third, they are relatively unknown to the public. While market share and revenue are quantitative and regularly utilized criteria for identifying HCs, academic studies typically do not operationalize the qualitative criterion of public awareness (e.g., Rammer & Spielkamp, 2015, 2019). As the definition indicates, HCs primarily pursue the two synergistic goals of market leadership and growth. On the one hand, HCs strive for market leadership in quantitative terms in the form of market share, as well as in qualitative terms in the form of leadership over market participants by setting standards or being pioneers. On the other hand, HCs strive for continuous growth. Numerous examples of former HCs that became major international enterprises listed on the stock exchange (e.g., *SAP* and *Fresenius Medical Care*) demonstrate this. To achieve their goals, HCs follow a strategy that combines two paradigms that initially appear to be contradictory. HCs strictly focus on niche markets where they serve selected customers with high-quality products. Nevertheless, while their focus on a selected niche makes their market small, international expansion gives them the necessary size to operate profitably. Therefore, HCs sell specialized products on a global scale (e.g., Audretsch et al., 2018; Voudouris et al., 2000).

Consequently, the HC phenomenon relates to the strategy literature. According to Porter (1980), firms strive for competitive advantages through the pursuit of one of three generic competitive strategies: cost leadership, product differentiation, or focus. While the achievement of competitive advantages through cost leadership refers to product standardization, mass-

market service, and the reduction of fixed costs, product differentiation attempts to achieve a competitive advantage by offering high-quality products and exploiting customers' increased willingness to pay for such products. The focus strategy represents a variation on product differentiation, as it aims to offer high-quality products specifically tailored to the needs of selected customers in a defined market segment. Hence, firms pursuing a focus strategy operate in niche markets (e.g., Audretsch et al., 2018; Toften & Hammervoll, 2009, 2010a, 2010b). In general, a niche market is a narrowly defined market that typically consists of only one customer or a comparatively small group of customers with similar needs (Dalgic & Leeuw, 1994). Accordingly, a niche market strategy describes a firm's concentration on certain customer needs, product segments, or geographically or demographically defined markets (Teplensky et al., 1993; Toften & Hammervoll, 2010a, 2010b). Firms following a niche market strategy position themselves in small, profitable, and homogeneous market segments that are not occupied by competitors (Dalgic & Leeuw, 1994).

Reviewing prior research, Toften and Hammervoll (2009, 2010b) identify seven interrelated characteristics of firms operating in niche markets. These characteristics contribute to the successful implementation of a niche market strategy and thus correspond to the HC strategy. First, niche firms think and act small (Hamermesh et al., 1978) as they offer, for example, comparatively small production volumes, concentrate only on selected customers, and deliberately choose markets in which few competitors operate (Hezar et al., 2006). Although HCs operate in narrowly defined markets and produce small volumes for their national customers, their production volumes grow due to their international expansion. Second, niche firms consciously select markets based on their own strengths and competencies (Hamermesh et al., 1978), entering into only those niches where they are able to contribute valuable products due to specific skills and in-depth knowledge. Consistent with this strategy, HCs are specialists within their industries. To maintain a market-leading position, they manufacture technologically advanced products and position themselves as quality leaders. Consequently, HCs require profound expertise, which they have acquired mainly due to their qualified workforce and extensive innovation activities (e.g., Lehmann et al., 2019; Rammer & Spielkamp, 2015, 2019; Schenkenhofer, 2022). Third, niche firms stand out by applying specialization and differentiation, typically with reference to products and customers (e.g., Audretsch et al., 2018, 2020; Dalgic & Leeuw, 1994; Kotler, 1997). In line with this, HCs focus on the individual demands of a limited customer base for whom they provide a correspondingly defined product segment. Moreover, they not only manufacture quality products but also offer a deep range of services within narrowly defined markets. To provide depth in value creation,

HCs typically have their own production facilities and innovation labs (Rammer & Spielkamp, 2015, 2019). Fourth, they are subsequently able to cover several stages of their customers' value chain, directly aligning their specialized competencies and resources with their customers' needs. Hence, HCs tailor their products precisely to customer-specific demands and set a strong focus on customer needs (Dalgic & Leeuw, 1994). Fifth, niche firms attach great importance to their reputation and use word-of-mouth references to expand (Dalgic & Leeuw, 1994). Since HCs typically operate in business-to-business (B2B) markets, they are little known to end-product consumers. Because HCs avoid extensive marketing activities, a strong reputation functions as a prerequisite for successful business relations. Apart from this, HCs practice a strong value system based on conservative principles such as trust and loyalty, guiding both their internal and external relationships. Sixth, HCs consequently build strong long-term relationships with relevant stakeholders (Dalgic & Leeuw, 1994; Voudouris et al., 2000). In addition to close relationships with employees, HCs maintain tight customer relations (e.g., Audretsch et al., 2018). Customer proximity forms their greatest strength and is, due to international expansion, actively practiced across national borders. Because complex, customized products require regular customer contact, HCs enter foreign markets at an early stage, rely on direct sales, and establish their own subsidiaries abroad. Furthermore, HCs carry out innovation activities in close consultation with their customers, and even top management maintains regular contact with customers (e.g., Rammer & Spielkamp, 2015, 2019). Seventh, niche firms charge a price premium, as they are able to offer superior customer value (e.g., Dalgic & Leeuw, 1994; Kotler, 1997). Since HCs provide highly specialized products with state-of-the-art technology, they do not compete on the price of their products. Therefore, prices are typically above the market average, which in combination with their international expansion significantly contributes to niche market profitability. Analyzing a sample of 4,677 German manufacturing firms over a period of ten years, Johann et al. (2022) for example show that HCs have a significantly higher profitability with regard to ROA than non-HCs.

5.2.2 Determinants and dimensions of regional development

Regional development represents a multifaceted construct that links both different determinants and different dimensions at the regional level, as the processes and resources available to a region determine its development along several dimensions (Stimson et al., 2006). With regard to the determinants of regional development, prior research has investigated, among other things, whether the presence of certain firm types affects regional development. For example, scholars have examined the role of family businesses (e.g., Basco, 2015; Block & Spiegel,

2013; Stough et al., 2015). Starting with the specific characteristics of family businesses, Basco (2015) systematically links the family business and regional development literatures to analyze whether family businesses affect the factors, processes, and proximity dimensions of regional development. Similarly, Stough et al. (2015) investigate whether and how family businesses contribute to regional economic growth and development. Moreover, Block and Spiegel (2013) study the impact of family firm density on regional innovation output. Furthermore, scholars have analyzed the influence of new business formation on regional development (e.g., Fritsch, 2008; Stuetzer et al., 2014). For example, Fritsch and Müller (2004) examine the relationship between new business formation and regional development over time, identifying time lags as well as both positive and negative effects of new business formation on regional employment changes. As a follow-up, Fritsch and Schroeter (2011) investigate the effect of start-up activity on employment growth at the regional level, finding an inverse U-shaped relationship. However, while prior research has frequently examined the impact of specific types of firms, such as family businesses or start-ups, on regional development, research analyzing HCs as a determinant of regional development is rather scarce. Lang et al. (2019) as well as Vonnahme and Lang (2019) examine the role of HCs in small towns and peripheral regions. Analyzing five economic indicators, Lang et al. (2019) show that small towns with HCs, in peripheral as well as non-peripheral regions, are in a better economic situation than small towns without HCs. Also, qualitative research on HCs as a determinant of regional development exists in form of case studies (e.g., Kirchner, 2019). Taking a quantitative approach, Vonnahme and Lang (2019) examine innovation activities based on a survey of 129 HCs. Since no homogeneous picture for the innovation behavior of HCs can be drawn, a cluster analysis divides the firms into groups that differ, for instance, with regard to the geographic focus of innovation activities. As the extent to which HCs contribute to progress and prosperity at the regional level remains mainly unclear, this study aims to empirically investigate the effect of HCs on several dimensions of regional development.

Concerning the dimensions of regional development, prior research has offered a diverse set of thematic priorities, including economic (e.g., Porter, 2003), institutional (e.g., Rodriguez-Pose, 2013) and social (e.g., Iyer et al., 2005) dimensions. Focusing on the economic dimensions of regional development, scholars have investigated regional innovativeness (e.g., Broekel & Brenner, 2011). In this context, Fritsch and Slavtchev (2011) emphasize the role of regional innovation systems, empirically analyzing factors that account for differences in the efficiency of regional innovation systems. Moreover, various studies have investigated the innovation output of regions as measured by the number of successful patent applications (e.g.,

Berlemann & Jahn, 2016; Block & Spiegel, 2013). In addition to analyzing dimensions related to knowledge creation at the regional level, others have considered employment-related dimensions (e.g., Fritsch & Müller, 2008). Relating start-up rates to regional employment changes over time, Fritsch and Müller (2008), for example, find significant differences across regions in Germany; the effects of new business formation on regional employment changes are higher in agglomerations and regions with a high level of labor productivity than in rural areas and regions with a low level of labor productivity. For this study, we select three different dimensions of regional development in order to offer a broad picture on how HCs influence regional development.

5.3 Hypotheses

Since prior research has not sufficiently addressed the role of HCs as a determinant of regional development, the present study empirically investigates the effect of HCs on the following three dimensions of regional development: (1) regional economic performance, (2) regional employment, and (3) regional innovation. These three dimensions of regional development and the referring variables only partially capture the role of HCs as a determinant of regional development. In the following sections, we present each dimension and address their operationalization and the corresponding hypotheses. *Figure 5.1* provides an overview of the seven hypotheses and the expected influence of HC intensity on these regional development dimensions. In our study, we focus on the HCs' headquarters.[19] Even though HCs organize their work on average with ten different locations (Vonnahme & Lang, 2019), prior research shows that the headquarters of multinational and multibusiness firms play a significant role in an entrepreneurial as well as administrative sense (e.g., Ambos & Mahnke, 2010; Chandler, 1991; Landau & Bock, 2013). Therefore, we would like to put an emphasis on the HCs' headquarters and their impact on regional development.

5.3.1 Regional economic performance

The economic performance of a nation is closely linked to that of its individual regions, which can vary considerably. Therefore, many of the essential determinants of economic performance reside within individual regions rather than nations (e.g., Porter, 2003; Kitson et al., 2004). One of the most commonly used measures of economic performance is GDP. It represents the total value of all goods, including products and services, generated in one year within the national

[19] If the global headquarter is located outside of Germany, we include the national German headquarter of the HC.

borders of an economy. When transformed into GDP per capita for a defined area, conclusions about the development and performance of a region are possible. GDP is primarily generated by the production of goods. Although HCs operate in niche markets with small production volumes, operating on an international scale offers the potential to expand their production volumes. Since they manufacture on their own, HCs possess large production facilities, often located in rural areas. By producing large quantities locally (e.g., Lehmann et al., 2019), HCs significantly contribute to the GDP of their native regions. Consequently, we expect districts with a high intensity of HC headquarters to exhibit a higher GDP per capita.

H1a: *Regional HC intensity is positively associated with regional GDP.*

In addition to GDP, which captures the productive strength of a region, income levels are a fundamental measure of economic performance, as they reflect the standard of living of the regional workforce (Porter, 2003). As previously mentioned, HCs generate huge profits by selling specialized goods on a global scale. Since HCs are deeply rooted in their home region, a large portion of their profits flows into the firm and its employees. Moreover, HCs are stable employers who view their workforce as an important factor in their success (e.g., Lehmann et al., 2019; Voudouris et al., 2000). Hence, monetary incentives play an important role in keeping employees over the long term. Profitably operating within global niche markets, HCs typically possess sufficient economic strength to offer monetary incentives and pay adequate salaries. Consequently, we expect districts with a high intensity of HC headquarters to have a higher median income.

H1b: *Regional HC intensity is positively associated with regional labor income.*

In addition to GDP and labor income, business taxes represent another appropriate indicator of regional economic performance, adding a tax perspective to the presented measures. Business taxes are levied on the earnings generated by a domestic business. Thus, the amount of business tax to be paid directly depends on the amount of profits made. Therefore, business taxes are the most important source of revenue for a district's municipalities. For the same reasons as those already presented for hypotheses 1a and 1b, HCs significantly contribute to the business tax revenue of the municipality in which they are located (Lang et al., 2019; Röhl, 2008). Because HCs successfully operate within global niche markets, they achieve comparatively high profits, thus leading to high business tax payments. Also, since HCs act independently and concentrate most of their activities and employees in their selected locations (e.g., local production facilities), business tax payments flow almost entirely into their native municipalities (e.g., Becker & Fuest, 2010). As a result, municipalities that are home to HCs have higher business

tax revenues. Wealthy municipalities in turn form the basis for the financial strength and economic prosperity of entire districts. Consequently, we expect districts with a high intensity of HC headquarters to have higher business tax revenues.

H1c: *Regional HC intensity is positively associated with regional business tax revenues.*

5.3.2 Regional employment

In addition to performance indicators, human resource-related figures reflect regional development. Regional employment refers to the proportion of working-age people employed within a given region. Due to regional differences in population density, the unemployment rate serves as an accepted indicator of employment levels, making regions more comparable. Because HCs serve global niche markets, they need to handle relatively large production quantities. Nonetheless, HCs avoid outsourcing or strategic alliances and rely on maximum independence as well as control in production (Simon, 2013). Consequently, they require a large workforce. Their strong growth further fuels the continuous demand for qualified employees. As a result, HCs try to manage the recruitment and long-term retention of employees by offering attractive jobs and familial corporate cultures (e.g., Lehmann et al., 2019; Voudouris et al., 2000). Accordingly, HCs make larger investments in human resource management practices (Rammer & Spielkamp, 2019), acting as reliable long-term employers within mostly rural regions (Lang et al., 2019; Lehmann et al., 2019; Pahnke & Welter, 2019). HCs permanently attract new employees and thus significantly contribute to regional employment. As a result, we expect districts with a high intensity of HC headquarters to exhibit lower unemployment rates.

H2a: Regional HC intensity is negatively associated with the regional unemployment rate.

The manufacture of advanced products also requires specific expertise and technical knowledge (e.g., Lehmann et al., 2019; Rammer & Spielkamp, 2015, 2019). Hence, HCs need specially trained workers and invest not only in the training and development of employees but also in the education of the trainees themselves. In particular, the dual apprentice system in Germany, which specifically combines theoretical and practical teaching content, is an important pillar of the HC employment strategy (Audretsch et al., 2020; Jahn, 2018; Lehmann et al., 2019; Schenkenhofer & Wilhelm, 2020). It systematically ensures the technical competence of the workforce that is necessary to provide high-quality products. Jahn (2018) also verifies a significantly positive relationship between the relative importance of medium-sized firms and

apprenticeship training at the regional level. Consequently, we expect districts with a high intensity of HC headquarters to have higher numbers of trainees.

H2b: *Regional HC intensity is positively associated with the regional trainee rate.*

5.3.3 Regional innovation

The relevance of regional innovation as well as its possible determinants have received great attention in recent research (e.g., Block et al., 2021; Fritsch & Slavtchev, 2011; Makkonen & van der Have, 2013). For example, Broekel and Brenner (2011) examine how twelve selected regional factors, including the number of R&D employees, the presence of universities and technical colleges, and public research institutions, among others, affect the innovativeness of a region. Similar to various other studies (e.g., Block & Spiegel, 2013; Fritsch & Slavtchev, 2011; Fritsch & Wyrwich, 2021; Thomi & Werner, 2001), they relate these factors to the concept of regional innovation systems. A regional innovation system describes the components and processes of innovation on a regional level, forming an institutional setting within a region in which firms and other organizations interact and learn from each other (Cooke, 2001; Cooke et al., 1998). This system provides targeted support for innovation activities at the regional level by creating an innovation-friendly climate that stimulates research cooperation, knowledge creation, and spillovers. Ultimately, this leads to increased regional innovation activities, both with regard to innovation input, for example, in terms of R&D expenditures, and innovation output, for example, indicated by the number of patent applications and NPD. R&D expenditures and granted patents only represent a fraction of local innovation activities and allow limited statements on the innovation dynamics of a region as they focus almost exclusively on technological innovation (Block et al., 2021); however, they are established indicators in this context (e.g., Fritsch & Slavtchev, 2011).

Niche firms play a particularly important role within regional innovation systems, as they require substantial expertise and profound knowledge to provide customers with specialized products (e.g., Dalgic & Leeuw, 1994). Thus, to meet individual requirements and offer technological enhancements, HCs maintain large innovation capacities (e.g., Rammer & Spielkamp, 2015, 2019). With regard to innovation input, HCs are associated with high levels of R&D investments (e.g., Audretsch et al., 2018; Schlepphorst et al., 2016; Zucchella & Palamara, 2006). In a survey of 129 German HCs, Vonnahme and Lang (2019) find that more than 80% conduct in-house R&D. In addition to their own R&D activities, HCs often maintain regional relationships with universities and research institutions for innovation development,

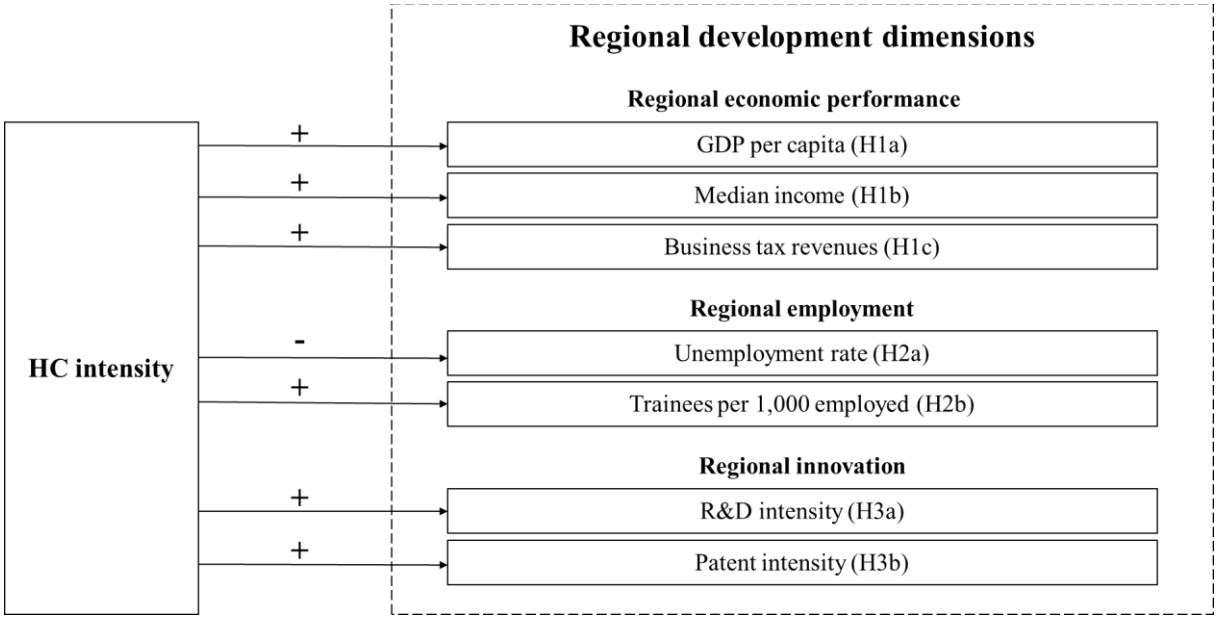
thus fostering the creation and exchange of knowledge (Rammer & Spielkamp, 2015). Also, the majority of HCs assigns R&D contracts to third parties (Vonnahme & Lang, 2019). Further, Fritsch and Slavtchev (2011) show that knowledge spillovers enhance private sector innovation activity, positively influencing regional innovation system efficiency. Therefore, by continuously investing in innovation (e.g., Rammer & Spielkamp, 2015, 2019), HCs contribute to technological progress and substantially promote regional innovation. Consequently, we expect districts with a high intensity of HC headquarters to exhibit higher R&D expenditures.

H3a: *Regional HC intensity is positively associated with regional R&D intensity.*

Furthermore, the innovation activities of HCs are also visible with regard to innovation output. As HCs claim to be quality and technology leaders within global niches, they actively shape their markets by setting standards and taking on a pioneering role in the introduction of market novelties. Typically, HCs conquer their niche markets with radical innovations and subsequently defend their market-leading position through incremental improvements (e.g., Audretsch et al., 2020; Rammer & Spielkamp, 2015, 2019; Voudouris et al., 2000). The innovation rate of HCs considerably exceeds the average rate for the German economy (Vonnahme & Lang, 2019). As a result, the protection of intellectual property plays an important role, particularly with regard to product innovations. In addition to lead-time advantages, HCs heavily rely on patents as an effective protection mechanism. Typically, HCs possess significantly more patents than large firms do (e.g., Rammer & Spielkamp, 2019). Thus, their leading role in knowledge creation and innovation development results in higher innovation output at the regional level, which is partly reflected by patent indicators. Consequently, we expect districts with a high intensity of HC headquarters to have a higher number of granted patents.

H3b: *Regional HC intensity is positively associated with regional patent intensity.*

Figure 5.1: Influence of HC intensity on regional development dimensions



Source: Own illustration.

5.4 Data and method

5.4.1 Data sources and sample

The sample in our study consists of 401 observations, representing the 401 German districts. These refer to the NUTS 3 level (Nomenclature des unités territoriales statistiques), the official classification of the European Union for regional statistics, including all German districts and independent cities (European Union, 2018). Data at the district level stem from various sources: (1) the INKAR online database of the Federal Office for Building and Regional Planning (BBSR), (2) the EPO, (3) the Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States, (4) the Donors' Association for Science Statistics, and (5) the Communal Education Database of the Statistical Offices of the Federal Republic of Germany and the Federal States. *Section 5.4.2* provides more details on the data source for each variable. The independent variable HC intensity is an exception, as we first collect data for this variable at the firm level via the BvD database Orbis and the Electronic Federal Gazette (Bundesanzeiger) and then convert it into a district level variable. Additionally, we accessed data on the C-DAX stocks from the webpage of the Deutsche Börse AG, and venture capital (VC) investment data stem from the business-matching platform Spotfolio.

5.4.2 Variables

In the following, we describe the variables included in our analyses in detail. Additionally, *Table A5.1* provides a summary of the variables, including variable names, short descriptions of the variables, the data sources, and variable categories.

Dependent variables

Seven dependent variables are included in our study, referring to the three regional development dimensions identified in S*ection 5.3*. Regional economic performance is captured by *GDP per capita* in Euros per district in 2016; *median income*, measured as the monthly salaries of full-time employees subject to social insurance contributions in Euros per district in 2017; and *business tax revenues* in Euros per inhabitant per district in 2017. Data for all three variables are retrieved from the INKAR online database.

The *unemployment rate* is the first indicator for the second dimension, regional employment. It is measured as the share of unemployed individuals in the civilian labor force in percent per district in 2017. A further indicator for this dimension is the variable *trainees per 1,000 employees* as the number of trainees per 1,000 employees subject to social insurance contributions per district in 2017. Data for both variables are obtained from INKAR.

Regional innovation activity is the third dimension which is partly covered by two established indicators (e.g., Fritsch & Slavtchev, 2011). A measure for the innovation input is *R&D intensity*. The initial data for this variable stem from the Donors' Association for Science Statistics, providing total corporate internal R&D expenditures, including personnel expenses in thousands of Euros, for 377 districts in 2015. For privacy reasons, the values for the remaining 24 districts are included in the total of another district. Therefore, we divide this total value by the number of districts it comprises and use the result to replace the missing data for this variable in the dataset, thus keeping overall R&D expenditures constant. Finally, we calculate R&D expenditures per 100,000 inhabitants, giving the total corporate internal R&D expenditures in thousands of Euros per 100,000 inhabitants per district in 2015. Another variable belonging to this dimension and referring to the innovation output is *patent intensity*, which is the number of patents granted per 100,000 inhabitants per district between 2011 and 2015. The total number of patens per district between 2011 and 2015 for 402 districts is taken from the EPO. Since November 2016, only 401 districts have existed due to Osterode and Göttingen being combined into a single district, Göttingen; hence, we utilize the mean value of the patents from the two former districts as the value for the combined district. Additionally,

we obtain the number of inhabitants in each district from INKAR, which we then divide by 100,000. Finally, the total number of patents is divided by this value to obtain the number of patents granted per 100,000 inhabitants per district.

Independent variable

The starting point for our independent variable is the construction of a sample consisting of 1,645 German HCs. A list-based search was conducted in order to identify the HCs. As a foundation, the HC lists of WirtschaftsWoche (2020) Langenscheidt and Venohr (2014) and Simon (2012) were combined. In addition, we checked other firm lists such as the list of German family enterprises by Seibold et al. (2019) and the lists of innovative (Mittelstand) firms published in Yogeshwar (2019) and Frankfurter Allgemeine Zeitung (2019) for potential HCs. Information on market leadership was additionally selected from the firm websites of the respective firms. Furthermore, we set Google alerts for the terms *Weltmarktführer* and *Hidden Champion* in order to identify additional HCs for our sample.

The 1,645 firms identified fulfill five criteria. First, they are among the top three market leaders worldwide or are number one on a continent. Second, their revenues for 2019, 2018, or 2017 must lie between ten million and five billion Euros. Depending on availability, the revenue data are taken from the BvD database Orbis or the electronic Federal Gazette. Third, all firms must be older than ten years and employ more than 50 people. Information on founding years and employee numbers stems from Orbis or the firm websites. Fourth, all firms must be located in Germany. Fifth, subsidiaries of foreign firms are only included if they operate independently of the mother firm. As the typical HC criterion *unknown to the public* is difficult to measure, we do not include it in our study.

After constructing our sample of 1,645 German HCs, we obtain data on the NUTS 3 level of these firms via Orbis and the firm websites. Thus, we are able to calculate the total number of HCs for each of the 401 German districts. Additionally, we divide the number of inhabitants in each district by 100,000. Finally, the total number of HCs is divided by this value to create our independent variable *HC intensity*: the number of HCs per 100,000 inhabitants per district.

Control variables

We include several control variables in our study. First, *population density*, calculated as the number of inhabitants per km² per county 2017, indicates the rurality of a district. To gain information about the population, we utilized the *population average age* in years per district

in 2017. Both variables are obtained from INKAR. To analyze the business structure of the districts, we utilize *firm intensity* as the number of firms per 100,000 inhabitants per district in 2017, sourced from the Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States. Furthermore, we calculate *university intensity* as the number of public and private universities per 100,000 inhabitants per district in 2018. Data on the total number of universities at the district level originate from the Communal Education Database of the Statistical Offices of the Federal Republic of Germany and the Federal States. Moreover, we calculate *C-DAX intensity* as the number of firms listed in the C-DAX per 100,000 inhabitants per district. Therefore, we accessed a list of the 414 C-DAX stocks from the Deutsche Börse AG on 17 June 2020 and eliminated 16 stocks to avoid double counting, as the associated firms were listed with more than one stock and eliminated another seven stocks because the corresponding firms have not been active since 2016. The remaining 391 stocks and respective firms serve as the basis for our control variable. In addition, we access the number of newly established businesses per 1,000 inhabitants in 2017 from INKAR and replace the missing values for the districts of Bremen and Bremerhaven with the mean from the 399 available districts. We then multiply the numbers by 100 to achieve the number of newly established businesses per 100,000 inhabitants per district in 2017 as our variable *new business formation intensity*.

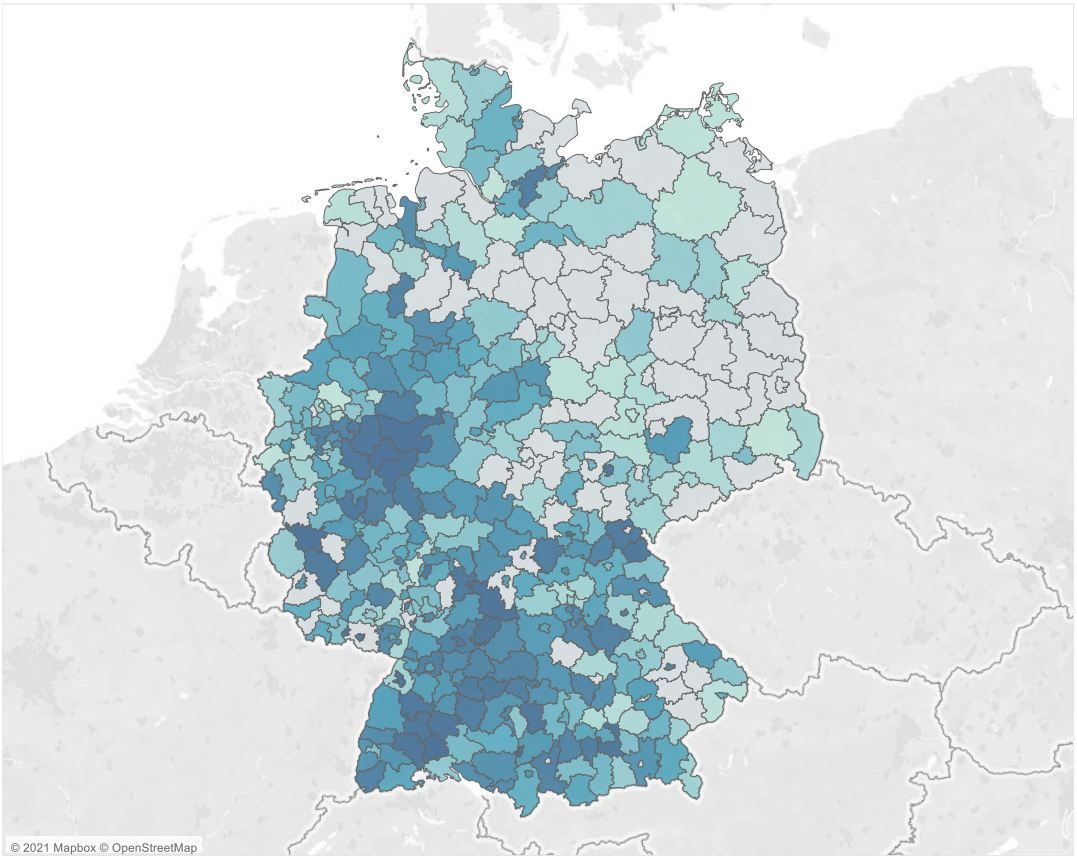
5.5 Results

5.5.1 Descriptive results

In advance of the multivariate analysis, we present a series of descriptive results, starting with an illustration of where the HCs are located in Germany. *Figure 5.2* presents a map of Germany including the district boundaries and the distribution of the number of HCs per 100,000 inhabitants per district. The color of the district indicates the HC intensity; gray districts possess an HC intensity of zero, and darkly colored districts indicate an increasing HC intensity. Tuttlingen possesses the highest HC intensity, with 12.13 HC per 100,000 inhabitants, followed by the districts of Olpe (HC intensity = 10.39), Vulkaneifel (HC intensity = 9.90), Memmingen city (HC intensity = 9.12), and Zweibrücken city (HC intensity = 8.77). Utilizing the absolute number of HCs per district, we calculate a coefficient of concentration, stating that approximately 50% of the HCs are located in 54 of the 401 districts and that the six districts with the highest number of HCs account for more than 10% of the total number of HCs (1,645). Additionally, *Figure A5.1* presents a map of the distribution of the absolute number of HCs per

district, again with darkly colored districts indicating an increasing number of HCs. Ranking the districts according to their absolute number of HCs, the city of Hamburg has the highest number of HCs (35), followed by the city of Munich (33), the city of Berlin (30), Märkischer Kreis (28), and Esslingen (27). Several cartographic representations of HCs in Germany already exist. In order to verify our sample and the distribution of HCs, we compared our map to the representations of Langenscheidt and Venohr (2014), Simon (2012), and Ermann et al. (2011) which is based on the dataset of the Weissman Institute for Family Business. Our map shows a high visual similarity to the reference maps. Thus, it can be assumed that our sample and the distribution of HCs in Germany are in line with previous research. In addition, we calculated the number of world market leaders per district based on the WirtschaftsWoche (2020) sample and correlated it with the number of HCs per district of our sample. We find a correlation of 0.67, indicating a considerable overlap between the geographical distributions of the two samples.

Figure 5.2: Regional distribution of HC intensity in Germany



Notes: Distribution of the number of HCs per 100,000 inhabitants per district; darker colors represent an increasing HC intensity; grey colored districts possess a HC intensity of zero.
Source: Own illustration, created via Tableau.

Table 5.1 presents the descriptive statistics of and correlations among the variables included in the regression model. We detect a greater correlation between median income and GDP per capita (0.72) as well as between median income and population average age (-0.70), neither of which are problematic for the regression analysis. Regarding multicollinearity, the VIFs of the independent and control variables are relatively low and thus unobjectionable. The independent variable HC intensity has a mean of 1.98, which indicates that a district possesses on average two HCs per 100,000 inhabitants, with a minimum of zero and a maximum of 12.13 HCs per 100,000 inhabitants per district. In terms of economic performance, the average district had a GDP per capita of approximately 36 thousand Euros in 2016 and a median income of approximately three thousand Euros in 2017. Concerning regional employment, the districts possessed a mean unemployment rate of 5.36% and 43 trainees per 1,000 employees in 2017. The mean R&D intensity of 65,432.23 thousand Euros per 100,000 inhabitants in 2015 and the mean patent intensity of 69.11 granted patents between 2011 and 2015 provide an overview of the regional innovation activities. Regarding regional exports, the average district possessed an export intensity of 1,060,115 thousand Euros per 100,000 inhabitants in 2017.

Table 5.1: Descriptive statistics

Variable	Mean	SD	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	VIF
(1) GDP per capita	35,684.85	15,891.95	15,920.9	178,706.3															
(2) Median income	3,064.95	451.10	2,183	4,635	0.72														
(3) Business tax revenues	553.45	285.38	180	2,330.1	0.74	0.66													
(4) Unemployment rate	5.36	2.41	1.5	14	-0.05	-0.19	-0.13												
(5) Trainees per 1,000 employed	43.49	8.74	23.98	75.91	-0.01	0.24	0.03	-0.36											
(6) R&D int.	65,432.23	124,742.3	381.89	983,442.9	0.51	0.53	0.30	-0.08	-0.05										
(7) Patent int.	69.11	110.85	0	1,304.21	0.49	0.57	0.45	-0.13	0.01	0.48									
(8) Export int.	1,060,115	1,181,402	15,681.49	1.21e+07	0.47	0.50	0.39	-0.10	0.13	0.48	0.48								
(9) HC int.	1.98	2.00	0	12.13	0.21	0.37	0.33	-0.28	0.33	0.07	0.27	0.20							1.17
(10) Population density	533.75	702.70	36.13	4,686.17	0.48	0.48	0.45	0.42	-0.12	0.23	0.38	0.15	0.02						1.53
(11) Population average age	44.54	1.97	39.81	50.21	-0.49	-0.70	-0.51	0.28	-0.36	-0.28	-0.36	-0.24	-0.28	-0.46					1.77
(12) Firm int.	4,423.55	709.95	2,543.16	8,144.85	0.29	0.18	0.45	-0.35	0.09	-0.03	0.16	0.05	0.23	0.13	-0.23				1.47
(13) University int.	0.14	0.34	0	2.14	0.30	0.13	0.18	0.12	-0.14	0.09	0.09	0.09	0.02	0.26	-0.24	0.14			1.13
(14) C-DAX int.	0.33	0.68	0	4.87	0.40	0.38	0.41	-0.02	-0.09	0.17	0.39	0.13	0.21	0.31	-0.26	0.30	0.20		1.24
(15) New business formation int.	614.69	150.45	207.48	1,481.94	0.31	0.49	0.43	-0.07	0.19	0.08	0.18	0.13	0.17	0.47	-0.57	0.49	0.12	0.27	2.07

Notes: N = 401; SD = standard deviation; VIF = variance inflation factor; int. = intensity.

5.5.2 Multivariate results

Sample assessment

Before testing our hypotheses, we assess the quality of our HC sample as relates to the market leadership criterion. Continental market leadership or being one of the top three firms worldwide is strongly connected with a high degree of internationalization, which can be measured by, i.e., the export performance of a firm (e.g., Sullivan, 1994). Since HCs strive for market leadership in global niche markets, they are characterized by above-average export rates (Fryges, 2006; Johann et al., 2022). Therefore, we test whether regional HC intensity is associated with regional export performance, captured by the variable *export intensity*. The Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States offers data on the export revenues of firms in the manufacturing sector in 2017. Twenty-one missing observations are replaced with the mean of the 380 districts with available data. We report the final variable as export revenues in thousands of Euros per 100,000 inhabitants per district in 2017. The linear regression analysis in the last column of *Table 5.2* indicates a positive effect of HC intensity on export intensity ($\beta = 89{,}074.73$, $p < 0.01$). The international orientation and export strength of HCs make a decisive contribution to the export performance of the region in which they are located. Hence, districts with higher HC intensity also have higher export intensity, supporting our selection of HCs.

Hypothesis tests

We test our hypotheses and examine the influence of HC intensity on various regional development dimensions by conducting a linear regression analysis for each dependent variable (see *Table 5.2*). Thus, we expect the number of HCs per 100,000 inhabitants per district to influence the regional development dimensions. Starting with regional economic performance, we find only partial support for our first hypothesis. HC intensity does not affect a district's GDP per capita, whereas it positively influences median income ($\beta = 45.52$, $p < 0.01$) and business tax revenues ($\beta = 20.55$, $p < 0.01$). Hypothesis 2 on regional employment is fully supported. A large number of HCs per 100,000 inhabitants per district significantly decreases the unemployment rate ($\beta = -0.08$, $p < 0.05$) and increases the number of trainees per 1,000 employees ($\beta = 0.99$, $p < 0.01$). The regression analysis does not support hypothesis 3a, but it does confirm hypothesis 3b, supporting the argument that high HC intensity positively affects the number of patents granted per 100,000 inhabitants per district. We find statistically significant support ($\beta = 9.49$, $p < 0.01$), implying that HC intensity significantly influences only

the output of innovation, measured by patent intensity, not innovation input, i.e., R&D expenditures.

Table 5.2: Linear regression analyses

	Regional economic performance			**Regional employment**		**Regional innovation**		
Dependent variables	GDP per capita (H1a)	Median income (H1b)	Business tax revenues (H1c)	Unemployment rate (H2a)	Trainees per 1,000 employed (H2b)	R&D intensity (H3a)	Patent intensity (H3b)	Export intensity
	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)
Independent variable								
HC intensity	470.63	45.52	20.55	-0.08	0.99	174.12	9.49	89,074.73
	(331.55)	(7.85)***	(5.61)***	(0.04)**	(0.19)***	(3,186.40)	(2.51)***	(28,591.96)***
Control variables								
Population density	6.86	0.12	0.11	0.00	-0.00	24.01	0.05	111.36
	(1.08)***	(0.03)***	(0.02)***	(0.00)***	(0.00)***	(10.39)**	(0.01)***	(100.35)
Population average age	-2,568.29	-114.04	-40.76	0.71	-2.03	-17,644.76	-13.67	-102,252.5
	(415.30)***	(9.83)***	(7.02)***	(0.05)***	(0.24)***	(3,991.31)***	(3.14)***	(38,535.37)***
Firm intensity	4.07	-0.05	0.12	-0.00	-0.00	-14.75	0.01	-68.96
	(1.05)***	(0.02)**	(0.02)***	(0.00)***	(0.00)	(10.08)	(0.01)	(97.34)
University intensity	4,916.57	-98.15	-21.04	0.98	-4.13	-3,149.90	-27.15	116,329.1
	(1,939.35)**	(45.91)**	(32.79)	(0.25)***	(1.14)***	(18,638.49)	(14.67)*	(179,951.1)
C-DAX intensity	4,267.26	109.73	66.86	-0.02	-2.16	22,136.36	41.00	86,096.45
	(1,013.63)***	(24.00)***	(17.14)***	(0.13)	(0.60)***	(9,741.63)**	(7.67)***	(94,053.62)
New business formation intensity	-18.75	0.26	-0.12	0.00	0.01	-108.35	-0.17	-191.92
	(5.87)***	(0.14)*	(0.10)	(0.00)***	(0.00)	(56.43)*	(0.04)***	(544.80)
Constant	136,882.8	8,047.93	1,791.01	-22.99	132.09	963,184.7	673.22	5,756,527
	(20,275.12)***	(480.01)***	(342.78)***	(2.59)***	(11.92)***	(194,857.5)***	(153.39)***	(1,881,313)***
R^2	0.41	0.59	0.48	0.59	0.33	0.12	0.31	0.09
F	39.48***	81.32***	51.73***	79.32***	27.51***	7.64***	25.14***	5.23***

Notes: N = 401 districts; two-sided tests: Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level; Coeff = coefficients, H = hypothesis; SE = standard error.

5.5.3 Spatial autocorrelation results

Spatial autocorrelation is a common source of bias in regional level analyses. Hence, we run a spatial autocorrelation regression analysis for each of the dependent variables, including our independent variable HC intensity and the control variables involved in our main analyses (see *Section 5.5.2*). Therefore, we systematically consider which of the variables require the inclusion of a spatial lag. We suspect the dependent variables, the independent variable and the university- and firm-related control variables to be spatially autocorrelated. The regression model further includes the control variables population density and population average age, which we do not suspect to be spatially autocorrelated. In addition to including the spatial lags of the variables to assess the strength of spatial interactions, we further include spatial error terms to correct for the spatial autocorrelative biases (Anselin, 2001). As the coefficients of the spatial autocorrelation regression analyses are a combination of direct and indirect effects, we perform an impact test that estimates the mean of the direct, indirect, and total influences of the independent and control variables on the reduced-form mean of the dependent variables. *Table 5.3* presents the results of the impact test following the spatial autocorrelation regression analyses, including the direct, indirect, and total effects of HC intensity on the dependent variables. The direct effects report the change in the dependent variable within the same district. Accordingly, the indirect effects describe the spillover effects, i.e., the changes in the dependent variable in neighboring districts. The total effect on a given dependent variable is the sum of the direct and indirect effects.

After controlling for spatial autocorrelation, we retest the effect of HC intensity on our dependent variables, starting with the regional economic performance dimension. While HC intensity does not affect a district's GDP per capita, it positively influences the business tax revenue ($\beta = 20.90$, $p < 0.01$) of the same district. For median income, we find a significantly positive direct ($\beta = 22.64$, $p < 0.01$), indirect ($\beta = 39.19$, $p < 0.01$), and total ($\beta = 61.83$, $p < 0.01$) effect of HC intensity. For the second dimension, regional employment, we detect a significantly negative indirect ($\beta = -0.17$, $p < 0.05$) and total ($\beta = -0.17$, $p < 0.05$) influence of the independent variable on the unemployment rate. Furthermore, HC intensity significantly affects the number of trainees per 1,000 employees directly ($\beta = 0.50$, $p < 0.01$) and in total ($\beta = 1.19$, $p < 0.1$). We find no significant effects for the regional innovation dimension. A comparison between the effects of HC intensity and C-DAX intensity on the dependent variables is discussed in *Section 5.6.1*.

Table 5.3: Impact test following the spatial autocorrelation regression analyses

	Regional economic performance			**Regional employment**		**Regional innovation**		**Sample test**
Dependent variables	GDP per capita	Median income	Business tax revenues	Unemployment rate	Trainees per 1,000 employed	R&D intensity	Patent intensity	Export intensity
	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)
Direct effects								
HC intensity	401.25	22.64	20.90	-0.00	0.50	426.83	6.60	119,110.3
	(358.95)	(7.92)***	(6.12)***	(0.04)	(0.17)***	(139,383.4)	(62.26)	(2,433,441)
C-DAX intensity	4,868.00	101.26	67.59	0.09	-0.82	20,861.31	41.89	-131,488.1
	(1,009.70)***	(21.88)***	(17.32)***	(0.11)	(0.51)	(1,409,616)	(256.27)	(1.05e+07)
Indirect effects								
HC intensity	-206.78	39.19	-13.81	-0.17	0.68	508,127.7	31.20	92,342.05
	(764.70)	(13.87)***	(14.16)	(0.08)**	(0.57)	(2.65e+07)	(202.40)	(2,222,752)
C-DAX intensity	-795.98	61.27	-68.81	-0.07	0.94	-5,146,078	-130.94	-395,087.5
	(2,979.31)	(55.74)	(60.19)	(0.31)	(2.62)	(2.70e+08)	(972.12)	(9,397,393)
Total effects								
HC intensity	194.47	61.83	7.01	-0.17	1.19	508,554.6	37.80	211,452.4
	(771.71)	(14.04)***	(14.34)	(0.08)**	(0.63)*	(2.67e+07)	(263.56)	(241,467.8)
C-DAX intensity	4,072.01	162.53	-1.22	0.02	0.12	-5,125,217	-89.05	-526575.5
	(3,306.80)	(61.69)***	(65.78)	(0.34)	(2.92)	(2.70e+08)	(1,223.84)	(1,211,221)

Notes: N = 401 districts; two-sided tests: Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level; Coeff = coefficients; SE = standard error. Further control variables are included in the model, which are not shown in this table: Population density, population average age, firm intensity, university intensity, and new business formation intensity. Model includes spatial lags of the dependent variables, the independent variable, the control variables C-DAX intensity, firm intensity, university intensity, and new business formation intensity, and spatial autoregressive errors. Generalized spatial two-stage least-squares estimator is used in order to fit multiple spatial lags.

5.5.4 Robustness-checks and further analyses

In addition to the analyses presented above, we perform several robustness checks. First, we exchange several variables with alternative measures to detect divergent effects in the regression analysis. We replace the dependent variable median income with *household income*, retrieved from INKAR as the monthly household income in Euros in 2016 per inhabitant per district. Household income is an alternative measure for regional economic performance, showing how income is distributed across districts. We discover a similar impact of HC intensity on household income ($\beta = 26.87$, $p < 0.01$) compared to median income. The coefficient is lower because the values for household income lie below the median income values.

Furthermore, we choose alternative measures for the control variable university intensity. First, we exchange the control variable with *technical college intensity*. The variable contains the number of technical colleges per 100,000 inhabitants per district in 2018, with data obtained from the Communal Education Database of the Statistical Offices of the Federal Republic of Germany and the Federal States. The significant influence of university intensity on median income, trainees per 1,000 employees and patent intensity now lose significance, while we detect a positive effect of technical college intensity on business tax revenues ($\beta = 50.32$, $p < 0.01$). The significance of the various effects of HC intensity on the different dependent variables remains unaffected. In addition, we combine the two academic education variables and test the effect of using the number of universities and technical colleges as a control variable in the regression analysis. Compared to those of the initial variable, the effects of *university and technical college intensity* on median income, trainees per 1,000 employees and patent intensity become insignificant, and we uncover a positive effect on business tax revenues ($\beta = 34.21$, $p < 0.05$) and export intensity ($\beta = 129{,}132.4$, $p < 0.1$). Again, the significance of the effect of HC intensity on the dependent variables remains unaffected. Thus, the number of universities affects regional development dimensions more significantly than the number of technical colleges.

As a further robustness check, additional control variables are integrated into the regression analysis. We calculate the number of VC investments per 100,000 inhabitants per district between 2011 and 2015, namely, *VC investment intensity*, to capture the number of innovative new businesses. Data on VC investments come from Spotfolio, a business-matching platform with a focus on innovative German high-tech firms. Except for a significantly negative effect on trainees per 1,000 employees ($\beta = -0.47$, $p < 0.01$), the additional control variable is

found to have no effect. In addition, the dependent variable R&D intensity is used as a control variable for the dependent variable patent intensity in a supplementary regression analysis to examine the relationship between the two innovation variables. Slight scaling adjustments, i.e., recalculating the variable as the total corporate internal R&D expenditures in millions of Euros, increase its applicability as a control variable. R&D intensity exerts a significantly positive influence on patent intensity ($\beta = 0.32$, $p < 0.01$). As expected, the innovation input of a district influences its innovation output.

As a final robustness check, we recalculate the independent variable HC intensity as the number of HCs per 100,000 employees per district. Data on the number of employees per district in 2017 stem from the Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States. We find similar significant effects on the dependent variables in the regression analysis, except for the impact on export intensity, which loses significance. Unsurprisingly, effect sizes are smaller for HC intensity per 100,000 employees, as the number of employees per district is below the corresponding number of inhabitants. Additionally, we rerun the regression analyses using the *absolute number of HCs* per district as the independent variable. Significantly positive influences on median income, business tax revenue, and patent intensity persist.

A series of post hoc analyses, which do not focus on our hypotheses, completes the examinations of this study, starting with the test of *VC investment intensity* as an additional dependent variable in the regression analysis. HC intensity does not significantly influence VC investment intensity, i.e., the number of innovative business formations. Thus, this dependent variable is not further examined.

Additionally, we perform a seemingly unrelated regression with the variables included in the main analysis, assuming correlation in the error terms across the equations. The significant and insignificant effects of HC intensity on the dependent variables remain, and the effect sizes are nearly equal to those found in the results of the linear regression models.

As HCs are argued to be mainly active in the manufacturing sector (Rammer & Spielkamp, 2015, 2019), we would like to analyze whether the effects of HC intensity on these regional dimensions are driven by the manufacturing firms in the sample. Therefore, the NACE codes for the HCs are collected via Orbis; missing data are supplemented by a personal assessment of the industry after collecting information from the firm websites. We then divide the sample into two groups: firms mainly active in manufacturing, i.e., NACE codes 10 to 33, and firms in the remaining industries. HC intensity measured as the number of HCs per 100,000

inhabitants per district is then recalculated for the two groups, resulting in *manufacturing HC intensity* and *non-manufacturing HC intensity*. *Table 5.4* shows the results of the linear regression analyses. Starting with exports as a quality assessment of our HC sample selection, only manufacturing HC intensity exerts a significant influence on regional level export intensity ($\beta = 120{,}456.3$, $p < 0.01$).

Concerning the four regional development dimensions, we detect divergent influences of the two HC intensities on several dependent variables. In terms of regional economic performance, the regional GDP is affected only by manufacturing HC intensity ($\beta = 615.16$, $p < 0.1$), as is the case for business tax revenues ($\beta = 20.25$, $p < 0.01$). Both manufacturing HC intensity ($\beta = 45.95$, $p < 0.01$) and non-manufacturing HC intensity ($\beta = 43.52$, $p < 0.1$) positively influence regional median income. The unemployment rate is only influenced by non-manufacturing HC intensity ($\beta = -0.19$, $p < 0.1$), while the trainees per 1,000 employees are affected only by the HC intensity of manufacturing firms ($\beta = 1.22$, $p < 0.01$), representing the differing influence of the different HCs on regional employment. As a measure of regional innovation output, patent intensity is affected by both manufacturing HC intensity ($\beta = 7.98$, $p < 0.01$) and non-manufacturing HC intensity ($\beta = 16.42$, $p < 0.01$). In terms of R&D intensity, we do not find significant effects for the two HC intensities. However, the differing results for exports and the dependent variables presented above show that HCs are a group of firms that are indeed heterogeneous.

Table 5.4: Linear regression analyses (manufacturing versus non-manufacturing firms)

	Regional economic performance			**Regional employment**		**Regional innovation**		
Dependent variables	GDP per capita (H1a)	Median income (H1b)	Business tax revenues (H1c)	Unemployment rate (H2a)	Trainees per 1,000 employed (H2b)	R&D intensity (H3a)	Patent intensity (H3b)	Export intensity
	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)	Coeff (SE)
Independent variables								
Manufacturing HC intensity	615.16 (367.79)*	45.95 (8.72)***	20.25 (6.22)***	-0.06 (0.05)	1.22 (0.21)***	-607.70 (3,537.21)	7.98 (2.78)***	120,456.3 (33,965.3)***
Non-manufacturing HC intensity	-193.03 (802.04)	43.52 (19.01)**	21.92 (13.57)	-0.19 (0.10)*	-0.08 (0.47)	3,764.94 (7,713.68)	16.42 (6.06)***	-55,021.46 (74,069.00)
Control variables								
Population density	7.01 (1.09)***	0.12 (0.03)***	0.11 (0.02)***	0.00 (0.00)***	-0.00 (0.00)***	23.24 (10.51)**	0.05 (0.01)***	142.18 (101.93)
Population average age	-2,623.40 (419.79)***	-114.21 (9.95)***	-40.65 (7.10)***	0.70 (0.05)***	-2.12 (0.25)***	-17,346.58 (4,037.41)***	-13.09 (3.17)***	-114,217.9 (38,768.37)***
Firm intensity	4.10 (1.05)***	-0.05 (0.02)**	0.12 (0.02)***	-0.00 (0.00)***	-0.00 (0.00)	-14.87 (10.09)	0.01 (0.01)	-63.97 (96.93)
University intensity	4,891.06 (1,939.99)**	-98.22 (45.98)**	-20.99 (32.83)	0.98 (0.25)***	-4.17 (1.13)***	-3,011.84 (18,657.98)	-26.89 (14.66)*	110,079.3 (179,159.2)
C-DAX intensity	4,338.25 (1,016.86)***	109.95 (24.10)***	66.71 (17.21)***	-0.00 (0.13)	-2.04 (0.59)***	21,752.23 (9,779.70)**	40.26 (7.69)***	101,511.3 (93,907.43)
New business formation intensity	-19.00 (5.88)***	0.26 (0.14)*	-0.12 (0.10)	0.00 (0.00)***	0.01 (0.00)	-107.02 (56.54)*	-0.16 (0.04)***	-245.30 (542.92)
Constant	139,488.2 (20,481.24)***	8,055.77 (485.39)***	1,785.64 (346.63)***	-22.58 (2.61)***	136.27 (11.96)***	949,088.2 (196,980.1)***	646.00 (154.80)***	6,322,208 (1,891,459)***
R^2	0.41	0.59	0.48	0.59	0.34	0.12	0.31	0.10
F	34.63***	70.97***	45.16***	69.60***	25.16***	6.71***	22.23***	5.19***

Notes: N = 401 districts; two-sided tests: Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level; Coeff = coefficients, H = hypothesis; SE = standard error.

5.6 Discussion, limitations, and outlook

5.6.1 Discussion

By analyzing regional HC intensity in the context of regional development, we reveal several significant effects on three regional development dimensions: regional economic performance, employment, and innovation. Regarding the first dimension of regional economic performance, we find that HC intensity exerts a significant influence on median income and business tax revenues. This shows that a portion of the value creation generated by HCs remains in their region and is passed on to the inhabitants of the region through salaries and to the governments of the districts in the form of business tax payments. A significant impact on GDP per capita cannot be confirmed. Hence, the production volume that HCs process locally seems to be smaller than expected. This aligns with the findings of Herstatt et al. (2017) that although HCs concentrate their production activities in their German headquarters, most firms pursue a cooperative production strategy and produce in BRIC countries, especially China and India. According to a study by Vonnahme and Lang (2019), 85% of the 129 HCs surveyed possess more than one location, while the mean value accounted for ten locations worldwide. This also implies that the production of HCs is not exclusively limited to the German headquarters. Furthermore, spatial autoregressive analyses reveal that there is no significant direct effect of HC intensity on GDP per capita but there is such an effect on both median income and business tax revenues. In addition, HC intensity has significant indirect and total effects on median income. Once again, although the insignificant effect of HC intensity on GDP per capita is somehow surprising given our initial argumentation for hypothesis 1a, it is in line with the results of our main analyses. Moreover, significant results for median income are reasonable, as inhabitants of neighboring districts move between districts to work at HC firms but receive their income in their home district. Business taxes, however, are paid in the district where the HC is located; i.e., HC intensity has only a direct effect on tax revenue.

For the second dimension, regional employment, we find support for the impact of regional HC intensity on both the regional unemployment rate and the number of trainees per 1,000 employees. Hence, HCs are essential employers and trainers in their districts. The previous literature stating that HCs invest highly into human capital strengthens this argument (e.g., Rammer & Spielkamp, 2019). Furthermore, spatial autoregressive analyses show mixed effects of HC intensity on the regional unemployment rate. Although HC intensity does not influence the unemployment rate within the HCs' home districts, it has significant indirect and total effects, emphasizing their enormous regional scope as major employers. Due to continuous

growth and mostly independent business activities, HCs require a large workforce that they attract supra-regionally and retain over the long run, thus contributing to increased employment levels across districts. Consequently, this finding again underlines the fact that employees travel between districts to work at HC firms. Additionally, HC intensity has both a significant direct and total effect on trainees per 1,000 employees. Although HCs train their own specialists within their home districts, their strong emphasis on trainees also has a clear effect beyond their home districts. Thus, HCs play a meaningful role in employment and training (e.g., Lehmann et al., 2019) both within and across districts.

HC intensity significantly affects the third dimension of regional innovation only in terms of innovation output, i.e., regional patent intensity, but not in terms of innovation input, measured by regional R&D intensity. Although HCs are associated with high R&D expenditures (e.g., Audretsch et al., 2018; Schlepphorst et al., 2016; Simon, 2012), no regional level impact on R&D intensity is found. This result corresponds with the findings of Rammer and Spielkamp (2015, 2019), who argue that HCs do not spend more on R&D than other firms but rather use resources more efficiently, thus enabling higher levels of innovation. HCs seem to innovate in a more efficient way. Furthermore, spatial autoregressive analyses show no significant direct, indirect or total effects of HC intensity on regional innovation – for either innovation input or output – which conflicts with prior research (e.g., Audretsch & Feldmann, 2004). With regard to innovation output as measured by patent intensity, these results might indicate a shift within the innovation strategy of HCs away from purely formal protection mechanisms such as patents towards more multifaceted intellectual property protection strategies (e.g., secrecy) and open innovation approaches. This assumption would be to some extent consistent with the findings of Rammer and Spielkamp (2019), who conclude that HCs apply a complex intellectual property management system that combines different protection mechanisms such as patents, secrecy, and complexity of design. Also, Vonnahme and Lang (2019) find that most HCs pursue internal R&D and innovation activities often take place at the HCs' headquarters. They also find that regional innovation cooperation is of limited relevance. In line with Simon (2012), Vonnahme and Lang (2019) further show that HCs often rely on non-R&D activities such as production or customer relations as sources of innovation. These activities are not covered by our two variables for regional innovation.

In addition to the effect of HC intensity on the dimensions of regional development, we further consider the effect of C-DAX firms on a regional level. Thus, we examine the results of an impact test conducted following the spatial autocorrelation regression analyses, including a comparison of the direct, indirect, and total effects of HC intensity and C-DAX intensity on the

dependent variables. The results should be interpreted with the understanding that overlaps between the two groups are possible, as HCs may also be listed in the C-DAX. The issue of firm size should also be considered because C-DAX firms tend to be larger. Furthermore, the relevance of HCs differs across different spatial categories, as a large HC in a small peripheral town might possess stronger direct impacts compared to a small HC in an urban agglomeration (Lang et al. 2019). Interestingly, neither HC intensity nor C-DAX intensity significantly affects regional export intensity within either home or neighboring districts. While C-DAX firms are not associated with high levels of export activity per se, this result is surprising for HCs in particular, as they strongly emphasize international expansion. However, regarding the first dimension of regional economic performance, we find a significant direct effect of C-DAX intensity on each of the three measures: GDP per capita, median income, and business tax revenues. Because we find no significant direct effect of HC intensity on GDP per capita, our results indicate that C-DAX firms contribute more to a district's productive strength than HCs. Moreover, although we find a significant total effect of C-DAX intensity on median income, C-DAX intensity generates no significant spillover effects for neighboring districts. Thus, although total effects for median income are significant for both C-DAX firms and HCs, only HCs generate a significant indirect effect on median income. Consequently, employees of C-DAX firms seem to be less distributed across district boundaries, travelling less between districts for work than HC employees. For the regional economic performance dimension, it is clear that both C-DAX firms and HCs have a significant impact on their home district, but only HCs generate significant spillover effects, as they positively affect the median income of neighboring districts. For the second dimension of regional employment, we find no significant effects of C-DAX intensity on the unemployment rate, while HC intensity has significant indirect and total effects on the unemployment rate. Consequently, C-DAX firms influence neither their home nor their neighboring districts' unemployment rate. Moreover, only HC intensity has a significant direct and total effect on the number of trainees per 1,000 employees. Therefore, HCs considerably contribute to the regional training of skilled workers. For the third dimension of regional innovation, similar to HC intensity, we find no significant effects of C-DAX intensity on either R&D intensity or patent intensity. Again, these results are debatable, particularly with regard to patent intensity. Firms listed on the C-DAX are typically larger, which is why we would have expected them to rely on patents for different reasons. According to Blind et al. (2006), strategic motives for patenting correlate positively with firm size. For example, by signaling successful innovation development and knowledge creation, patents function as helpful assets in negotiations with business partners.

5.6.2 Implications

Several implications for theory and practice arise from our study. Concerning our theoretical contribution, we add to the small and emerging stream of HC literature, as we examine the HC phenomenon on a regional level. Previous research on HCs has mainly focused on the internationalization (e.g., Audretsch et al., 2018), R&D, and innovation (e.g., Rammer & Spielkamp, 2015, 2019) strategies of HCs, as identified by Schenkenhofer (2022). A rather small strand of the literature analyzes HCs in a geographic context, examining, for instance, the worldwide distribution of HCs (e.g., Audretsch et al., 2020; Lehmann et al., 2019) or the role of HCs in small towns and peripheral regions (e.g., Lang et al. 2019; Vonnahme & Lang 2019). Our study examines German HCs at the district level. We not only show the geographic distribution of HCs across German districts but also analyze the impact that HC concentration has on the regional development of the districts in which they are located. In doing so, we review the characteristics HCs are typically associated with and examine whether these characteristics have a visible impact at the regional level. The results of this study indicate that several typical HC characteristics have an impact at the regional level. The economic success of these firms leads to an increase in the regional median income and business tax revenues when HC intensity grows. A decreasing unemployment rate and a growing number of trainees associated with a higher HC intensity speak for the role of these firms as major and popular regional employers. While the significant influence of HC intensity on regional patent intensity highlights the fact that HCs file many patents, no support for the statement that HCs invest highly in R&D (e.g., Rammer & Spielkamp, 2019) could be found at the regional level. Thus, the firm level characteristics of typical HCs are only partly detectable at the regional level.

Consequently, we also contribute to the literature on the determinants of regional development as a second theoretical contribution. Prior research has identified specific firm types as determinants of different dimensions of regional development. One such firm type is the start-up, as the relationship between new business formation and regional employment change is a prominent research topic (e.g., Fritsch, 2008; Fritsch & Müller, 2008). Furthermore, family firms are another firm type analyzed as a determinant of regional development (e.g., Basco, 2015; Block & Spiegel, 2013). Our study considers HCs as a determinant of regional development by examining the impact of regional HC intensity on regional level variables. Moreover, we include a variety of regional development dimensions, namely, regional economic performance, employment, and innovation, and a set of variables to measure each of these dimensions. Applying this approach offers a comprehensive overview of the impact of HCs on the regional development of German districts. Consequently, we add to the research on

specific firm types as determinants of regional development, as we identify HCs as impactful determinants at the regional level. The results indicate that regional HC intensity significantly influences each of the three dimensions analyzed. We find a clear impact on regional employment, as a high HC intensity reduces the regional unemployment rate and increases the number of trainees. For regional economic performance and innovation, we uncover only a partial impact: a high HC intensity increases only regional median income, business tax revenues, and patent intensity but not regional GDP and R&D intensity. Hence, HCs serve as an influential group of firms partly determining several dimensions of regional development.

Additionally, our results have practical implications, especially for policy makers at the regional level. We identify HCs as an important group of firms at the regional level and highlight their importance for the districts in which they are located. Hence, HCs contribute to the economic success of, employment in, and innovative performance of a district. Policy makers should consider the importance of such firms and keep them from moving to other locations. In addition, HCs can also influence soft factors of regional development that are difficult to measure, such as the image of a *region of world market leaders*. For example, the town Wertheim located in Baden-Wuerttemberg recently applied for adding the title *town of world market leaders* to their town sign (WirtschaftsWoche, 2021). The regional ties of HCs also lead to the promotion of culture and sports and thus to an increase in the well-being of the local population. At the same time, the HCs themselves benefit from being actively involved in the regional development, as they may regard their involvement as an opportunity to actively shape their business environment (Lang et al., 2019). Further practical implications arise for the educational sector. The study confirms that successful and innovative firms are also located in smaller cities or peripheral areas, which can offer attractive jobs to future employees (e.g., Fritsch & Wyrwich, 2021). In this context, the dual tertiary education model is also relevant, as it allows students to combine an academic education with practical training in technological leading firms (Schenkenhofer & Wilhelm, 2020).

5.6.3 Limitations and future research

Our study has several limitations. First, the criteria utilized to construct the sample of HCs deviate from the initial criteria defined by Hermann Simon (1996). While the market leadership criterion is similar, we adjust the size criterion of revenues below five billion Euros by including a minimum revenue level of ten million Euros. Moreover, we add two more size criteria: firm age above ten years and a minimum of 50 employees, to exclude start-ups and very small firms from our sample. Hence, the upper-bound size restriction is similar to the initial definition, but

we additionally use a set of lower-bound size restrictions. As the third HC criterion of Simon (1996), low public awareness, is difficult to measure and subjective, we do not include it in our study. This shortcoming of HC research has already been pointed out by Schenkenhofer (2022) who sees the development of a measure of the hidden criterion as a major avenue for future HC research.

A second methodological limitation is the disparate timeframes of the variables used, ranging from 2011 (patent intensity) to 2020 (HC intensity). Although we utilize the actual data available to us, we were forced to examine the influence of HC intensity on dependent variables from different years. Hence, a potential change in the data to date cannot be excluded. Nevertheless, changes at the regional level occur very slowly and are only clearly visible in the data after a longer period of time. Therefore, we consider this limitation to be rather unproblematic since most of the variables originate within five years of each other.

The third limitation of the study is its focus on German districts. Accordingly, the implications of the study are only partially transferable to other countries. By applying the study design to other countries, future research could increase the explanatory power of our results. Hence, future research could investigate the impact of local HCs on the dimensions of regional development in the corresponding economy or compare different countries in an analysis. Indeed, previous studies have examined the national HCs of different countries in single-country studies (e.g., McKieman & Purg, 2013) and recently, Audretsch et al. (2020) compare several countries in a single study. Another avenue for future research in this context would be to go beyond the headquarter level. Vonnahme and Lang (2019) find that HCs organize their work in average with ten different locations in different regional settings often on a global scale. Analyzing the interplay between these locations and the distribution of value creation, production and innovation activities would increase our knowledge about the influence of HCs on regional development for headquarter and subsidiary locations. For the variables employed in our study, we anticipate differing degrees of headquarter effects. While we expect central as well as decentral effects for the three regional economic performance indicators, the staff composition of headquarters and subsidiaries can differ (e.g., Tarique et al., 2006). Concerning regional innovation activity, we assume that patent applications are centralized at the headquarters, while R&D activities also take place at subsidiaries (Vonnahme & Lang, 2019).

Fourth, in addition to locational expansion, the unit of analysis in terms of the regional economic dimensions of the study could be extended. The focus of our study lies in the three regional development dimensions: regional economic performance, employment, and

innovation. Thus, only a part of regional development is covered, and statements regarding the effect of HCs are only valid for these three dimensions. To expand the explanatory power of these findings, future studies should include additional regional development dimensions and corresponding variables. The relationship between HCs and regional entrepreneurial culture serves as a promising dimension for analysis, as entrepreneurship and connected topics are a prominent research field in regional studies. For instance, previous research has examined the interplay between regional entrepreneurship cultures, regional knowledge bases, and new business formation (Fritsch & Wyrwich, 2018). Moreover, Stuetzer et al. (2014) find that entrepreneurial culture has an effect on individual perceptions of founding opportunities, which in turn predicts regional start-up intentions and activity. Additionally, the actual debate on entrepreneurial ecosystems summarized by Schäfer and Mayer (2019) could also serve as a regional development dimension in future research. Not only further dimensions of regional development could be analyzed but also additional variables to increase the understanding of the three regional development dimensions of our study. Especially, taking a multi-dimensional approach to the innovation dimension would be a promising avenue for future research. Besides the R&D expenditures and the number of granted patents, other variables such as new business formation in the high-tech sector (Richter, 2020) or direct innovation counts (e.g., Acs et al., 2002; Makkonen & van der Have, 2013) can be applied. Moreover, Block et al. (2021) point out the importance of *soft* types of innovation, introducing trademarks as an indicator for non-technological innovation at the regional level. Although several quantitative studies examine the R&D and innovation strategies of HCs (e.g., Herstatt et al., 2017; Rammer & Spielkamp, 2015; Vonnahme & Lang, 2019), qualitative and mixed-methods research could shed more light on how these strategies are shaped by regional characteristics and vice versa. Thereby, qualitative research designs could be used to better understand the role of HCs in regional innovation systems and knowledge networks (e.g., Cooke, 2001; Fritsch & Slavtchev, 2011) and precisely address the question of how and why HCs deliver added value in the region and how they differ from other (family) firms in their degree of locality and regional embeddedness (Baù et al., 2021; Stough et al., 2015). Qualitative research approaches are of particular relevance in the field of economic geography because, unlike quantitative analyses, they reduce concerns about measurement, provide important contextual information, and help develop compelling substantive arguments (Barthelt & Li, 2020). For example, Schoenberger (1991) refers to the corporate interview as a qualitative research method in economic geography and Rutten (2019) uses qualitative comparative analysis in order to investigate the relationship between openness values and regional innovation.

A fifth limitation of our study is the potential for reverse causality. We assume that HCs influence the regional development of their districts and thus, for example, ensure a higher GDP. In contrast, HCs could settle in districts that are already regionally successful and have, for example, a high GDP. However, the possibility of reverse causality has been mitigated, as the HCs in our sample have an average age of 92.51 years, and we have applied an age minimum of ten years to exclude start-ups. Hence, no firm in the sample recently settled in its district. Nevertheless, the potential problem of reverse causality cannot be completely excluded. To further reduce this issue, future research could examine historical data at the regional level and examine the past regional economic performance, employment, and innovation of currently successful districts. Comparable analyses have already been performed in previous research. For instance, Fritsch and Müller (2008) investigate historical data on regional employment and the impact of new business formation over time. Another example is a recent study on the historic causes behind the spatial distribution of innovation activities in Germany (Fritsch & Wyrwich, 2021).

Finally, future research is necessary to expand knowledge on the phenomenon of HCs, especially at the firm level. Although an increasing number of studies on this phenomenon exist to date (see Schenkenhofer, 2022), the number of scientifically published academic studies in the field is rather limited (e.g., Audretsch et al., 2018, 2020; Johann et al., 2022; Lehmann et al., 2019). Hence, further research is needed to better understand the inner workings of the HC phenomenon at the firm level as well as the external impact of this specific group of firms. The examination of the subgroup of younger HCs could be of particular interest, as they might have different dynamics, especially in terms of spatial patterns and the structural disadvantage of more rural regions. In this context, the presence of HCs might also have more impact than in urban regions and be of greater relevance to regional development issues. Future research could tie in with the previous work of Lang et al. (2019) to further examine these aspects. Due to their technological strength and extensive internationalization efforts, linking younger HCs with the born globals concept (e.g., Baum et al., 2011, 2015; Knight & Cavusgil, 2004; Sui et al., 2012) could be a fruitful approach to future research. Similar to HCs, born global firms are associated with distinct organizational features, early internationalization, and superior performance (e.g., Knight & Cavusgil, 2004). Although existing studies already offer further differentiations of early internationalizing firms, e.g., between born globals and born regionals (Baum et al., 2015; Lopez et al., 2009; Sui et al., 2012), insights on globally active, technology-oriented startups, their characteristics and dynamics could also be transferable to the HC phenomenon.

Chapter 6

Conclusion

The last chapter of this dissertation proceeds as follows: Section 6.1 summarizes the main findings of each chapter and answers the research questions of this thesis. Section 6.2 provides implications for theory and practice arising from this thesis and Section 6.3 discusses the limitations. Finally, Section 6.4 concludes this thesis by identifying avenues for future research.

6.1 Findings per chapter

This chapter summarizes the main findings of each chapter. *Table 6.1* provides an initial overview of the results obtained in each study, thus summarizing the answers to the research questions. Afterwards, four subchapters outline the results of each chapter in detail.

Table 6.1: Summary of the main findings

Research question	Answered in	Summarized answers
Digital transformation of Mittelstand firms		
RQ 1	Chapter 2	• Dynamic capabilities facilitate the digital transformation of the business model. • The positive effect of dynamic capabilities on digital business model transformation is significantly weakened by founder ownership but not by family ownership.
RQ 2	Chapter 3	• Family ownership inhibits the pursuit of growth goals with digitalization. • Emotional attachment of family owners promotes the pursuit of growth goals with digitalization.
Economic success and regional impact of Hidden Champions		
RQ 3	Chapter 4	• Compared to other Mittelstand firms, HCs have, among other things, higher export ratios, higher patent output levels, and higher equity ratios. • HCs have significantly higher profitability regarding ROA but less so regarding ROE. • The HC performance effect decreases with firm size.
RQ 4	Chapter 5	• HCs are not equally distributed across regions and influence regional development. • Regions with a higher number of HCs show strong regional economic performance in terms of median income. • HC intensity affects regional unemployment and trainee rates as well as regional innovation in terms of patents. • The effect of HCs is not limited to the particular region in which they are located but spills over to neighboring districts.

Source: Own illustration.

6.1.1 Chapter 2: Dynamic capabilities and the digital transformation of the business model: The role of family and founder firms

RQ 1: *How do dynamic capabilities influence the digital transformation of the business model, and how is this relationship affected by family and founder ownership?*

Chapter 2 investigates the digital transformation of the business model in Mittelstand firms. Specifically, it examines how dynamic capabilities influence digital business model transformation and how this relationship is affected by ownership structure. To answer RQ 1

and provide quantitative empirical evidence, Chapter 2 separately analyzes the direct effect of dynamic capabilities on the digital transformation of the business model as well as the moderating effects of family and founder ownership on this relationship. Therefore, a unique database of German firms with varying levels of family and founder ownership was used, combining firm-related information from Orbis with survey data.

The results of ordered logistic regressions show that dynamic capabilities facilitate the digital transformation of the business model, but that this positive effect depends on ownership structure. Regarding the direct effect, Chapter 2 therefore concludes that firms with strong dynamic capabilities also have more digitalized business models. Hence, results of our empirical analyses support some of the earlier evidence on dynamic capabilities and their beneficial role for digital transformation (e.g., Witschel et al., 2019, 2022). Regarding the moderating effects of ownership structure, however, results reveal clear differences between family and founder firms. Regressions show that the positive relationship between dynamic capabilities and digital business model transformation is significantly weakened by founder but not by family ownership. Accordingly, founder firms seem to be less dependent on dynamic capabilities to transform their business model in a digital way.

6.1.2 Chapter 3: Family ownership and the use of digitalization to pursue growth goals

RQ 2: *How do family-owned firms and the socioemotional characteristics of family owners influence the use of digitalization to pursue growth goals?*

Chapter 3 sheds light on another aspect of the digital transformation of Mittelstand firms, linking ownership structure to the organizational goals pursued with digitalization. Specifically, Chapter 3 investigates the relationship between family ownership and the pursuit of growth goals with digitalization in Mittelstand firms. Although prior research indicates that family firms tend to pursue efficiency rather than growth goals, so far, no study has empirically proven this assumption in the context of digitalization. To fill this gap, Chapter 3, like Chapter 2, utilizes data from a sample of 525 mid-sized German manufacturing firms, including both family and non-family firms.

Linear regression results show that family ownership reduces the importance of growth goals with digitalization, thus supporting earlier assumptions that family firms are somehow reluctant to take full advantage of the many opportunities offered by digital technologies (e.g., Batt et al., 2020; Ceipek et al., 2021). Hence, family firms are indeed less likely to follow a growth agenda with digitalization, at least compared to non-family firms. However, to provide

in-depth insights, Chapter 3 goes beyond the firm level and additionally considers the owners of family firms by analyzing how their identification with the firm, emotional attachment, and succession intentions relate to the pursuit of growth goals with digitalization. Results from subsample analysis reveal that stronger emotional attachment of family owners promotes the pursuit of growth goals with digitalization. With this result, Chapter 3 provides empirical evidence that the owners of family firms themselves have the power to overcome potential growth barriers and thus drive digital transformation and organizational growth.

6.1.3 Chapter 4: Financial performance of Hidden Champions: Evidence from German manufacturing firms

RQ 3: *When and to what extent do HCs outperform other Mittelstand firms?*

Chapter 4 analyzes the financial performance of HCs relative to other mid-sized firms. In particular, the chapter investigates when and to what extent HCs outperform non-HCs in terms of profitability. Furthermore, HCs are compared to non-HCs regarding the typical characteristics attributed to HCs, namely, above-average export ratios, pronounced innovation activities, and healthy capital structures. Therefore, a sample of 4,677 German manufacturing firms, including 617 HCs, is analyzed for a period of ten years.

Results of OLS regressions support some of the earlier evidence on HCs (Audretsch et al., 2018; Rammer & Spielkamp, 2015; Voudouris et al., 2000). For example, HCs are found to have higher export ratios and higher patent output levels than other Mittelstand firms. Moreover, they are older, have less performance risk, and have higher equity ratios. Regarding performance, results show that HCs have a higher ROA but not a higher ROE. The HC performance effect on ROA is 1.7 percentage points and is therefore not only of statistical but also of practical significance. Furthermore, results of the empirical analyses indicate that the HC performance effect is very heterogeneous and varies greatly. In particular, an interaction exists, and the effect seems to decrease with firm size. Interestingly, the HC performance effect dissappears for firms with more than 900 employees.

6.1.4 Chapter 5: Hidden Champions as a determinant of regional development: An analysis of German districts

RQ 4: *What impact does regional HC intensity have on regional development?*

Chapter 5 examines the influence of HCs on regional development. Since HCs are an important part of the German Mittelstand with strong regional roots, it is assumed that they significantly contribute to regional development. To answer RQ 4 and provide detailed insights on the role

of HCs as a determinant of regional development, the chapter analyzes the effect of HC intensity on seven selected indicators related to three dimensions: regional economic performance (GDP per capita, median income, business tax revenues), regional employment (unemployment rate, trainees per 1,000 employed), and regional innovation (R&D intensity, patent intensity). Therefore, a dataset of 1,645 HCs located in 401 German districts is used.

Results of the empirical analyses show that HCs are not equally distributed across regions and indeed influence regional development. Regions with a higher number of HCs show strong regional economic performance in terms of median income. Moreover, HC intensity affects regional unemployment and trainee rates as well as regional innovation in terms of patents. Surprisingly, no effect of regional HC intensity on regional R&D levels and GDP can be found. Chapter 5 further concludes that the effect of HCs is not limited to the particular region in which they are located but that sizable spillover effects exist.

6.2 Implications for theory and practice

This dissertation provides various implications for theory and practice. Following the two-part structure of this thesis, the results obtained in each study contribute to the growing field of research on the digital transformation of Mittelstand firms (e.g., Soluk & Kammerlander, 2021) as well as the small and emerging stream of HC literature (e.g., Audretsch et al., 2018, 2020). Regarding the digital transformation of Mittelstand firms, this thesis primarily contributes to a better understanding of the determinants of digitalization as well as relevant context factors. Chapters 2 and 3 extend existing knowledge on the role of dynamic capabilities and organizational characteristics, such as ownership structure (e.g., Witschel et al., 2019, 2022). Furthermore, regarding the HC phenomenon, this thesis adds quantitative empirical evidence of their economic success and regional impact, in turn providing valuable insights into the particularities and consequences of a focused niche market strategy. While Chapter 4 adds to research on the link between strategy and firm performance (e.g., Bowman & Helfat, 2001; Hansen & Wernerfelt, 1989) by showing that the HC strategy can indeed lead to financial outperformance, Chapter 5 contributes to the regional development literature by introducing HCs as another specific firm type as determinant of regional development. Besides implications for theory, this dissertation provides important practical implications, especially for firm managers and owners as well as policy makers. The following sections summarize the detailed theoretical and practical implications of each chapter.

Chapter 2 contributes to prior research on the determinants of digitalization, which has always focused on the question of which organizational capabilities drive digital transformation

(e.g., Annarelli et al., 2021; Steininger et al., 2022b). Although literature has already identified dynamic capabilities relevant to digital transformation (e.g., Daniel & Wilson, 2003; Warner & Wäger, 2019) and indicated their importance for digital business model innovation (e.g., Witschel et al., 2022), this study is among the first to empirically analyze the effect of dynamic capabilities on the actual digital transformation level of the business model. Chapter 2 provides quantitative empirical evidence that dynamic capabilities facilitate the digital transformation of the business model, thus validating existing assumptions and contributing to research on the relationship between organizational capabilities and digital transformation. A second theoretical contribution refers to the fact that the results of this study enable a better understanding of how contextual factors at the organizational level, namely, ownership structure, influence the relationship between dynamic capabilities and digital business model transformation. Specifically, Chapter 2 extends existing research on the moderating role of ownership structure (e.g., Witschel et al., 2022) as it separately analyzes both founder and family ownership. Since the results indicate that (compared to family firms) founder firms are less dependent on dynamic capabilities to master digital transformation, Chapter 2 contributes to the ongoing debate in literature on the differences between family and founder ownership and their consequences for strategic behavior and capabilities development (e.g., Le Breton-Miller & Miller, 2008). Accordingly, this study also adds to the literature on the digital transformation of family-owned firms (e.g., Ceipek et al., 2021; Soluk et al., 2021a). Results of the empirical analyses confirm the beneficial role of dynamic capabilities for the digital transformation of family firms and, as they go beyond previous measurement approaches and relate the original dynamic capabilities dimensions (e.g., Teece, 2007) to the actual digital transformation level of the business model, extend existing knowledge. Finally, from a practitioner's perspective, Chapter 2 provides distinctive implications for firm managers and owners. The results of this study encourage firms to invest in developing strong dynamic capabilities as they represent an important determinant of digital transformation. However, despite the beneficial role of dynamic capabilities, firms should also pay attention to possible contextual factors. In particular, the importance of dynamic capabilities for digital business model transformation seems to depend on ownership structure.

While Chapter 2 contributes to research on the digital transformation of Mittelstand firms considering the interaction between dynamic capabilities and firm ownership in the transformation of the business model, **Chapter 3** provides empirical insights on the relationship between family ownership and the pursuit of growth goals with digitalization. In this regard, Chapter 3 investigates the role of family ownership as a determinant of digitalization both at

the firm and owner level, in turn offering detailed implications for theory and practice. At the firm level, results of the empirical analyses show that family ownership reduces the importance of growth goals with digitalization. Chapter 3 therefore contributes to the scarce research on the link between firm ownership and digital transformation and extends existing knowledge on the digital transformation of family firms (e.g., Cucculelli et al., 2022; Soluk et al., 2021a). Furthermore, it enriches literature on the differences between family and non-family firms, especially in terms of their goals and strategies (e.g., Williams Jr. et al., 2018, 2019). In particular, the results show that goal discrepancies caused by family ownership also prevail in the context of digitalization. Since Chapter 3, however, goes beyond the firm level and additionally considers the owners of family firms, it also contributes to research on the heterogeneity of family firms from a digital transformation perspective. By showing that stronger emotional attachment of family owners promotes the pursuit of growth goals with digitalization, it enables a better understanding of relevant factors at the owner level. Accordingly, this study provides important practical implications for decision makers, in particular the owners of family firms. Given the influential role of firm ownership for organizational goalsetting and strategic decision-making, firms should be aware that family ownership hinders the pursuit of growth goals with digitalization, but that the owners themselves have the power to influence this effect. Since family owners can build on their emotional attachment to drive digital transformation, they should allow emotion-based arguments to affect strategic decision-making in the context of digitalization and, for example, listen to their gut feelings when pursuing organizational growth.

Chapter 4 contributes to three strands of literature. First, this chapter contributes to a better understanding of the HC phenomenon (e.g., Audretsch et al., 2018, 2020; Benz et al., 2021; Lehmann et al., 2019) and shows that the HC strategy can indeed lead to stronger financial performance as measured by ROA. Second, as HCs are an important part of the German Mittelstand, Chaper 4 also contributes to the broader literature on the (German) Mittelstand (e.g., Berghoff, 2006; Block & Spiegel, 2013), particularly its success factors (De Massis et al., 2018). The results of this study thus enrich existing literature on the strategies employed by successful Mittelstand firms (e.g., De Massis et al., 2018; Pahnke & Welter, 2019). Third, this study contributes to the literature on the determinants of financial profitability, particularly the link between strategy and firm performance (e.g., Bowman & Helfat, 2001; Hansen & Wernerfelt, 1989). Prior research on strategy typologies describes a focused niche market strategy (e.g., Dalgic & Leeuw, 1994; Porter, 1980; Teplensky et al., 1993) and recommends this approach as a good strategy for SMEs (e.g., De Massis et al., 2018;

Muzyka et al., 1997) and family firms (e.g., Hennart et al., 2019; McCann et al., 2001). The results of this study contribute to this discussion by showing that such a strategy can indeed lead to financial outperformance and that the relative advantage of a HC strategy compared to other strategies decreases with firm size, making it a good strategy for SMEs. Hence, this study also adds to the literature on the role of firm size in the strategy-performance relationship (e.g., Lee, 2009; Serrasqueiro & Nunes, 2008). Regarding practical implications, Chapter 4 thus demonstrates firm managers and owners that a HC strategy can lead to superior performance, particularly for firms with fewer than 900 employees. Focusing on niche markets with a strong international and export orientation seems to be a profitable strategy.

Chapter 5 offers several implications for theory and practice. Regarding theoretical contributions, Chapter 5 adds to the small and emerging stream on HC literature, as it examines the HC phenomenon at the regional level. While prior research has focused on the internationalization (e.g., Audretsch et al., 2018), R&D, and innovation (e.g., Rammer & Spielkamp, 2015, 2019) strategies of HCs, little is known about HCs in a geographic context, examining, for example, the worldwide distribution of HCs (e.g., Audretsch et al., 2020; Lehmann et al., 2019) or the role of HCs in small towns and peripheral regions (e.g., Lang et al., 2019; Vonnahme & Lang, 2019). Investigating HCs as a determinant of regional development, Chapter 5 not only shows their geographic distribution across German districts but also analyzes the impact that HC concentration has on regional economic performance, regional employment, and regional innovation in the districts in which they are located. Consequently, Chapter 5 also contributes to the literature on the determinants of regional development as a second theoretical contribution. Specifically, it adds HCs as another specific firm type (i.e., besides start-ups or family firms) as determinant of different dimensions of regional development. By showing that HC intensity significantly affects regional economic performance in terms of median income, regional unemployment, and trainee rates as well as regional innovation in terms of patents, Chapter 5 also has practical implications, especially for policy makers at the regional level. For example, policy makers should consider the importance of such firms and keep them from moving to other locations.

6.3 Limitations

As with all scientific studies, this dissertation has some limitations. Regarding the digital transformation of Mittelstand firms, which Chapters 2 and 3 examine in more detail, limitations arise primarily in methodological terms due to the underlying sample and survey design. Regarding the economic success (Chapter 4) and regional impact (Chapter 5) of HCs, in

contrast, limitations arise from the novelty of the HC phenomenon itself as well as its operationalization. However, these limitations offer valuable opportunities for future research. In the following, the limitations of the studies included in this thesis are discussed in detail.

Chapters 2 and 3 deal with different aspects of the digital transformation of Mittelstand firms. While **Chapter 2** investigates the interaction of dynamic capabilities with firm ownership in the transformation of a firm's business model, **Chapter 3** focuses on the link between family ownership and the pursuit of growth goals with digitalization. Nevertheless, both studies utilize the same database which combines firm-related information from Orbis with unique survey data for a sample of 525 mid-sized German manufacturing firms. Given the resulting overlaps in terms of sampling and data collection, both studies show similar limitations, which can therefore be discussed together. In essence, Chapters 2 and 3 have three limitations. First, the sample used in both studies is limited to Germany and to the manufacturing sector. Results therefore may neither generalize to other countries nor Mittelstand firms operating in industries that are less export-oriented, more B2C focused, or more service dominated. Furthermore, the underlying sample does not cover the entire manufacturing sector but only a selected subset of mostly research-intensive industries, in turn limiting the transferability of the results to non-research-intensive industries. Second, both studies lack information about firms' environmental settings, albeit considered to be crucial in the context of digitalization. Environmental dynamism, for example, captures the extent to which firms' external environment is perceived as uncertain, complex, and dynamic (Chirico & Baù, 2014). Accordingly, it is assumed to be an important contextual factor in the digital transformation of firms, affecting both capabilities development as well as strategic decision-making and goalsetting. A third limitation concerns time lags between sampling and data collection. While the criteria-based drawing of the initial sample and the collection of firm-related information took place in 2020, the final sample was surveyed some months later. Finally, both chapters are cross-sectional studies and thus cannot claim causal effects.

Chapters 4 and 5, however, investigate the HC phenomenon from different perspectives. While Chapter 4 analyzes the financial performance of HCs at the firm level, Chapter 5 examines the HCs' regional economic importance at the level of German districts. Although both chapters have several limitations that also apply to the other chapter, study-specific, non-transferable limitations can be derived as well. Consequently, the following sections first present the limitations of Chapter 4 and then supplement those from Chapter 5.

Chapter 4 on the financial performance of HCs points out to limitations regarding sample selection and variables measurement. Because the sample used in Chapter 4 is limited to Germany and the manufacturing sector, findings may not generalize to HCs and Mittelstand firms operating in industries that are less export-oriented, more B2C focused or more service dominated. Furthermore, as the sample contains mostly privately owned firms, this study lacks information on their market values and market-based performance measures. Additionally, the large number of missing values for the profitability measures could lead to sample selection bias. Finally, as the independent variable HC status is constant over time, this study cannot run fixed-effects regressions and therefore cannot claim causal effects.

Similarly, **Chapter 5** on the regional economic importance of HCs mainly shows methodological limitations. First, the criteria utilized to construct the sample of 1,645 HCs located in 401 German districts deviate from the initial criteria defined by Simon (1996). In particular, the size criterion of revenues below five billion Euros is adjusted by including a minimum revenue level of ten million Euros and two more size criteria, namely, firm age above ten years and a minimum of 50 employees, are added. Furthermore, as the study does not include the third HC criterion of Simon (1996), low public awareness, it shows a shortcoming that has already been pointed out by other HC research (Schenkenhofer et al., 2022). Second, another methodological limitation refers to disparate timeframes of the variables used in this study. Specifically, due to data availability, the variables' timeframes range from 2011 (patent intensity) to 2020 (regional HC intensity). However, as changes at the regional level occur very slowly and evolve over time, this limitation seems rather unproblematic. Third, as the focus of this study is on German districts, its implications are only partially transferable to other countries. In addition to locational expansion, a fourth limitation refers to extending the unit of analysis in terms of the regional economic dimensions examined in this study. Since Chapter 5 focuses on three distinct dimensions (regional economic performance, employment, and innovation) only a part of regional development is covered, and statements regarding the effect of HCs are only valid for these three dimensions. Finally, although the possibility of reverse causality has been mitigated (i.e., by applying an age minimum of ten years to exclude start-ups), this study cannot completely exclude the potential problem of reverse causality. While we assume that HCs influence regional development and thus, for example, ensure a higher GDP, it could also be argued the other way round that HCs settle in districts that are already regionally successful and have, for example, a high GDP.

6.4 Future research avenues

The limitations of each study included in this dissertation offer valuable opportunities for future research. As outlined in the previous section, **Chapter 2** and **Chapter 3** relate to the same database and thus show methodological overlaps (i.e., regarding sampling, study design, and data collection). Analogous to the limitations applicable to both studies, similar directions therefore emerge for future research on the digital transformation of Mittelstand firms. First, the sample used in both studies exclusively focuses on German manufacturing firms which, in turn, limits the transferability of the results obtained. To address this shortcoming and increase the validity of the findings, future research could investigate other countries and industries. For example, cross-country comparisons could be interesting, as family firms represent the prevalent form of entrepreneurial organizations worldwide (Heider et al., 2022b). In this regard, countries with a similar business landscape, for example, in terms of a strong base of mid-sized firms or focus on the manufacturing sector, should be considered (i.e., Italy or China could therefore be particularly suitable for comparison; e.g., Cucculelli et al., 2022). Furthermore, intra-industry differences might be of particular interest as the results give reason to believe that digital transformation pressure, and thus the need to change the business model using digital technologies, varies within the manufacturing sector. Follow-up studies could delve deeper into industry-specific drivers of digitalization and, for example, explore the reasons for this. Second, apart from industry affiliation and location, both studies lack information about further contextual factors of the digital transformation of Mittelstand firms. Future research could close this gap and enrich the results of this thesis by, for example, further elaborating on the role of environmental settings, such as environmental dynamism. Moreover, in case of Chapter 2, follow-up studies could also deepen the argumentation about learning routines as a substitute for (first-order) dynamic capabilities by collecting data on organizational learning alongside dynamic capabilities and investigate its effect on digital transformation. Finally, to address the limitation of time lags between sampling and data collection, future research could use longitudinal data to verify the validity and generalizability of the results.

Besides avenues for future research on the digital transformation of Mittelstand firms that apply to both studies and are primarily derived from their underlying methodology, the following research recommendations should be added. Regarding Chapter 2, future research could further deepen the investigations of the relationship between dynamic capabilities and the digital transformation of the business model by, for example, separately analyzing the original dynamic capabilities dimensions (e.g., Teece, 2007). Such research would provide in-depth insights into the interplay between dynamic capabilities and digital transformation,

disentangling possible differences in the effects of sensing, seizing, and reconfiguring (transforming) capabilities. Regarding Chapter 3, however, future research could enrich the results obtained in this thesis by analyzing further characteristics of family owners, such as the SEW dimension 'binding social ties' (e.g., Gerken et al., 2022), and their effects on the pursuit of growth goals with digitalization. Also, follow-up studies could explore other goalsets in the context of digitalization, for example in terms of internationalization or diversification, and thus extend or modify the dependent variable used in the analyses of this study.

Chapters 4 and 5, in contrast, provide avenues for future research on another aspect of the German Mittelstand, addressing the economic success and regional impact of HCs. Although HC literature continues to grow (see Schenkenhofer, 2022), future research is necessary to expand knowledge on the HC phenomenon, especially at the firm level. Based on the results of **Chapter 4**, this thesis makes an important contribution to this, and several future research directions can be derived. First, this study can be seen as a starting point for research on the performance of HCs and their determining factors. In particular, more research is needed to better understand why and under which conditions HCs outperform other firms. Future research could examine internal and external factors leading to (out-)performance in relation to the HC strategy. Potential external factors include country and regional level institutions (Audretsch et al., 2020; Lehmann et al., 2019; Pahnke & Welter, 2019), competitive factors (Porter, 1980), and technological and industry environments (Spanos et al., 2004). Potential internal factors include a firm's resources and capabilities, such as its absorptive capacity, ambidexterity, and dynamic capabilities. Such a resource-based perspective of the HC strategy is missing in the literature on HCs so far and would also extend the strategic fit literature (e.g., Bingham et al., 2011; Lindow et al., 2010). Finally, future research could examine the relationship between firm ownership and HC strategy and, for example, investigate whether family owners, due to their long-term focus, are the ideal owners to pursue a HC strategy (e.g., Le Breton-Miller & Miller, 2006).

Furthermore, **Chapter 5** shows that HCs influence regional development and thus provides avenues for future research on the HC phenomenon at the regional level. More precisely, regional HC intensity significantly affects regional economic performance in terms of median income and business tax revenues, regional employment in terms of unemployment rate and trainee number, and regional innovation in terms of patents. Future research could examine additional regional development dimensions and corresponding variables to expand the explanatory power of these findings. For example, entrepreneurial culture may serve as another promising dimension for analysis at the regional level (e.g., Fritsch & Wyrwich, 2018;

Stuetzer et al., 2014). Regarding additional variables, future research could take a multi-dimensional approach to the innovation dimension, for example, including new business formation in the high-tech sector (Richter, 2020) or direct innovation counts (e.g., Acs et al., 2002; Makkonen & van der Have, 2013). Besides extending the unit of analysis, future research could apply this study design to other countries and investigate the impact of local HCs on regional development in the corresponding economy. Of course, follow-up studies could also compare different countries in an analysis and thus extend existing single-country studies on HCs (e.g., McKieman & Purg, 2013). Another avenue for future research in this context would be to go beyond the headquarter level and analyze the influence of HCs on regional development for headquarter and subsidiary locations (e.g., Vonnahme & Lang, 2019). Apart from that, follow-up studies could use historical data at the regional level and examine the past regional economic performance, employment, and innovation of currently successful districts to further reduce the potential problem of reverse causality. To address methodological shortcomings, future researchers should refine the HCs operationalization and develop a measure of the hidden criterion (Schenkenhofer, 2022).

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Appendix

Appendix of Chapter 2:

Table A2.1: Description of the main variables collected with the survey

Constructs and items
Digital transformation of the business model
How digitalized is your business model?
(Response categories range from *1 = not digitalized at all* to *5 = fully digitalized*)
Dynamic capabilities (based on Kump et al., 2019) (CA = 0.88)
To what extent do the following statements apply to your firm?
(Response categories range from *1 = strongly disagree* to *5 = strongly agree*)
Sensing capabilities (CA = 0.76)
(1) Our firm knows the best practices in the market.
(2) Our firm is up to date with the current market situation.
(3) Our firm systematically searches for information about the current market situation.
(4) As a firm, we know how to access new information.
(5) Our firm always keeps an eye on the activities of our competitors.
Seizing capabilities (CA = 0.75)
(6) Our firm can quickly relate to new knowledge from outside.
(7) We recognize what new information can be used in our firm.
(8) Our firm can translate new technological knowledge into process and product innovations.
(9) Current information leads to the development of new products and services in our firm.
Reconfiguring capabilities (CA = 0.81)
(10) By defining clear responsibilities, we successfully implement plans for change in our firm.
(11) Decisions on planned changes are implemented consistently.
(12) In our firm, transformation projects can be put into action alongside day-to-day business.
(13) Even if unforeseen disruptions occur, transformation projects are consistently ended in our firm.
(14) In the past, we have demonstrated our strength in implementing change.

Notes: CA = Cronbach's alpha (Scale reliability coefficient).

Table A2.2: Descriptive statistics

	Founder firms			Family firms			t-stat.	z-stat.
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**		
Digital transformation of the business model	2.74	0.87	3	2.72	0.90	3	0.17	0.24
Dynamic capabilities	3.70	0.65	3.79	3.55	0.65	3.58	1.50	1.56
Firm age (in 2022)	29.81	11.17	29	52.75	35.66	42	-4.42***	-4.84***
Employees (in 2018)	125.10	158.14	87	178.66	298.57	100	-1.21	-1.55
Patents (d)	0.44	0.50	0	0.45	0.50	0	-0.17	-0.17
Number of firms	48			302			350	

Notes: Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable.

Table A2.3: Industry distribution

NACE code	Industry description	All firms	Founder firms	Founder firms in industry (%)	Family firms	Family firms in industry (%)
20	Manufacture of chemicals and chemical products	33	4	12.12	14	42.42
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	3	-	-	1	33.33
22	Manufacture of rubber and plastic products	69	3	4.35	41	59.42
23	Manufacture of other non-metallic mineral products	33	4	12.12	16	48.48
24	Manufacture of basic metals	22	1	4.55	11	50.00
25	Manufacture of fabricated metal products, except machinery and equipment	135	17	12.59	87	64.44
26	Manufacture of computer, electronic and optical products	41	6	14.63	14	34.15
27	Manufacture of electrical equipment	42	2	4.76	19	45.24
28	Manufacture of machinery and equipment n.e.c.	130	9	6.92	86	66.15
29	Manufacture of motor vehicles, trailers, and semi-trailers	9	1	11.11	6	66.67
30	Manufacture of other transport equipment	8	1	12.50	7	87.50
Total		525	48	9.14	302	57.52

Table A2.4: Regional distribution

	Federal state	All Firms	Founder firms	Founder firms in state (%)	Family firms	Family firms in state (%)
1	Baden-Wurttemberg	98	9	9.18	56	57.14
2	Bavaria	67	5	7.46	38	56.72
3	Berlin	5	1	20	2	40
4	Brandenburg	5	1	20	1	20
5	Bremen	-	-	-	-	-
6	Hamburg	1	-	-	1	100
7	Hesse	41	2	4.88	26	63.41
8	Mecklenburg-Western Pomerania	9	2	22.22	3	33.33
9	Lower Saxony	41	4	9.76	25	60.98
10	North Rhine-Westphalia	152	12	7.89	96	63.16
11	Rhineland-Palatinate	26	2	7.69	17	65.38
12	Saarland	6	1	16.67	1	16.67
13	Saxony	25	3	12	11	44
14	Saxony-Anhalt	12	2	16.67	6	50
15	Schleswig-Holstein	14	2	14.29	5	35.71
16	Thuringia	14	2	14.29	14	100
Total		525	48	9.14	302	57.52

Table A2.5: Ordered logistic regression results using subsamples

Variables	**Digital transformation of the business model**	
	Founder firm sample	Family firm sample
Dynamic capabilities	0.94	1.07***
	(0.87)	(0.19)
Firm age (log.)	1.76	0.24
	(1.21)	(0.20)
Employees (log.)	-0.06	0.07
	(0.79)	(0.16)
Patents (d)	-0.14	-0.04
	(0.96)	(0.24)
NACE (d)	Yes	Yes
Federal states (d)	Yes	Yes
Pseudo *R*-squared	0.28	0.00
Chi-square	33.16	61.02
Prob > *Chi*-square	0.158	0.0002
Akaike crit. (AIC)	141.556	748.744
Bayesian crit. (BIC)	195.210	862.296
Observations	47	288

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table A2.6: Regression results using alternative dependent variables

	Variables	**Samples**		
	Independent variable: Dynamic capabilities [a]	All firms (N = 525)	Founder firms (N = 48)	Family firms (N = 302)
	Dependent variable:			
1	Digital transformation (overall) [b]	0.40*** (0.04)	0.61** (0.23)	0.39*** (0.05)
2	Digital transformation of processes [c]	0.39*** (0.04)	0.62** (0.23)	0.38*** (0.05)
	Digital transformation of …			
3	… production (manufacturing)	1.12*** (0.15)	4.08*** (1.24)	1.29*** (0.21)
4	… logistics	1.05*** (0.15)	4.35*** (1.27)	0.94*** (0.18)
5	… marketing and sales	0.79*** (0.14)	1.65* (0.92)	0.77*** (0.18)
6	… customer service	0.73*** (0.15)	5.87*** (1.80)	0.62*** (0.19)
7	… personnel	0.81*** (0.15)	-0.51 (0.89)	1.10*** (0.20)
8	… corporate administration	0.76*** (0.14)	2.97** (1.27)	0.63*** (0.18)
9	… R&D	0.93*** (0.17)	5.07* (2.66)	1.10*** (0.24)
10	… procurement	0.74*** (0.14)	1.38 (0.91)	0.74*** (0.19)
11	Digital transformation of products	0.41*** (0.13)	1.20 (0.87)	0.42** (0.17)
12	Digital transformation of services	0.98*** (0.15)	0.41 (0.97)	0.84*** (0.19)
13	Digital transformation of the business model [d]	1.02*** (0.15)	0.94 (0.87)	1.07*** (0.19)

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. [a] Models show coefficients with standard errors in parentheses for the effect of dynamic capabilities on the respective digital transformation measure. Control variables are the same as in our main analysis except for family ownership and founder ownership when used as differentiators. [b] *Digital transformation (overall)* refers to the average digital transformation level across all digital transformation measures (mean value of positions 3 to 13). [c] *Digital transformation of processes* refers to the average digital transformation level across all business functions (mean value of positions 3 to 10). [d] *Digital transformation of the business model* refers to the dependent variable used in our main analysis and is only shown again for comparison.

Table A2.7: Ordered logistic regression results using later generation family ownership

Variables	**Digital transformation of the business model**
Dynamic capabilities	1.08***
	(0.23)
Later generation family ownership (d)	0.33
	(1.04)
Later generation family ownership (d) x Dynamic capabilities	-0.10
	(0.29)
Firm age (log.)	0.19
	(0.15)
Employees (log.)	0.03
	(0.12)
Patents (d)	-0.20
	(0.18)
NACE (d)	Yes
Federal states (d)	Yes
Pseudo *R*-squared	0.06
Chi-square	74.32
Prob > *Chi*-square	0.000
Akaike crit. (AIC)	1311.536
Bayesian crit. (BIC)	1454.284
Observations	492

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table A2.8: Mediation analysis using founder ownership

Variables	**Digital transformation of the business model**
Direct effects	
Founder ownership (d) → Dynamic capabilities	0.14
	(0.09)
Founder ownership (d) → Digital transformation of the business model	-0.08
	(0.13)
Dynamic capabilities → Digital transformation of the business model	0.49***
	(0.07)
Indirect effect	
Founder ownership (d) → Dynamic capabilities	0.07
→ Digital transformation of the business model	(0.05)
Total effect	
Founder ownership (d) → Digital transformation of the business model	-0.01
	(0.15)

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable.

Table A2.9: Mediation analysis using family ownership

Variables	**Digital transformation of the business model**
Direct effects	
Family ownership (d) → Dynamic capabilities	-0.07
	(0.06)
Family ownership (d) → Digital transformation of the business model	-0.06
	(0.08)
Dynamic capabilities → Digital transformation of the business model	0.48***
	(0.07)
Indirect effect	
Family ownership (d) → Dynamic capabilities	-0.03
→ Digital transformation of the business model	(0.03)
Total effect	
Family ownership (d) → Digital transformation of the business model	-0.09
	(0.09)

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable.

Appendix of Chapter 3:

Table A3.1: Description of the main variables of interest

Items	Construct and its properties
How important are the following goals of digitalization for your firm? (Response categories range from *1 = not important at all* to *5 = very important*) (1) Creation of new services (2) Creation of new products and product functions (3) Entry into new markets (4) Addressing new customers and customer groups (5) Strengthening the corporate brand (6) Introduction of new pricing and revenue models	*Pursuit of growth goals with digitalization* (CR = 0.87; AVE = 0.52)
To what extent do the following statements apply to the owners of your firm? (based on Gerken et al., 2022) (Response categories range from *1 = strongly disagree* to *5 = strongly agree*) (1) The owners consider the success of our firm to be their personal success. (2) Our firm has a high personal meaning for the owners. (3) Belonging to our firm is part of the identity of the owners. (4) The owners are proud to let others know that they are part of our firm.	*Identification with the firm* (CR = 0.88; AVE = 0.65)
To what extent do the following statements apply to the owners of your firm? (based on Gerken et al., 2022) (Response categories range from *1 = strongly disagree* to *5 = strongly agree*) (1) In our firm, emotions and moods often influence decision-making processes. (2) In our firm, emotion-based arguments are often as important as economic arguments.	*Emotional attachment* (CR = 0.81; AVE = 0.68)
To what extent do the following statements apply to the owners of your firm? (based on Gerken et al., 2022) (Response categories range from *1 = strongly disagree* to *5 = strongly agree*) (1) Continuing the heritage and tradition of the owners is an important goal for our firm. (2) It is unlikely that the owners would consider selling our firm. (3) Successfully handing over the firm to the next generation of owners is an important goal for the owners.	*Succession intentions* (CR = 0.80; AVE = 0.58)

Notes: CR = Composite reliability; AVE = Average variance extracted.

Table A3.2: Alternative family firm definitions

Definition of family firm	**Proportion of family firms in the sample**	**OLS regression coefficients**	
Family ownership		Model 1	Model 2
1. Founder and/or family holds shares.	66.67%	-0.17**	-0.19**
		(0.08)	(0.09)
2. Founder and/or family holds at least 5% shares.	66.48%	-0.16**	-0.18**
		(0.08)	(0.09)
3. Founder and/or family holds at least 51% shares.	62.10%	-0.12	-0.13
		(0.08)	(0.09)
Family management			
4. Family involved in management.	29.90%	-0.19**	-0.22**
		(0.08)	(0.09)

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table A3.3: Subsample analysis for non-family firms

Variables	**Pursuit of growth goals with digitalization**			
	Model 1	Model 2	Model 3	Model 4
Identification with the firm	0.14*			0.12
	(0.08)			(0.09)
Emotional attachment		0.10		0.07
		(0.07)		(0.08)
Succession intentions			0.03	0.00
			(0.06)	(0.07)
Dynamic capabilities	0.23*	0.28**	0.25*	0.25*
	(0.14)	(0.13)	(0.14)	(0.14)
Digitalization level (in primary activities)	0.06	0.09	0.07	0.05
	(0.12)	(0.12)	(0.12)	(0.13)
Patents (d)	-0.17	-0.13	-0.10	-0.16
	(0.15)	(0.15)	(0.16)	(0.16)
Firm age (log.)	-0.12	-0.08	-0.08	-0.11
	(0.11)	(0.11)	(0.11)	(0.12)
Employees (log.)	0.16*	0.14	0.12	0.15
	(0.09)	(0.09)	(0.09)	(0.10)
NACE (d)	Yes	Yes	Yes	Yes
Federal states (d)	Yes	Yes	Yes	Yes
R-squared	0.26	0.26	0.24	0.26
F-test	1.59	1.66	1.41	1.43
Prob > F	0.05	0.03	0.11	0.09
Observations	152	158	152	147

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table A3.4: Alternative independent variable at the owner level

Variables	**Pursuit of growth goals with digitalization**
Ownership commitment	0.17**
	(0.08)
Dynamic capabilities	0.09
	(0.08)
Digitalization level (in primary activities)	0.35***
	(0.08)
Patents (d)	-0.05
	(0.09)
Firm age (log.)	0.10
	(0.08)
Employees (log.)	0.09
	(0.07)
NACE (d)	Yes
Federal states (d)	Yes
R-squared	0.21
F-test	2.70
Prob > F	0.00
Observations	342

Notes: Standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Appendix of Chapter 4:

Table A4.1: Clustered OLS regressions for our main sample including industry dummies

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.73*** (0.45)	2.56 (2.41)
Firm age (log.)	0.71*** (0.17)	4.33*** (0.99)
Employees (log.)	-0.46*** (0.18)	-1.08 (1.02)
Patents per employee	-0.33* (0.17)	-0.39 (1.25)
Patents (d)	0.67* (0.36)	6.60*** (2.19)
Export intensity (%)	0.01 (0.01)	0.09 (0.06)
Export (d)	1.34*** (0.46)	5.51* (2.89)
Liquidity ratio	0.21*** (0.03)	-0.24*** (0.09)
Debt-to-equity ratio (%)	-0.01*** (0.00)	0.04*** (0.01)
Stock market listing (d)	-6.50*** (0.95)	-19.03*** (3.16)
Blockholder (d)	-0.57 (0.36)	0.38 (1.76)
Industry diversification (d)	0.02 (0.29)	1.59 (1.69)
ROA volatility (%)	0.03 (0.04)	0.21 (0.24)
NACE (d)		
11	0.31 (1.07)	-4.90 (4.36)
12	6.87 (5.07)	57.43 (38.80)
13	-0.82 (1.03)	-0.09 (7.75)
14	-0.58 (1.68)	7.31 (12.28)
15	0.66 (1.44)	-4.10 (5.07)
16	-1.26 (1.12)	-7.87 (4.84)
17	-0.45 (1.06)	-0.02 (6.82)
18	0.06 (1.49)	0.28 (7.77)
19	-1.03 (1.54)	-7.10 (5.20)
20	2.16*** (0.68)	8.90** (4.21)
21	0.63 (1.10)	4.88 (5.02)
22	2.36*** (0.75)	4.46 (3.92)
23	-0.03 (0.98)	-2.12 (4.57)
24	-1.26* (0.73)	-6.15 (3.99)
25	0.77 (0.60)	6.26* (3.74)
26	2.78*** (0.75)	9.14** (3.96)
27	2.12*** (0.79)	8.24* (4.69)
28	1.31** (0.59)	3.18 (3.23)
29	0.46 (0.91)	-4.67 (6.11)
30	0.00 (1.55)	0.56 (8.96)
31	0.91 (1.24)	4.01 (7.47)
32	2.08** (1.04)	13.05 (8.06)
33	1.35 (1.26)	2.97 (7.48)
Constant	9.80*** (1.48)	7.21 (8.52)
Observations	28,584	28,584
R-squared	0.07	0.02

Notes: Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period and German federal state. The sample comprises 28,584 firm-year observations from 4,677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable(s); log. = logarithmized.

Table A4.2: Overview of the main sample and subsamples

Sample	Criteria	All Firms	HCs	Non-HCs	HCs in Sample (%)
Main sample	50 to 2,999 employees	28,584 (4,677)	3,958 (617)	24,626 (4,060)	13.85 (13.19)
Subsample 1	50 to 499 employees	23,052 (3,781)	2,242 (353)	20,810 (3,428)	9.73 (9.34)
Subsample 2	500 to 2,999 employees	5,532 (896)	1,716 (264)	3,816 (632)	31.02 (29.46)
Subsample 3	50 to 2,999 employees and at least 10 years old	27,498 (4,370)	3,840 (588)	23,658 (3,782)	13.96 (13.46)
Subsample 4	Revenue threshold of 3 billion Euros	24,817 (4,630)	3,773 (616)	21,044 (4,014)	15.20 (13.30)

Notes: Overview of all samples analyzed in this study. The table refers to firm-year observations and shows the corresponding firms in parentheses. Criteria were applied for the year 2018 regarding employees and for 2020 regarding age.

Table A4.3: Clustered OLS regressions for subsample 1

Variables	**ROA (%)**	**ROE (%)**
HC (d)	2.33***	5.78*
	(0.60)	(3.34)
Firm age (log.)	0.68***	4.85***
	(0.20)	(1.21)
Employees (log.)	-0.55**	-1.95
	(0.27)	(1.61)
Patents per employee	-0.29	-0.38
	(0.19)	(1.38)
Patents (d)	0.73*	6.46***
	(0.39)	(2.34)
Export intensity (%)	0.01	0.12*
	(0.01)	(0.07)
Export (d)	1.07**	5.37*
	(0.53)	(3.14)
Liquidity ratio	0.24***	-0.23**
	(0.03)	(0.09)
Debt-to-equity ratio (%)	-0.01***	0.04***
	(0.00)	(0.01)
Stock market listing (d)	-9.93***	-26.48***
	(1.62)	(4.79)
Blockholder (d)	-0.63	0.43
	(0.43)	(1.98)
Industry diversification (d)	0.13	2.87
	(0.33)	(1.90)
ROA volatility (%)	0.02	0.18
	(0.05)	(0.26)
Constant	10.64***	9.64
	(1.90)	(10.79)
Observations	23,052	23,052
R-squared	0.08	0.02

Notes: Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 23,052 firm-year observations from 3,781 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Table A4.4: Clustered OLS regressions for subsample 2

Variables	**ROA (%)**	**ROE (%)**
HC (d)	0.67	-1.78
	(0.63)	(3.24)
Fim age (log.)	0.91***	2.71*
	(0.28)	(1.53)
Employees (log.)	-0.56	-0.91
	(0.46)	(2.55)
Patents per employee	-0.34	0.09
	(0.39)	(2.38)
Patents (d)	0.77	11.15*
	(0.91)	(6.50)
Export intensity (%)	0.02	0.01
	(0.02)	(0.12)
Export (d)	2.17**	4.70
	(0.90)	(6.72)
Liquidity ratio	0.09*	-0.17
	(0.05)	(0.26)
Debt-to-equity ratio (%)	-0.01***	0.04**
	(0.00)	(0.02)
Stock market listing (d)	-3.74***	-13.92***
	(1.05)	(4.76)
Blockholder (d)	-0.76	-0.78
	(0.57)	(3.67)
Industry diversification (d)	-0.56	-3.45
	(0.57)	(3.67)
ROA volatility (%)	0.12	0.44
	(0.10)	(0.60)
Constant	9.31***	12.01
	(3.40)	(21.72)
Observations	5,532	5,532
R-squared	0.11	0.07

Notes: Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 5,532 firm-year observations from 896 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Table A4.5: Clustered OLS regressions for subsample 3

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.80***	2.68
	(0.46)	(2.46)
Firm age (log.)	0.31	3.55***
	(0.19)	(1.08)
Employees (log.)	-0.44**	-1.08
	(0.18)	(1.04)
Patents per employee	-0.25	0.61
	(0.16)	(0.87)
Patents (d)	0.68*	6.47***
	(0.37)	(2.20)
Export intensity (%)	0.01	0.09
	(0.01)	(0.06)
Export (d)	1.46***	6.53**
	(0.48)	(2.97)
Liquidity ratio	0.22***	-0.24***
	(0.03)	(0.09)
Debt-to-equity ratio (%)	-0.01***	0.05***
	(0.00)	(0.01)
Stock market listing (d)	-6.50***	-19.46***
	(0.96)	(3.18)
Blockholder (d)	-0.68*	0.09
	(0.36)	(1.78)
Industry diversification (d)	0.07	1.40
	(0.30)	(1.72)
ROA volatility (%)	0.05	0.24
	(0.04)	(0.25)
Constant	10.95***	8.21
	(1.54)	(8.84)
Observations	27,498	27,498
R-squared	0.07	0.03

Notes: Results of separate clustered OLS regressions of ROA and ROE on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 27,498 firm-year observations from 4,370 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Table A4.6: Seemingly unrelated regression for our main sample

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.73***	2.56*
	(0.23)	(1.38)
Firm age (log.)	0.71***	4.33***
	(0.09)	(0.53)
Employees (log.)	-0.46***	-1.08*
	(0.09)	(0.55)
Patents per employee	-0.33***	-0.39
	(0.09)	(0.56)
Patents (d)	0.67***	6.60***
	(0.18)	(1.07)
Export intensity (%)	0.01**	0.09***
	(0.00)	(0.03)
Export (d)	1.34***	5.51***
	(0.26)	(1.60)
Liquidity ratio	0.21***	-0.24***
	(0.02)	(0.09)
Debt-to-equity ratio (%)	-0.01***	0.04***
	(0.00)	(0.00)
Stock market listing (d)	-6.50***	-19.03***
	(0.44)	(2.69)
Blockholder (d)	-0.57***	0.38
	(0.18)	(1.11)
Industry diversification (d)	0.02	1.59*
	(0.15)	(0.88)
ROA volatility (%)	0.03**	0.21**
	(0.01)	(0.08)
Constant	9.80***	7.21
	(0.79)	(4.81)
Observations	28,584	28,584
R-squared	0.07	0.02
Chi-square	2,253.81	700.94
Breusch-Pagan test of independence (*Chi*-square)	12,749.54***	

Notes: Results of the seemingly unrelated regression of ROA and ROE on HC and further firm characteristics. Regression includes dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 28,584 firm-year observations from 4,677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Table A4.7: Clustered OLS regression for ROS

Variables	**ROS (%)**
HC (d)	1.03***
	(0.35)
Firm age (log.)	0.48***
	(0.14)
Employees (log.)	-0.06
	(0.15)
Patents per employee	0.81**
	(0.34)
Patents (d)	0.14
	(0.30)
Export intensity (%)	0.02***
	(0.01)
Export (d)	1.20***
	(0.32)
Liquidity ratio	0.24***
	(0.03)
Debt-to-equity ratio (%)	-0.01***
	(0.00)
Stock market listing (d)	-3.38***
	(0.86)
Blockholder (d)	-0.17
	(0.25)
Industry diversification (d)	0.20
	(0.23)
ROA volatility (%)	-0.06*
	(0.03)
Constant	3.31***
	(1.12)
Observations	24,778
R-squared	0.08

Notes: Results of clustered OLS regression of ROS on HC and further firm characteristics. Regression includes dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 24,778 firm-year observations from 4,630 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Table A4.8: Clustered OLS regressions for our main sample using winsorized data

Winsorization level	**ROA (%)**	**ROE (%)**
1%	1.65***	3.37*
	(0.42)	(2.02)
5%	1.36***	2.69**
	(0.34)	(1.16)

Notes: Results of the clustered OLS regressions for our main sample analyzing the relationship between the independent variable HC and the winsorized dependent variables ROA and ROE. The sample comprises 28,584 firm-year observations from 4,677 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level.

Table A4.9: Clustered OLS regressions for our main sample using EBIT

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.59***	2.65
	(0.43)	(2.37)
Firm age (log.)	0.68***	3.95***
	(0.17)	(1.01)
Employees (log.)	-0.53***	-2.01*
	(0.17)	(1.02)
Patents per employee	-0.63***	-1.11
	(0.19)	(1.43)
Patents (d)	0.63*	6.90***
	(0.36)	(2.25)
Export intensity (%)	0.01*	0.09
	(0.01)	(0.06)
Export (d)	1.42***	5.19*
	(0.44)	(2.85)
Liquidity ratio	0.16***	-0.39***
	(0.03)	(0.09)
Debt-to-equity ratio (%)	-0.01***	0.08***
	(0.00)	(0.01)
Stock market listing (d)	-5.63***	-16.86***
	(0.97)	(3.25)
Blockholder (d)	-0.76**	0.00
	(0.35)	(1.78)
Industry diversification (d)	-0.00	1.69
	(0.29)	(1.70)
ROA volatility (%)	0.03	-0.00
	(0.04)	(0.00)
Constant	10.84***	14.38*
	(1.44)	(8.35)
Observations	28,443	28,443
R-squared	0.06	0.04

Notes: Results of separate clustered OLS regressions of ROA and ROE (based on EBIT) on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 28,443 firm-year observations from 4,660 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

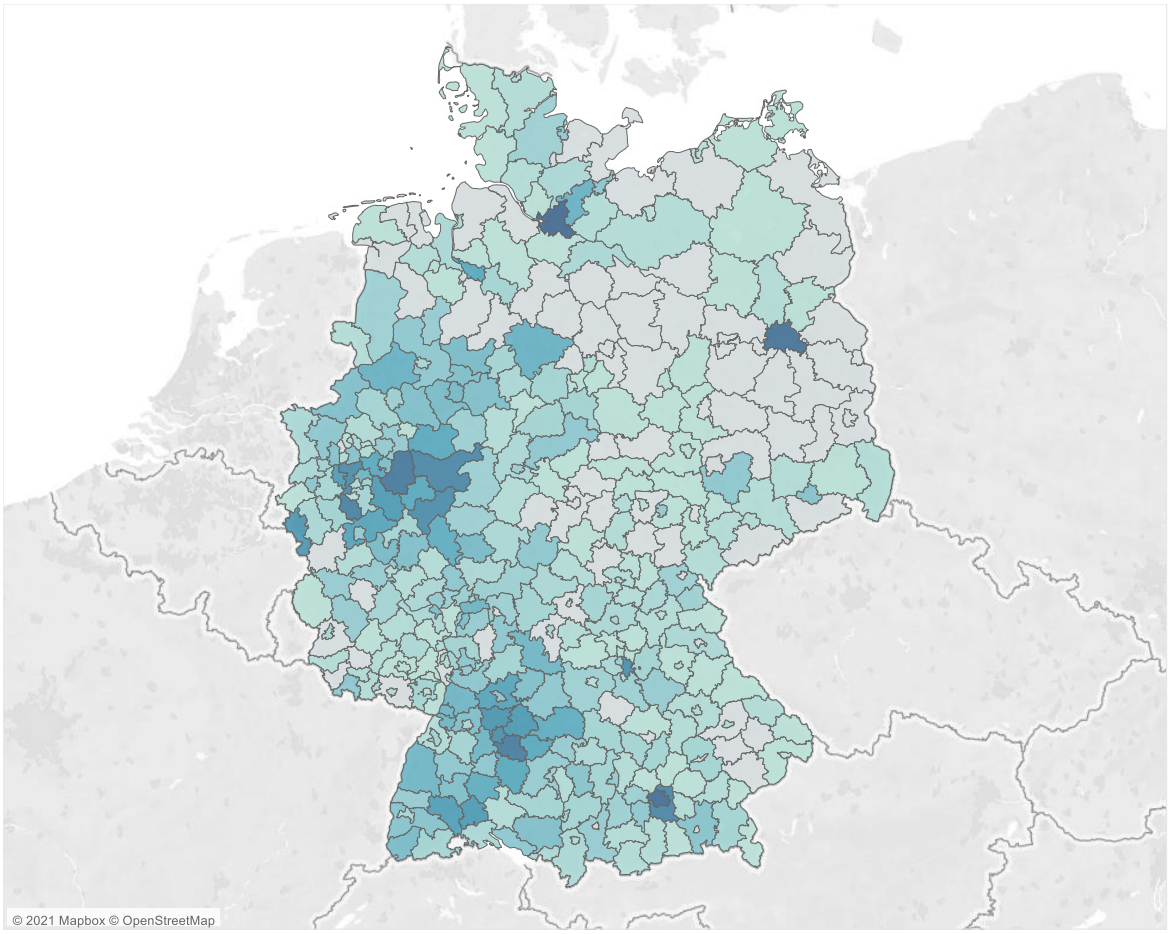
Table A4.10: Clustered OLS regressions for our main sample using EBITDA

Variables	**ROA (%)**	**ROE (%)**
HC (d)	1.18**	1.27
	(0.46)	(2.63)
Firm age (log.)	0.45**	2.37**
	(0.17)	(1.10)
Employees (log.)	0.04	-0.38
	(0.18)	(1.16)
Patents per employee	-0.64**	-1.14
	(0.27)	(1.75)
Patents (d)	1.18***	11.65***
	(0.38)	(2.62)
Export intensity (%)	0.01	0.08
	(0.01)	(0.06)
Export (d)	1.53***	6.18*
	(0.45)	(3.38)
Liquidity ratio	0.10***	-0.89***
	(0.03)	(0.11)
Debt-to-equity ratio (%)	-0.01***	0.17***
	(0.00)	(0.01)
Stock market listing (d)	-5.82***	-19.03***
	(0.99)	(3.50)
Blockholder (d)	-0.86**	1.19
	(0.36)	(2.00)
Industry diversification (d)	0.30	1.00
	(0.30)	(1.96)
ROA volatility (%)	0.00	0.01
	(0.00)	(0.01)
Constant	13.55***	18.45**
	(1.49)	(9.16)
Observations	28,443	28,443
R-squared	0.04	0.11

Notes: Results of separate clustered OLS regressions of ROA and ROE (based on EBITDA) on HC and further firm characteristics. All regressions include dummy variables for each year of the sample period, for German federal states and for two-digit NACE codes. The sample comprises 28,443 firm-year observations from 4,660 firms. The model shows coefficients with robust standard errors in parentheses. Asterisks denote statistical significance at the 0.01(***), 0.05(**), and 0.10(*) level. d = dummy variable; log. = logarithmized.

Appendix of Chapter 5:

Figure A5.1: Regional distribution of HCs in Germany



Notes: Distribution of the absolute number of HCs per district; darker colors represent an increasing number of HCs; grey colored districts possess zero HCs.
Source: Own illustration, created via Tableau.

Table A5.1: Description of variables for Chapter 5

Variable name	Definition	Data Source	Category
GDP per capita	In € per district in 2016	INKAR	Dependent
Median income	Monthly salaries of full-time employees subject to social insurance contributions in € per district in 2017	INKAR	Dependent
Unemployment rate	Share of unemployed in the civilian labor force in % per district in 2017	INKAR	Dependent
Business tax revenues	Business tax revenues in € per inhabitant per district in 2017	INKAR	Dependent
Trainees per 1,000 employed	Number of trainees per 1,000 employees subject to social insurance contributions per district in 2017	INKAR	Dependent
R&D intensity	Total corporate internal R&D expenditures in tsd € per 100,000 inhabitants per district in 2015	Donors' Association for Science Statistics	Dependent
Patent intensity	Number of granted patents per 100,000 inhabitants per district between 2011 and 2015	EPO	Dependent
Export intensity	Export turnover in tsd € per 100,000 inhabitants per district in 2017	Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States	Dependent
HC intensity	Number of HCs per 100,000 inhabitants per district in 2020	Own research	Independent
Population density	Number of inhabitants per km² per county 2017	INKAR	Control
Population average age	In years per district in 2017	INKAR	Control
Firm intensity	Number of firms per 100,000 inhabitants per district in 2017	Regional Database of the Statistical Offices of the Federal Republic of Germany and the Federal States	Control
University intensity	Number of public and private universities per 100,000 inhabitants per district in 2018	Communal Education Database of the Statistical Offices of the Federal Republic of Germany and the Federal States	Control
C-DAX intensity	Number of firms listed in the C-DAX per 100,000 inhabitants per district in 2020	Deutsche Börse AG	Control
New business formation intensity	Number of newly established businesses per 100,000 inhabitants per district in 2017	INKAR	Control