Corporate Real Estate Ownership Under a Dynamic Business Environment

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Summary

Companies are increasingly faced with a dynamic business environment. Fundamental structural changes overlap with economic cycles and force decision-makers to act under uncertainty. This situation challenges corporate real estate management to adapt the provision of space to the new corporate situation. In this context, one of the most critical decisions represents the choice between the provision forms of ownership, rental or leasing. In the past, European companies in particular have held ownership to a large extent. However, doubts have arisen as to whether this strategy should be continued. Owning property is considered to be highly inflexible as it can often only be sold with a time delay or at a discount in the event of a quantitative change in space demand. This represents a first possible contradiction to the progressively dynamic corporate environment. Accordingly, this paper addresses the question whether the role of ownership alters in an environment characterised by change. To answer this question, six studies were conducted and summarised in five articles.

In order to understand adjustments in provision strategy, it is necessary to understand its impact on corporate success. Maximisation of the company's success represents the guiding motive for adapting the provision of space to environmental changes. Here, the first article develops a holistic framework for the relationship between corporate real estate management and corporate success as well as empirically testing its validity. This understanding, in turn, forms the basis for the subsequent studies and allows initial conclusions to be drawn about the impact of holding property on corporate success.

In the three subsequent articles (2-4), which focus on Germany, the UK and Europe as a whole, a first step is to use balance sheet ratios to illustrate the role that real estate ownership has played for non-property companies in recent decades. Against the background of an increasingly dynamic corporate environment, possible changes over time would support the theory regarding the changing role of real estate ownership. An empirical investigation of real estate ownership and its influence on capital market performance allows initial insights about the importance of ownership strategy for corporate success.

Although up to this point the articles pursue a similar objective, they then attempt to map the importance of real estate ownership for corporate success with different foci of investigation depending on the corporate situation. Thus, Article 2 aims to show that the contribution of real estate ownership to success depends not only on the core business as previous studies have shown, but also on additional business segments in which companies operate. This is of high interest because companies are increasingly expanding their existing activities with services by offering integrated solutions, resulting in new requirements for the provision of space.

In contrast, Article 3 addresses the question of whether holding real estate actually reduces flexibility and, therefore, has a negative impact on a company's success in the event of economic fluctuations. For this purpose, the impact of real estate ownership during economic upswings and downturns is to be compared.

Article 4 then ties in with this line of argument. Due to the previously described long-term nature and difficult revisability, the importance of property should change, especially for companies under uncertainty. Thus, it should be shown that companies anticipate uncertainty by restraining their investment behaviour. If firms were to continue to hold on to property under uncertainty, then this could have a negative impact on their performance.

The concluding Article 5 extends the previous research by establishing a link between current structural change and ownership strategy. Through a comprehensive survey of CREM decision-makers, companies are grouped according to the extent of their affection by structural change and examined with regard to a possible reaction in their ownership strategy. A differentiated analysis according to types of use and a query of ownership-reducing measures provides a more detailed insight into the types of use for which an ownership reduction could be considered as well as for how this could be implemented.

This dissertation thus expands previous discussions regarding the advantageousness of real estate ownership by explicitly including the increasingly dynamic and uncertain corporate environment. At the same time, the underlying work complements previous studies focusing on Anglo-American and Asian markets by adding a European perspective. This not only provides a valuable contribution to knowledge but, in parallel, these studies provide practice-relevant insights into the possible consequences of adhering to or adapting current ownership strategies. However, the knowledge gained is not only relevant for non-property companies. An adapted ownership strategy would also have overall real estate economic implications for investors as well as service providers.

Zusammenfassung

Unternehmen sehen sich zunehmend einer dynamischeren Unternehmensumwelt ausgesetzt. Tiefgreifende strukturelle Veränderungen überlagern sich mit Wirtschaftszyklen und zwingen Entscheidungsträger unter Unsicherheit zu agieren. Dies stellt das betriebliche Immobilienmanagement vor die Herausforderung die Flächenbereitstellung an die neue Unternehmenssituation anzupassen. Eine der erfolgskritischsten Entscheidungen stellt dabei die Wahl zwischen den Bereitstellungsformen Eigentum, Miete und Leasing dar. Haben gerade europäische Unternehmen in der Vergangenheit noch verstärkt Eigentum gehalten, kommen Zweifel auf, ob weiterhin an dieser Strategie festgehalten werden sollte. So gilt Immobilieneigentum als besonders unflexibel, da es infolge von quantitativen Flächenbedarfsänderungen häufig nur zeitverzögert oder unter Discounts veräußert werden kann. Dies stellt einen ersten möglichen Wiederspruch zur immer dynamischeren Unternehmensumwelt dar. Entsprechend wird sich in der vorliegenden Arbeit der Frage zugewandt, inwiefern sich die Bedeutung von Eigentum in einem vom Wandel gekennzeichneten Umfeld verändert. Zur Beantwortung dieser Frage wurden sechs Studien durchgeführt, welche in fünf Artikeln zusammengefasst wurden.

Um Anpassungen in der Bereitstellungsstrategie nachzuvollziehen, ist es notwendig dessen Einfluss auf den Unternehmenserfolg zu verstehen. Die Maximierung des Unternehmenserfolges stellt das handlungsleitende Motiv dar, die Flächenbereitstellung an Umweltveränderungen anzupassen. Hier knüpft der erste Artikel an, indem in diesem ein ganzheitliches Framework zum Zusammenhang zwischen dem betrieblichen Immobilienmanagement und Unternehmenserfolg entwickelt und dessen Gültigkeit empirisch testet. Dieses Verständnis bildet wiederum die Basis für die folgenden Untersuchungen und lässt erste Schlüsse darüber zu, inwiefern sich das Halten von Immobilieneigentum auf den Unternehmenserfolg auswirken kann.

In den drei anschließenden auf Deutschland, UK und Gesamteuropa abzielenden Artikeln (2-4) soll jeweils in einem ersten Schritt anhand von Bilanzkennzahlen dargestellt werden, welche Bedeutung Immobilieneigentum für Non-Property Unternehmen in den vergangenen Jahrzehnten eingenommen hat. Mögliche Veränderungen im Zeitverlauf würden die These einer sich im Wandel befindlichen Rolle von Immobilieneigentum vor dem Hintergrund einer immer dynamischeren Unternehmensumwelt stützen. Eine empirische Untersuchung des Immobilieneigentums und dessen Einfluss auf die Kapitalmarktperformance lässt erste Vermutungen über das Bedeutungsgewicht der Eigentumsstrategie für den Unternehmenserfolg zu.

Verfolgen die Artikel bis zu diesem Punkt eine ähnliche Zielsetzung, versuchen sie im Anschluss mit unterschiedlichen Untersuchungsschwerpunkten die Bedeutung von Immobilieneigentum für den Unternehmenserfolg je nach Unternehmenssituation abzubilden. So soll durch Artikel 2 aufgezeigt werden, dass sich der Erfolgsbeitrag von Immobilieneigentum nicht nur wie in bisherigen Studien aufgezeigt wurde vom Kerngeschäft, sondern auch von zusätzlichen Geschäftsfeldern, in denen Unternehmen operieren, abhängt. Dies ist daher von besonderem Interesse, da Unternehmen verstärkt über das Angebot integrierter

Lösungsangebote ihre bisherigen Tätigkeiten mit Dienstleistungen erweitern und damit neue Anforderungen an die Flächenbereitstellung stellen.

Artikel 3 befasst sich dagegen mit der Frage, ob das Halten von Immobilieneigentum tatsächlich die Flexibilität mindert und sich daher im Falle wirtschaftlicher Schwankungen negativ auf den Unternehmenserfolg auswirkt. Hierfür soll die Erfolgswirkung von Immobilieneigentum während wirtschaftlichen Auf- und Abschwüngen verglichen werden.

An diese Argumentation knüpft im Anschluss Artikel 4 an. Aufgrund der zuvor beschriebenen Langfristigkeit und schweren Revidierbarkeit sollte sich die Bedeutung von Eigentum besonders für Unternehmen unter Unsicherheit verändern. So soll aufgezeigt werden, dass Unternehmen Unsicherheiten durch ein zurückhaltendes Investitionsverhalten antizipieren. Würden Unternehmen weiterhin unter Unsicherheit an Eigentum festhalten, könnte sich dies negativ auf den Unternehmenserfolg auswirken.

Der abschließende Artikel 5 erweitert die bisherigen Untersuchungen, indem er einen Zusammenhang zwischen dem aktuellen Strukturwandel und der Eigentumsstrategie herstellt. Durch eine umfassende Befragung von CREM Entscheidungsträgern werden Unternehmen anhand ihrer Betroffenheitssituation durch den Strukturwandel gruppiert und hinsichtlich einer möglichen Reaktion in ihrer Eigentumsstrategie untersucht. Eine differenzierte Betrachtung nach Nutzungsarten und Abfrage von eigentumsreduzierenden Maßnahmen gibt einen detaillierteren Einblick, für welche Nutzungsarten ein Eigentumsabbau in Frage kommt und wie dieser erfolgen könnte.

Damit erweitert die vorliegende Dissertation die bisherige Diskussion um die Vorteilhaftigkeit von Immobilieneigentum um die explizite Einbeziehung der immer dynamischeren und von Unsicherheiten geprägten Unternehmensumwelt. Gleichzeitig ergänzt die Arbeit bisherige schwerpunktmäßig sich auf anglo-amerikanische und asiatische Märkte konzentrierende Studien um eine europäische Perspektive. Dies liefert nicht nur einen wertvollen Beitrag zur Forschung, sondern gibt gleichzeitig praxisrelevante Einblicke zu möglichen Konsequenzen, wenn an der bisherigen Eigentumsstrategie festgehalten oder diese angepasst wird. Die gewonnen Erkenntnisse sind jedoch nicht nur für Non-Property Unternehmen von Bedeutung. Eine angepasste Eigentumsstrategie hätte auch gesamtimmobilienwirtschaftliche Implikationen für Investoren und Dienstleister.

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List of Abbreviations

ANOVA	Analysis of variance
CAPM	Capital Asset Pricing Model
CATI	Computer assisted telephone interview
CFO	Chief financial officer
CRE	Corporate real estate
CREM	Corporate real estate management
CRER	Corporate Real Estate Ratio
D.A.F.	Dispersion Accounted For
Df	Degrees of freedom
GDP	Gross domestic product
GRS test	Gibbons, Ross and Shanken test
HR	Human Resource
IFRS16	International Financial Reporting Standard 16
IT	Information Technology
MDS	Multi-dimensional scaling
OLS	Ordinary least squares
R&D	Research and development
REIT	Real estate investment trust
RI	Return Index
s.d.	Standard deviation
SIC	Standard Industrial Classification
SLB	Sale-and-lease-back
SME	Small and medium-sized enterprise
WZ2008	Klassifikation der Wirtschaftszweige (2008)

1 Introduction

1.1 Motivation and research question

Companies worldwide are facing increasingly intense and complex environmental dynamics and uncertainties. This dynamic is intensified by the current Covid-19 pandemic situation (Sharma *et al.,* 2020). Change is becoming the new normal (Harris and Cook, 2014). As a result, companies are forced to continuously adapt their business models, structures, processes and products to new business conditions (Pfnür and Wagner, 2020). While in the past the focus was more on the transformation of the four corporate resources, people, capital, technology and information, today, corporate real estate is moving into focus as a resource that is at least as important and represents an essential component of a successful transformation process.[1] The importance of corporate real estate and its management for a company's success position becomes clear at first glance in terms of its cost and asset impact. For example, real estate-related costs account for 5–20% of total costs for non-property companies (Pfnür, 2019). A similar percentage range can be observed for non-property companies' real estate assets as a percentage of total assets (Rochdi, 2015). The awareness for real estate resources' impact on corporate success highlights the need for a provision that should not only keep pace with corporate dynamics but also be in line with long-term developments. Only under this consideration can inefficiencies be avoided inside the corporate real estate system and the competitive position secured during changes to the corporate environment.

However, the identification of individual changes in the corporate environment and their relevance for corporate real estate management (CREM) is challenging for research as well as for practice. Drivers and megatrends of structural change, for example, have a huge additive effect on companies, and often show interdependencies that are difficult to delineate from each other (Pfnür and Wagner, 2020). At the same time, structural changes overlap with periodic developments such as business cycles or real estate market cycles (Diller and Lorch, 1984). Nevertheless, different trends are considered to have a high relevance. For example, CREM is particularly affected by the digitalisation of business models, the bundling of products and services, and the use of new information and communication technologies. The further development of production technologies, the constant interlinking of people, machines, logistics and products ("Industry 4.0"), as well as increasing "mass customisation" and shortening production cycles, are increasing the pressure to act. These technical and economic paradigm shifts are additionally overlaid by a parallel change in social values concerning environment, health and the individualisation of professional lifestyles (Pfnür, 2019). The situation is complicated by the fact that the aforementioned changes increase uncertainty about future space demand.

In light of the growing complexity of real estate challenges, it is not surprising that CREM is only at the beginning of an upcoming transformation process. According to corporate real estate managers, almost 50% of existing portfolios are expected to be adapted to new

[1] This relation was already recognised and predicted by Joroff *et al. (*1993).

quantitative and qualitative user requirements by redevelopments or market transactions in the next ten years (Pfnür, 2019). The relationship of users toward corporate real estate (CRE) appears to be fundamentally changing. Whereas workplaces were previously seen as more of a static backdrop for individual work, new user requirements for the physical quality of space, associated services and the need for increasingly shorter availability are transforming them into a type of "hotel" or "as-a-service" facilities (Harris and Cook, 2014). Such spaces are intended to provide some control over costs, length of commitment and flexibility (Harris and Cook 2014). At the same time, future spaces should be designed to support teams and networking (Jylhä *et al*., 2018), allowing organisational members to experience, and, if possible to share the space via sharing concepts such as office centre, co-production, or co-logistics (Pfnür, 2019). It can be seen that the discussion about possible reaction strategies in both corporate practice and research is predominantly characterised by topics around workplace management and transformation in the sense of physical as well as virtual reorganisation of the work environment, social and environmental aspects of sustainability, the alignment of CRE strategy and management, and the outsourcing of CRE services (Jylhä *et al.,* 2019; Haynes, 2017). The upcoming transformation of real estate resources necessarily directs attention to the little-noticed—but for CREM central—question of whether the provision of space in the future should be done via ownership, leasing or renting. The optimal choice of a provision variant is considered to be particularly complex and critical due to its long-term nature and high capital investment, numerous intangible aspects to be taken into account and its proven effect on success (O'Mara, 1999; Barkham and Park, 2011).

Despite the high impact of the ownership decision on success, no general and company-wide reaction in the ownership strategy can be identified. In recent years, for example, ownership rates in the U.S. and Asia have stabilised at an average level of 20–30%. European companies, on the other hand, have a much higher level of ownership at 55% (Hartmann, 2007; Nappi-Choulet, 2002). However, further studies suggest that European and especially German companies are reducing their ownership very slowly (e.g. Pfnür and Weiland, 2010). It is unclear, however, whether this trend is continuing and represents a reaction strategy to an increasingly dynamic business environment. Whereas just two decades ago capital was still seen as a high bottleneck factor and, therefore, ownership with its high capital integration was critically scrutinised (Crommen, 2001), new user requirements for the provision of space could now lead to a break with the previous ownership strategy. Real estate ownership, for example, is considered to be particularly bulky when it has to be disposed of in light of quantitative changes in space demand (Ambrose *et al*.,2017). This is not at least due to the fact that it is often difficult to find buyers at short notice for land owned with its location and property characteristics, a sale is, therefore, often only possible at discounts and the disposal process itself turns out to be a time-consuming one. The high level of commitment to real estate ownership could thus contradict the increasing demand for flexibility. A continuing high level of ownership by European companies could thus become a risk. Despite the lack of rights of disposal over the real estate itself, rental and leasing solutions with their option to terminate or let expire the contractual relationship appear more advantageous.

However, this first argument in favour of reducing real estate ownership represents only the tip of the iceberg regarding possible advantages and disadvantages of such a reaction strategy. It does, however, exemplify to what extent the importance of CRE as a resource in general and the form of provision in particular seems to be changing.

If non-property companies would indeed rethink their ownership strategy, this would also have significant structural consequences for the entire real estate industry. This is clearly illustrated by the example of the German real estate market. With estimated real estate assets of German non-property companies valuing 2.5 trillion euros (Pfnür, 2019) and a conservatively assumed annual decrease in the ownership rate of 2%, the average transaction volume p.a. would be more than double. Absolutely, the volume on the investment market for commercial real estate is estimated at 45 billion euros (Colliers, 2021). A significant increase in capital market volume would be the result. In addition to this quantitative adjustment, a qualitative adjustment of the supply would probably also have to be expected. This is already indicated by a steadily growing supply of flexible provision forms such as serviced real estate and short leases (Harris and Cook, 2014). At this point, it is also apparent that not only investors but also service providers would be challenged by a reduction in ownership. Thus, in the case of an ownership reduction, e.g. through a sale-and-lease-back transaction, non-property companies tend to get rid of the management of the space at the same time (Pfnür and Seger, 2017). A move away from real estate ownership would not only be a paradigm shift for non-property companies themselves, but would also have far-reaching and visible consequences for the real estate industry as a whole.

Despite the importance of this issue, previous research on real estate ownership of non-property companies has only shed light on its impact on capital market performance (e.g. Tuzel, 2010; Dong *et al.,* 2012; Rochdi, 2015; Diop, 2018; Demirer *et al.,* 2018). Changes in the corporate environment have only sporadically been included as predictors to control for undesirable side effects on the holding of property and its contribution to success (e.g. Du and Ma, 2012; Fougère *et al*., 2017). In cases where individual influences were explicitly taken into account, these studies almost all refer to the U.S. or Asian market (e.g. Ting, 2006; Tuzel, 2010; Diop, 2018). Due to different conditions, however, the transferability of these studies to the European market is doubtful. To close this revealed research gap, the present work aims at investigating the importance of real estate ownership in the context of a changing and uncertain business environment. First, this paper focuses on structural and cyclical changes, taking into account the steadily increasing uncertainty. The aim is to examine not only the ownership strategy itself, but also its contribution to the company's success. However, this requires a holistic understanding about the contribution of real estate provision to corporate success. Only the understanding of the underlying success mechanisms makes it possible to evaluate whether it is beneficial to hold property in an increasingly dynamic corporate environment. Therefore, it is necessary to develop a framework that depicts the relationship between the provision of real estate and corporate success. So far, no comparable framework exists in the literature. This will not only close highly relevant research gaps, but also provide CREM practitioners with guidelines for future real estate provision. The

consideration of impacts on corporate performance shall sensitize decision makers to consequences if they should not adapt the ownership strategy to contextual conditions. The paper focuses on the European market as a whole as well as on its two largest economies, Germany and the UK, in particular.

Given this background, this thesis aims to answer the following underlying research questions:

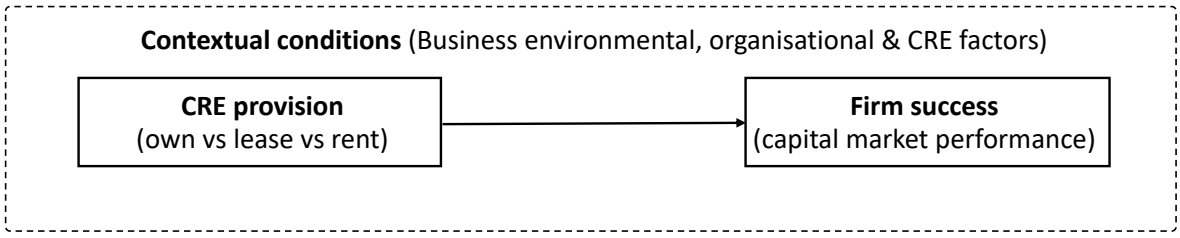
1. Through which mechanisms does real estate provision affect corporate success and what empirical relationships can be revealed?
2. How does a changing and increasingly uncertain business environment alter the real estate ownership strategy and what are the empirical implications for business success?

To answer these research questions, six studies were conducted, which were summarised in five papers. The problem is approached from different perspectives with varying databases and different methods.

1.2 Theoretical foundation

The introductory explanations underline the necessity of breaking down the topic into its individual and partly interdependent components, classifying them theoretically and reassembling them to form an overall framework. The theoretical framework consists of three components, which will be elaborated consecutively. The focus of interest is on Corporate Real Estate Management (CREM). In a first step, CREM is classified in order to address its core task of the real estate provision in general and the provision of ownership in particular. Serving as a starting point it examines the role of real estate provision regarding its impact on the company's success. This is based on the assumption that the role of the provision of ownership is determined by its positive or negative influence on the overall success of a company. The framework is completed by the consideration of contextual conditions, especially changes in the corporate environment; however, company- and property-related determinants also are included. These factors determine entrepreneurial action in terms of the provision of corporate real estate and its impact on success. This described relationship is summarised in Figure 1.

Figure 1: Overall framework



1.2.1 Corporate real estate management, real estate provision and ownership

Since the work of Zeckhauser and Silverman (1983), research and practice have been increasingly concerned with the management of corporate real estate. As an organisational unit, CREM encompasses all real estate activities of companies that do not focus on real estate as their core business. From an overarching corporate perspective, CREM thus represents a secondary service area that cannot be directly assigned to the core business activities, but supports them (Kämpf-Dern and Pfnür, 2014). According to the traditional view, the activities of CREM are oriented towards an optimal provision of real estate as a means of operation under aspects of an optimised benefit–cost ratio. This does not completely address the problem at hand. Companies not only act as users, but also as property owners with the aim of maximising the value of the capital employed. An extension of the purely user-oriented perspective to a more holistic view and, therefore, appears necessary. In addition, depending on the depth of the service, CREM also takes on the role of producer of the resource real estate itself and the associated real estate services (Pfnür, 2011). In summary, CREM comprises

> "*the planning, decision, organisation, implementation and controlling of all those real estate activities necessary to provide, operate or liquidate real estate of corporates… simultaneously acknowledging the three perspectives of the owner/investor, the user and the producer … to support the overall corporate strategy through effectively and efficiently dealing with land and building matters." (Kämpf-Dern and Pfnür 2014, p. 100)*

The focus of the present work lies on the provision of real estate. The term "provision" compromises "all tasks and activities concerned with the provision of building and land for the spatial organisation of the core business as well as central and supporting functions" (Hartmann 2007, p. 27). Providing space can be systematised as an overall process consisting of sub-steps along a hierarchical pyramid similar to that of capital investment management. Portfolio management derives the quantitative and qualitative space demand from higher level corporate goals and strategies while taking into account the existing space. The hierarchy underlying asset management develops provision variants on the property level and evaluates them to identify the optimal solution (Gier, 2006; Hartmann, 2007). Manning (1991) as well as Rodriguez and Sirmans (1996) describe this decision process as much more complex than in the case of conventional tangible assets because it depends on numerous intangibles. At the same time, numerous authors emphasise the high relevance of the provisioning decision and describe it as particularly critical (e.g. Brounen and Eichholtz, 2005; O'Mara, 1999), which is not least due to its high cost impact and partly difficult revisability.

In general, there are three provision variants, which differ in terms of their control rights over the real estate. On the one hand, corporate real estate can be acquired or developed, which is subsequently subsumed under ownership. On the other hand, corporate real estate

can be made available by renting or leasing. In the following, the three types of provision will only be briefly outlined as a detailed description would be too comprehensive.[2]

In the case of ownership (i.e. “freehold”), the company holds absolute control rights over the property. The owner can make any changes to the building as long as they are permitted by the legal framework (e.g. building and environmental law; Hayes, 2012). Another characteristic is the high and long-term asset commitment, which has to be considered in the balance sheet depending on accounting regulations and is also coupled with tax obligations (Schäfers, 1997). The disposal of owner-occupied real estate is similarly complex and time-consuming, for example, in the case of a traditional sale, sale-and-lease-back transactions or in light of a redevelopment of a vacant property for another use (Pfnür, 2011).

In the case of renting, the tenant receives a time-limited right to use the property in exchange for a rent payment. If a suitable property is available on the market, then it can be provided quickly (Schäfers, 1996). The terms of the contract, such as the amount of rent or incentives (e.g. tenant improvements or rent-free periods), depend strongly on the regional real estate market (Gier, 2006). An initial high capital requirement, as in the case of an ownership solution, is not necessary and no balance sheet accounting exists. However, rent can be claimed as an operating expense from a tax perspective. The commitment to the building is significantly lower than in the case of ownership because the right-of-use ends after the fixed term of the contract or upon termination.

Leasing combines characteristics of ownership and rent and, thus, represents a kind of intermediate form of the two forms of provision (Pfnür, 2011). In general, two forms of leasing can be distinguished: operating and financial leasing. The former can be terminated at any time within a period of notice; thus, operating leasing does not include a basic minimum lease term and is therefore similar to the above-mentioned provision form of rent. In comparison, financial leasing is characterised by a longer-term structure with a basic lease term covering 50–75% of the expected life cycle. After this agreed period the lessee has the option of either extending the lease, acquiring or returning the asset (Pfnür, 2011). The lease is accounted within the lessee’s balance sheet. Under operating leases, the lessee has not previously been obligated to report the leased asset on its balance sheet. Accordingly, this form of provision was considered attractive. However, this regulation has now been changed by the new IFRS accounting standards. As a consequence, operating leases must now also be reported in the balance sheet. This could make long-term leases, in particular, less attractive than ownership solutions (Baltussen *et al.*, 2014).

In addition, further sub-forms of provision variants have emerged in recent years, such as serviced office, virtual space, co-working (Hayes, 2012; Harris and Cooke, 2014) or the workplace at home, which has come into closer focus as a result of the Covid-19 pandemic (Pfnür *et al.*, 2021).

[2] A detailed description of provision alternatives can be found in Pfnür (2011), Haynes (2012), Gier (2006) or Schäfers (1996).

Actual data about the proportion of owned space has been documented only in few studies so far. Depending on the geographic focus, the proportion varies greatly between countries. For example, in the U.S. and Asia, only approx. 20% and 30% of non-property companies' space is owned, respectively (Nappi-Choulet, 2002). This relatively low level has emerged in recent decades and is the result of a long process of ownership reduction. For example, according to Ghent *et al.* (2018), the level of ownership in the United States has almost halved over the past 50 years. The reasons for the formerly high ownership rates are complex. For example, until the middle of the last century, a company's value was determined by its underlying assets. That led to the phenomenon whereby non-property companies invest in tangible capital such as corporate real estate (Krumm 2003). At the same time, the commercial real estate market was underdeveloped; as a consequence, many companies had hardly any opportunity to rent appropriate space and were therefore forced to own the property themselves (Krumm and Linneman, 2001). In addition, the economic structure at that time showed only minor fluctuations (Gier, 2006). As a result of the increased shareholder value orientation and the greater awareness about the high proportion of capital tied up in CRE, long-accumulated corporate ownership has been increasingly questioned. Due to value-based management, shareholders of US non-property companies in particular pushed for the release of capital tied up in CRE. In Europe, and especially in Germany, a time-lagged effect can be observed. Here, around the millennium, researchers and practitioners began to scrutinise the high ownership shares of German companies. A comparison of the studies by Pfnür and Hedden (2002) as well as Pfnür (2019), for example, shows that the shares of CRE held in ownership have fallen from 75% to 60% over the past 20 years. Similar trends can be seen in other European countries such as the UK and France. It can thus be speculated that the relevance of CRE ownership has shifted over time and will continue to change in the future. The causes and circumstances leading to a change in the importance of ownership will be examined in this paper.

1.2.2 Corporate real estate ownership and firm success

CREM, as a secondary service function, must also be measured by its contribution to the company's success. This also applies to the real estate provisioning decision. The sometimes-high share of real estate assets compared to total assets of companies suggests a significant influence on the overall success of a company. The quantification of this proves to be difficult, as there is no common understanding of the term "corporate success" in the literature. Thus, there is a multitude of different approaches that can be used to explain success and that are applicable in the present CREM context. A large part of CREM research deals with real estate activities, control concepts, performance measurement tools and the identification of value drivers that create real estate potential and contribute to the success of a company (Hartmann, 2011). According to one approach, success is the result of an activity to achieve ex-ante defined goals (goal approach) (Staehle *et al.*, 1999; Morschett, 2007). In the CREM context, this definition of success has been taken up in numerous articles and was especially examined in the context of company surveys (e.g. Hartmann *et al.*, 2010; Hartmann, 2011; Kämpf-Dern and Pfnür, 2014). In CREM research, this understanding of success serves more

as a theoretical connection between real estate-related activities and success than its quantification. Related to the real estate provisioning issue, Lindholm (2006), for example, uses a BSC map to show how CREM can increase flexibility and, thus, enhance business success by choosing a leasing solution instead of ownership. The underlying literature for a common definition of success will be revisited later in order to develop a holistic framework for CREM and its influence on corporate success (see Chapter 2).

However, a much larger part of the CREM research around the "own vs Lease" debate follows an understanding of success that can be attributed to the interests of the shareholders (e.g. Liow *et al.*, 2004; Lasfer, 2005; Nappi-Choulet *et al.*, 2009); in other words, success depends on the degree of satisfaction of the shareholders' expectations (Rappaport, 1986). Thus, the advantageousness of real estate ownership is examined from the perspective of the shareholders and the maximisation of the market value of the equity (shareholder value). This traditionally capital market-oriented approach is likely to be related on the one hand to the high capital intensity of property and, on the other hand, to globalisation, liberalisation and increasing competition in the financial markets of the 1980s and 1990s (Cromme, 2007). Following a central thesis on the ownership debate, it makes little sense from the shareholder's point of view that the capital provided is tied up in real estate by non-property companies, where it could instead be invested in property companies (e.g. REITs), which manage real estate-related risks better and are more likely to generate profit (Louko, 2006). Accordingly, companies should focus themselves and their capital on their core business, where they usually generate a higher return.

A wide range of different studies has been published on the holding of real estate by non-property companies and its impact on capital market performance. The studies can be roughly divided into two groups based on their methodology. Older studies examine the impact of acquisitions, sale-and-lease-back transactions, divestments or outsourcing of real estate holdings on the shareholder value or share price of non-property companies (Adams and Clarke, 1996; Rodriguez and Sirmans, 1996; Liow, 1997; Ezzell *et al.*, 2001; Devaney *et al.*, 2004; Ting, 2006; Groenlund *et al.*, 2008), whereas more recent studies try to prove effects of ownership ratios on shareholder value or share price (e.g. Brounen and Eichholtz 2005; Tuzel, 2010; Ling *et al.*, 2012; Dong *et al.*, 2012; Du *et al.*, 2014; Rochdi, 2015). The majority of work indicates a negative impact of real estate ownership on capital market performance. Nevertheless, opposing effects could also be measured. These partly contradictory results indicate that the question of optimal provision must be much more complex. The above argument that capital tied up in property should rather be invested in the core business reaches its limits here. If companies decide to cover their space requirements by means of ownership, then this is accompanied by both negative and positive consequences. These consequences range from tax and capital structure effects to the influence on liquidity due to the high level of capital tied up and the lendability of the property to the creation of strategic opportunities and a change in flexibility. Furthermore, it is possible to support corporate cash flows by leasing space that is no longer needed or to participate in value increases by selling it. This exemplary list of possible consequences makes it clear that the provision of

property is accompanied by a wide range of indirect, direct, tangible and intangible as well as short- and long-term success contributions. A systematisation of the multi-dimensional success contribution related to ownership or CREM in general is not to be found in the literature. Thus, existing frameworks either do not map holistically CREM's contribution to success or have not been empirically validated (Heywood and Arkesteijn, 2017).

By contrast, the number of studies attempting to prove a link between real estate ownership and overall corporate success via capital market performance appears to be far greater. However, their underlying models are also subject to criticism. Hartmann (2011), for example, criticises the fact that previous financial economic studies and models fall short and do not represent the much more complex reality sufficiently. This becomes clear when contingency theoretical considerations are taken into account. According to this, depending on the individual situation, specific best ways of organisations to perform best (Kämpf-Dern and Pfnür, 2014) result from the internal or external context of the company. Applied to the current topic, this means that there is no generally applicable best provision strategy to perform best per se as it depends specifically on the corporate context and changes in the corporate environment. The extent to which the deployment context plays a role will be examined in more detail below.

1.2.3 Contextual conditions and corporate real estate ownership

Organisational structures and decision-making processes are significantly influenced by internal and external contextual conditions (Wolf, 1994). With regard to CREM and the provisioning decision, a distinction can be made between real estate-related, company-related and company environment-related factors (Schäfers, 1997; O'Mara, 1999; Brueggemann, 2006; Hartmann, 2011; Kämpf-Dern and Pfnür, 2014). However, a review of the existing literature shows that most research only focuses on the relationship between real estate provision and success while ignoring contextual factors. When contextual factors have been considered in papers, they have served either to characterise the sample or as predictors to control for unwanted side effects on the independent variable of ownership or success.

Corporate real estate-related context

The optimal form of CRE provision is first and foremost determined by real estate-related factors such as the building design, the location, the intended purpose or use type (Roulac, 1999) where the use type can be justified by the different degrees of importance for each company. If the real estate serves, for example, as a simple physical input or production factor and for the sole execution of corporate strategies, then the leasing model represents the optimal form of provision. This usually includes several use types such as storage facilities, logistics and offices. In contrast, if CRE is used to create long-term competitive advantages, then it should be owned from the perspective of the resource-based view. Retail space, as an example, contributes significantly to company's success (Park and Glascock, 2010). Due to their specific characteristics, the same applies to properties as they create more added value for the company than for its competitors. The unique spaceship-like architecture of Apple Park, which opened in Cupertino, California in 2018, is an example of added

value by transmitting its company identity and ethos through property assets. Furthermore, the quality or condition of a property can also determine whether it should continue to be owned or sold. At the same time, it must be considered that ownership not only represents a hidden capital reserve; in the case of a maintenance backlog, it can also have a lower market value than the book value and represent a “hidden burden” (Remøy *et al*., 2019). A capitalisation of this through a disposal of real estate property would reduce a company’s profit and, as a result, CREM would continue to hold on to the property.

Organisational context

This is further complicated by the fact that the provision strategy is also influenced by a unique company's internal environment (Baltussen et al. 2014). For example, the company’s geographic location has an impact on its ownership strategy. Accordingly, ownership strategy sometimes varies significantly depending on the countries in which a company is located. Among other factors, Laposa and Charlton (2002) attribute these differences to the various "worldviews" of the CREM managers. Furthermore, the industry to which a company belongs plays also a decisive role (e.g. Redman and Tanner 1991). Due to the stronger link between real estate and the business model as well as the resulting higher strategic importance, holding properties is more common in industries such as the retail or hotel sectors than in the service sector (Roulac 1999). Furthermore, it is obvious that especially smaller and younger companies have limited financing possibilities and are less willing to tie up capital in real estate properties in the long run than large enterprises (Redman and Tanner 1991, Louargand 1999). Thus, the company’s size or age (e.g. Du and Ma 2012) plays a role as well as the capacity to raise debt for real estate investments (e.g. Gan 2007; Fougère et al. 2017).

If companies also show significant growth opportunities, they are encouraged to use capital in their core business and avoid ownership (Du and Ma 2012). Whether and to what extent the capital available to the company is used efficiently also depends on corresponding of shareholders’ control and incentive mechanisms towards the management. In this context, studies have shown that, depending on corporate governance, misguided real estate investments could have been prevented in the sense of "empire building" which finally has led to a higher company success (Sing and Sirmans 2008; Du and Ma 2012; Zhao and Sing 2014).

Business environmental context

At the same time, studies in recent years indicate that CREM in general and the provision of CRE in particular cannot be viewed in isolation from external influences (Schäfers, 1997; Tay and Liow, 2006; Hartmann, 2011). Companies are embedded in a constantly changing global environment with legal–political, technological, socio-cultural, physical-ecological and economic conditions. If changes occur within this environment, then this leads either to a direct or indirect pressure to adapt via the sales and procurement markets to which companies react in order to secure their long-term success (Picot, 1981; Diller and Lorch, 1984). As a result, corporate real estate management is challenged to develop an appropriate response to the new conditions in the corporate environment.

In this context, a distinction can be made between two dynamics. When the changes are relatively surprising for decision-makers and are also of significant importance for the achievement of the company's objectives, Picot (1981) describes them as "structural changes". Such changes can be characterised as unique and, therefore, usually lie outside the expectation horizon of the decision makers. Related to the research question, little evidence on how structural changes may have affected the importance of real estate ownership exists. There are no robust studies on this issue. Nevertheless, it can be assumed that real estate ownership was considered appropriate under earlier economic structural aspects such as long product life cycles and the long-life span of companies (Gier, 2006). This was followed by a shift in norms and values that led to a phase-wise popularity of different management approaches and critical debate about the benefits of capital tied up in real estate. An increased shareholder value orientation as well as the demand of the capital market for a stronger concentration on core competencies caused an increasingly critical attitude towards real estate property. This resulted in a considerable reduction of property, especially in the U.S. and Asia. Whereas the discussion used to be motivated by financial concerns about the high capital commitment, doubts about the property's suitability on the part of the user are now coming to the fore; hence the requirements for space provision are changing rapidly as ownership seems to be increasingly in conflict with the growing flexibility requirements in a more dynamic corporate environment (Haynes, 2012). Ownership is proving difficult to adapt in the case of quantitative changes in demand. For instance, Deng and Gyourko (1999) attribute low capital market performance of ownership-intensive firms to temporal mismatches between product cycles and long-term real estate investments.

These structural changes have to be separated from more short-term cyclical changes, which overlap to some extent but lie within the decision makers' horizon of expectations (Picot, 1981). Economic cycles or real estate market cycles can be mentioned as examples. With regard to the research question, the literature provides various hints on the extent to which the importance of real estate has changed in the course of regular changes. For instance, Tuzel (2010) explains the lower capital market performance of owner-occupied firms with the difficult quantitative adaptability of real estate ownership to economic fluctuations.

In addition, studies show a correlation between real estate and debt cycles and the advantageousness of real estate ownership. If, for example, there is an increase in the value of the real estate portfolio during a real estate cycle, then it would lead to an increase in debt capacity. Additional borrowing or lower debt costs allow non-property companies to increase their capital expenditures. Therefore, increases in real estate values not only lead to a direct increase in corporate performance but also to an indirect increase via improved financing conditions (Gan, 2007a; 2007b; Funke *et al.,* 2010; Chaney *et al.*, 2012).

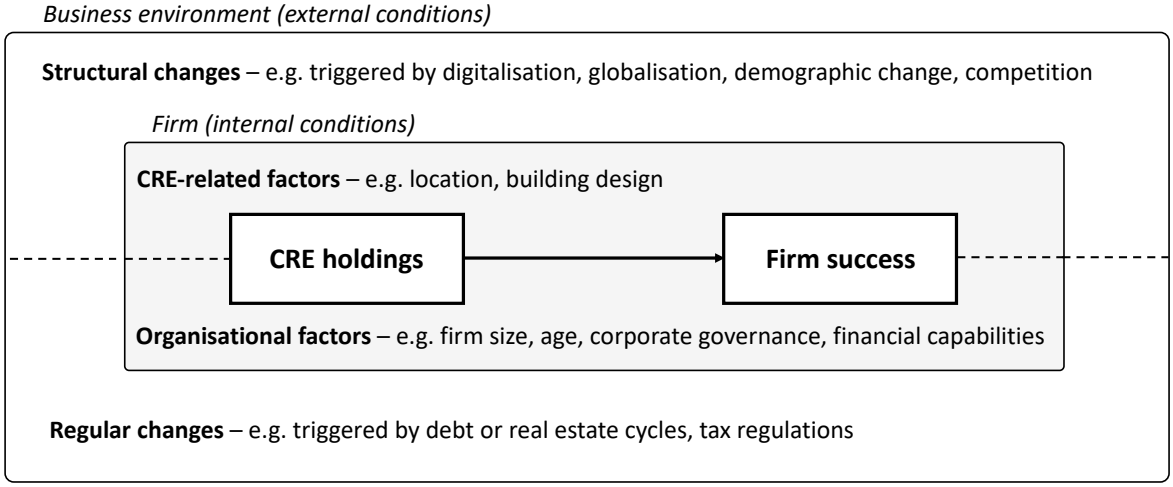
The current low interest rate policy shows that the cost of borrowing is also subject to fluctuations and, thus, has a significant impact on the contribution to success of real estate ownership that is predominantly financed with debt. If interest rates on debt rise or fall, then

this can have a negative or positive impact on the borrower's success through higher or lower obligations, respectively.

Legal and political interventions also seem to have an impact on the ownership strategy. Alvayay *et al.* (1995) show that tax regulation changes have prompted a reduction of ownership, which has had a positive effect on the valuation of companies due to reduced tax incentives. In this context, the new IFRS accounting standards should also be mentioned, which may have changed the view on ownership once again. If leasing and renting are included in the balance sheet in the future, then this may lead to an increase in liabilities and, as a result, to higher leverage. This could make ownership and shorter leases more attractive than long-term leases (Baltussen *et al.*, 2014).

The explanations show that the benefits of holding real estate properties strongly depend on the overall context, such as real estate-related needs and internal and external factors. An increasingly changing corporate environment, structural changes and higher uncertainties clash on a "bulky" and difficult to adapt ownership. This necessarily directs interest to the corporate environment and to the question of how it changes the role of ownership today and in the future. However, it is not possible to take a completely isolated view of real estate- and organisation-related influences. This will be shown later on the basis of real estate specificity and industry belonging.

Figure 2: Firm internal and external conditions of holding CRE



1.3 Positioning of the thesis

If the change processes in the CRE portfolio and specifically in the provision of real estate is to be understood, then one must first comprehend the motives guiding companies' actions, the real estate goals and the derived strategies. These result from the mechanisms through which real estate affects corporate success (Pfnür, 2019). How CREM can contribute to corporate success has already been investigated in the context of research on control concepts, performance measurement tools and the identification of value drivers. This partly very

heterogeneous research field provides diverse models and frameworks. However, it is striking that none of the existing models meets all the requirements of a theory-derived and holistic framework that brings a certain practicality and can also be empirically confirmed (Heywood and Arkesteijn, 2017). This gap is to be closed with the first article (Chapter 2).

The general basic considerations are followed by the question as to what extent owning real estate impacts on corporate success. However, the discussion, which is predominantly anchored in the research field of CRE finance, focuses largely on the U.S. or Asian economies. However, the general validity of the findings obtained from these studies and their transferability to other countries is doubtful due to often very different conditions. This directs the focus to German companies, which have hardly been studied so far. At the same time, another research gap is noticeable in the available literature. Previously, studies have only considered the industry affiliation of the core business as a decisive determinant of ownership. The fact that companies sometimes operate in other business areas, which even require a contrary real estate strategy, has not yet been taken into account. This is illustrated by an example from the automotive industry. Trends such as the provision of integrated solutions mean that car manufacturers are suddenly going beyond their core business of manufacturing and combining it with financing or services. Therefore, the consideration of other business areas seems necessary for the discussion regarding the influence of ownership on capital market performance. Otherwise, biases could occur in the empirical analyses. This issue is addressed in Chapter 3.

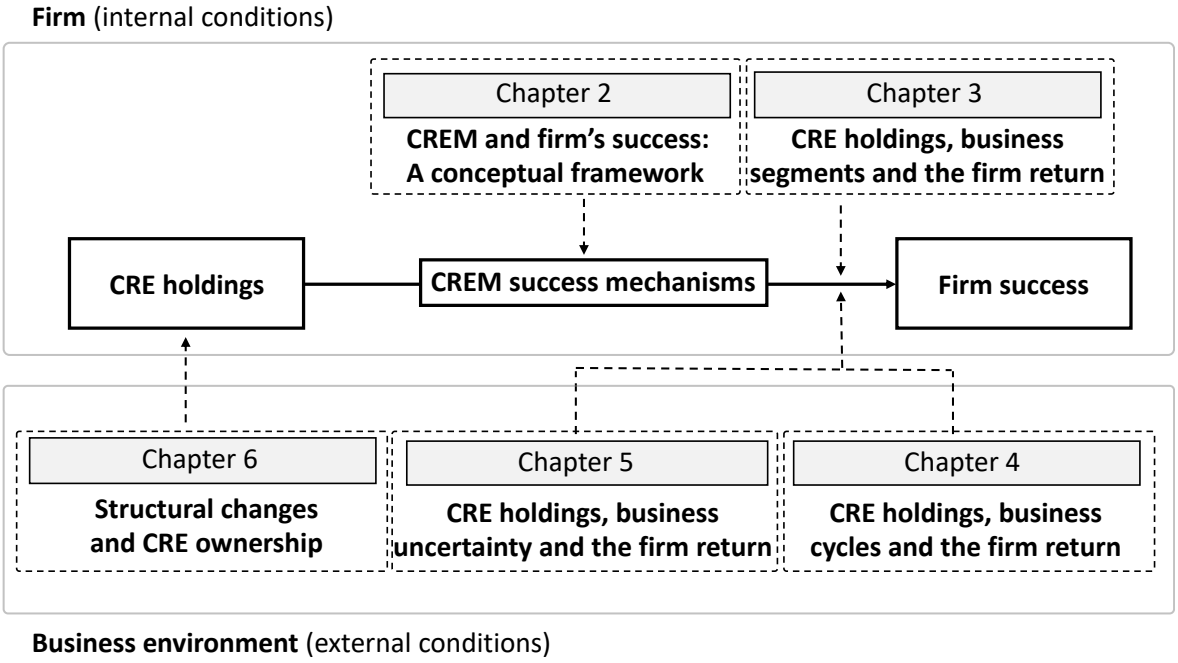
While Germany as the most important European economy has hardly been the subject of scientific contributions so far, numerous studies refer to Great Britain (GB) as the second largest economy. However, these numerous studies provide contradictory results and do not allow a clear conclusion about the positive or even negative influence of ownership on a company's success. In addition, previous studies refer to periods that are about two decades old. In the meantime, conditions for companies have changed rapidly (e.g. global economic crisis, BREXIT vote) and more precise balance sheet information on real estate assets allows a more detailed look at the relationship between ownership and capital market performance. An analysis of British companies can consequently be assessed as necessary, especially against the background of outdated studies. An inclusion of cyclical fluctuations could broaden the previous focus on the corporate environment and provide valuable insights into whether ownership proves to be problematic in the face of cyclical changes, especially in GB. This could be seen as further confirmation that real estate ownership proves to be flexibility-inhibiting especially in a dynamic environment. The considerations are, thus, argumentatively linked to studies conducted by Tuzel (2010) and Rochdi (2016). This topic will be addressed in Chapter 4.

Regardless of whether companies are exposed to structural or cyclically changes in the business environment, CREM must ensure optimal space provision despite uncertainty about future space requirements. This raises the question as to the extent to which companies anticipate uncertainty in their ownership strategy and how this ultimately affects the company's

success. This is of high interest because ownership is often seen as a backup that can be liquidated in case of financial bottlenecks in order to stabilise corporate cash flows. However, it is often ignored that owned real estates are often company-specific, can only be used by third parties to a limited extent and, therefore are resold at a discount. Which of these effects predominates is another research gap that this thesis aims to close in Chapter 5.

The previous considerations on influences from the corporate environment on the importance of real estate ownership refer to cyclical changes and uncertainties. Much more difficult to assess, however, are structural changes whose influence on business models lies outside previous experience and, by definition, outside management's expectation horizon (Picot, 1981). This is of high importance because the entire economy and, thus, the real estate industry are facing a broad structural change (e.g. Pfnür and Wagner, 2020). However, its influence on real estate provision and ownership strategies has not yet been considered. By addressing this research gap, Chapter 6 ties in with general real estate economic literature on the topic of structural change. Additionally, the chapter investigates the question whether non-property companies are rethinking their space provision by means of ownership in the course of structural changes. The respective chapters are systematised in the following illustration.

Figure 3: Theoretical framework, including positioning of chapters (articles)



1.4 Thesis structure

To answer the postulated research question, six empirical studies were conducted and summarised in five articles. This approach is used to close the research gaps identified in Chapter 1.3 and to create a deeper understanding of real estate ownership against the background of external changes and internal influences. All five articles were submitted to double-peer-

reviewed scientific real estate or finance-related journals. Articles 1, 2 and 5 have already been published, whereas Articles 3 and 4 are under advanced review. After a short description of the motivation and research questions, theoretical foundation and the position and structure of this thesis in Chapter 1, the mentioned articles follow chapter by chapter. Due to minor and mostly visual adjustments, the articles included here differ marginally from the originals. The included articles are listed in Table 1. A final chapter concludes the thesis with a theoretical and practical contribution, limitations and potential starting points for future research.

Table 1: Overview of the included research articles

Study 1	**Chapter 2** Article 1	**Corporate real estate management and companies' success** Pfnür, A., Seger, J., & Appel-Meulenbroek, R. (2021). Corporate real estate management and companies' success: empirical evidence for a conceptual framework. *Journal of Corporate Real Estate*, accepted and ahead-of-print.
Study 2	**Chapter 3** Article 2	**Corporate real estate holdings, business segments and the firm return** Seger, J., Li, A. & Pfnür, A. (2020). Corporate real estate holdings and the stock market performance. *Journal of European Real Estate Research*, 13(2), 181-206.
Study 3	**Chapter 4** Article 3	**Corporate real estate holdings, business cycles and the firm return** Seger, J., Stoner, K., & Pfnür, A. (2021). The pricing of corporate real estate holdings on the UK capital market. *Journal of Corporate Real Estate*, accepted and ahead-of-print.
Study 4 & 5	**Chapter 5** Article 4	**Corporate real estate ownership, business uncertainty and the firm return** Seger, J.; Gaar, E., Wagner, B., & Pfnür, A. (2021). Corporate real estate ownership and its contribution to firm performance under business uncertainty: Empirical evidence from European non-property companies. *Review of managerial science,* under review.
Study 6	**Chapter 6** Article 5	**Structural changes and corporate real estate ownership** Seger, J., & Pfnür, A. (2021). The impact of structural changes on corporate real estate ownership: evidence from Germany. *International Journal of Strategic Property Management*, *25*(1), 1-16.

In the following, each of the five articles is briefly summarised regarding its purpose, procedure and main contribution:

- Article 1 (Chapter 2) provides a holistic model to explain the relationship between CREM decisions and business success within non-property companies. The model is theoretically derived and illustrates the contribution to success based on performance drivers in different mechanisms and organisational level. The empirical analysis uses multidimensional data scaling from a telephone company survey (CATI) of 59 CREM managers sampled from the 200 largest German companies to confirm the model. This holistic understanding about CREM's contribution to corporate success provides new insights into the institutionalisation of the CREM function and offers a framework to systematise CREM research. With reference to the thesis, the developed framework provides insights into how the role of ownership changes in connection with contextual influences.

- Article 2 (Chapter 3) concerns the question of how real estate ownership affects capital market performance. Contrary to previous articles, the paper not only considers firms' primary business segment but also additional business fields. The paper focuses on German non-property companies, which have hardly been addressed in this context so far. For this purpose, the CRE holdings reported in the balance sheet of 490 listed companies from the period 2000–2016 are regressed to stock market performance using a two-stage approach. The research shows a negative influence of CRE ownership on capital market performance. Moreover, the results suggest that additional business activities also appear to impact the relevance of ownership for firm performance. For example, against the background of an increase in integrated solution offerings, this is interesting for theory and practice equally. This means that previous studies may have been subject to bias. At the same time, the insights allow capital market players to choose the right investment strategy while it also gives CRE decision-makers new information about optimal provision.

- Article 3 (Chapter 4) also deals with the question of whether real estate is priced into the capital market. However, the question is extended to whether this pricing differs during general ups and downs of the market. The test laboratory is Great Britain as the second largest European economy and one that is exposed to considerable dynamics and uncertainties, e.g. due to the BREXIT vote. For this purpose, 599 companies are subdivided on the basis of their reported real estate assets using a portfolio approach and examined with the help of the Fama and French multifactor model with regard to their influence on capital market returns. The sample covers the period 2006–2017. First, it shows that real estate assets have declined in recent years, whereas this trend seems to reverse with the BREXIT vote, at least in some industries. In addition, the studies show a pricing of real estate assets in partly very different industries such as in the service sector or manufacturing sector. If economic fluctuations are taken into account, then there is a more negative

valuation of ownership during downturns than during upturns. Especially in the case of high environmental dynamics, CREM should critically scrutinise ownership.

- Article 4 (Chapter 5) also addresses the ownership strategy of non-property companies and its impact. The article expands the scientific discourse by considering how uncertainty and the specificity of a property affect the holding of real estate property and how this in turn affects capital market performance. Two studies were conducted for this purpose. While the first study focuses on balance sheet data from the six largest European economies, the second study expands this to include a pan-European data set and capital market data. The results show that companies adjust their investment behaviour in (specific) real estate under uncertainty. Moreover, if the share of property increases under uncertainty, then this has a negative impact on excess returns, especially in the medium term. Moreover, the negative impact of real estate ownership on a firm's systematic risk is found to be independent of the uncertainty situation. Nevertheless, the paper illustrates that the often specific real estate provided by ownership in uncertain times such as a structurally changing corporate environment or pandemic situation can have a negative impact on corporate performance.
- Article 5 (Chapter 6) focuses on structural changes and how these affect the ownership strategy of non-property companies. Using a dataset obtained from a telephone company survey (CATI) among 69 corporate real estate managers of German companies, these are grouped by performing a two-step cluster analysis according to the degree to which they are affected by structural change. The resulting clusters are then tested regarding differences in their ownership strategy. The results show that companies that are particularly affected by structural change tend to reduce their ownership more than those that are less affected. This is particularly evident in the office segment. If the pressure to adapt is high, then companies react with sale-and-rent-back transactions.

Additional article (not included in the thesis):

In addition to the papers listed above, the following article was also published during my time as doctoral candidate. However, the article was not double-peer-reviewed and is not part of the thesis:

Pfnür A., & Seger J. (2017): Produktionsnahe Immobilien. Herausforderungen und Entwicklungsperspektiven aus Sicht von Corporates, Investoren und Dienstleistern. In: Andreas Pfnür (Hrsg.), Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 35.

2 Corporate real estate management and companies' success

Titel:	Corporate real estate management and companies' success: empirical evidence for a conceptual framework
Authors:	Andreas Pfnür, Technical University of Darmstadt, Germany Julian Seger, Technical University of Darmstadt, Germany Rianne Appel-Meulenbroek, Eindhoven University of Technology, The Netherlands
Published in:	Journal of Corporate Real Estate, accepted and ahead-of-print. https://doi.org/10.1108/JCRE-12-2019-0051

Abstract

The purpose of this study is to explain the contribution of Corporate Real Estate Management (CREM) to corporate success and to substantiate it empirically. The article develops a holistic two-dimensional model from existing literature to explain the relationship between CREM decisions and business success, and then tests it empirically using multidimensional data scaling from a telephone company survey (CATI) of 59 CREM managers sampled from the 200 largest German companies. The created theoretical model holistically explains CREM success and existence as part of a non-property company, with specific performance drivers on specific organisational levels. The empirical data confirm that both dimensions of the model and, thus the measurement concept for modelling the CREM contribution to business success are robust across sectors and company/portfolio size in Germany. The empirical confirmation of the conceptual model of CREM success provides novel support for the institutionalisation of the CREM function in companies as well as the holistic classification of different CREM research directions.

Keywords: CREM organisation, CREM performance, CREM model, multidimensional scaling, Corporate Real Estate finance

2.1 Introduction

Corporate Real Estate Management (CREM) must justify its existence as a supportive function in the company by contributing to the company's success. Therefore, knowledge of the mechanisms that CREM should trigger to improve corporate success is existential for any CREM department or researcher. There is broad agreement on the substantially high potential of CREM to support corporate success. However, opinions differ on what comprises 'success'. From the perspective of the workplace research community, the main proven contributions are increases in work productivity, employee satisfaction and employee health (e.g. Appel-Meulenbroek *et al*., 2018). From the real estate finance community's point of view, CREM's contributions are primarily based on financial success such as shareholder value (e.g. Brounen and Eichholz, 2005), whereas for the construction and facility management community, CREM success primarily involves reducing life cycle costs and/or CO_2 emissions (e.g. Hartmann, 2011). A closer look at CREM success also suggests that it is not only about the 3 effects, but especially how they are perceived. It is relevant through whose eyes success is measured and judged. In the CFO's view, for example, measures that contribute to greater employee well-being at the workplace are perhaps merely unnecessary high investments, whereas the human resources department could find it essential.

The discussion of CREM's contribution to success has a direct impact on the definition of CREM's internal goals and the institutionalisation of CREM in the company. Therefore, CREM strategy, organisation and control should also be indirectly derived from the success mechanisms between CREM and corporate success. For example, decisions on which board of directors segment is responsible for CREM and whether the CREM area is managed as a cost or profit centre are, in many cases, significantly influenced by the success effects attributed to CREM by the decision-maker. The efficiency of every substantial CREM decision, whether on institutional organisational structures or on the provision of real estate properties, can only be assessed in light of the expected contributions to profits.

In addition to the question of the institutionalisation of CREM, the realistic depiction of CREM success also determines the budget allocated by the company for the provision of real estate resources and, thus, the dimensioning of CREM. If success mechanisms are neglected in the evaluation of CREM success, then the results are often insufficient resources for the CREM team. A lack of resources then quickly leads to a downward spiral of the effectiveness of a company's operational real estate management. Numerous empirical studies show that in corporate practice, CREM success is often reduced either to minimising property provision costs or to user satisfaction (for an overview, see Pfnür, 2014). Overall, it can therefore be assumed that CREM success is systematically underestimated.

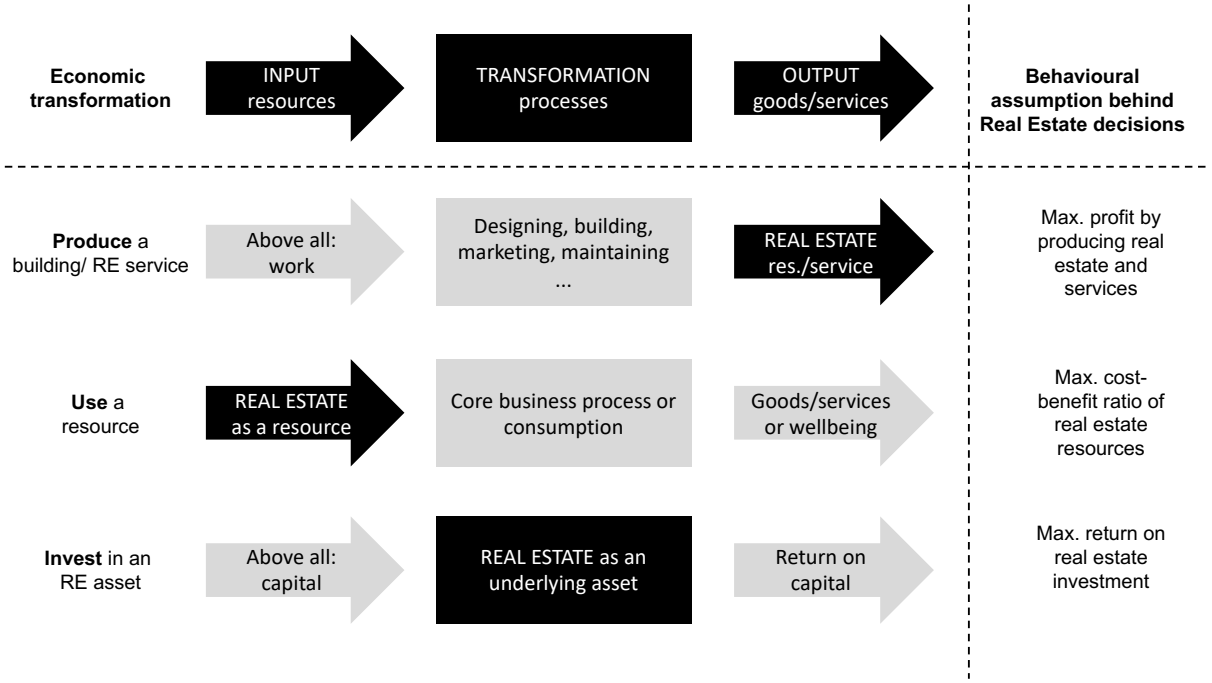
There are already many theoretical and empirical contributions in the most diverse lines of development of CREM within its specific mechanisms. Nonetheless, systematic reviews of CREM literature (e.g. Engelen *et al.*, 2019) show that even decisions within one of the mechanisms regularly have numerous different effects on success for different cases. Thus, it is conceivable that super-additive as well as counteracting effects of the different mechanisms

of action for CREM regarding corporate success exist. One example is the widespread competition for success between investment costs, user satisfaction and property value development (e.g. Kämpf-Dern and Pfnür, 2014). So far, there is a lack of meta-studies that take a holistic view of CREM's contribution to success and, importantly, also test the networked interactions of individual success mechanisms. Therefore, this paper aims to take a first step towards closing this research gap. First, it clarifies which relationships have been identified in the literature between CREM and corporate success and how these different relationships can be arranged conceptually in a holistic model. This model is not new in all its components. Rather, the innovation consists in explaining and measuring the individual CREM functions and their value contribution in a holistic model that includes detailed success parameters and also distinguishes internal organisational levels. Next, it is examined whether such a conceptual model can be confirmed by empirical validation. The next chapter explains the mechanisms and the meaning of success in more detail.

2.2 CRE and three different economic transformation processes on success

First, the term 'success' must be clarified. How 'successfully' the result of a decision is evaluated depends fundamentally on the objectives pursued and the corresponding behaviour of the decision-maker. With regard to CREM, the definition of clear behavioural assumptions is not so simple. Kämpf-Dern *et al.* (2013) show that depending on the importance of property in the company's economic transformation process, management decisions are characterised by very different behaviour. They assume that the following three different behavioural assumptions can apply to CRE decision-makers (see Figure 4).

Figure 4: Real estate in three different economic transformation processes



Source: Kämpf-Dern et al., 2013

Real estate is the output of a production process or a service process in the construction and real estate industry ('Produce' in Figure 4). From a CRE point of view, these services are partly provided by the company itself, but can also be purchased on the market. The target figure 'profit' is defined differently by CREM than by external suppliers. While suppliers maximise profit parameters, such as the contribution margin from the products, a rationally acting CREM achieves its profit by minimising the supply costs for its own company.

Using real estate as an operating resource in the service provision process is probably its original meaning in CREM (Silverman and Zeckhauser, 1983). The goal is to maximise the cost–benefit ratio, but it is methodologically and empirically difficult to fully capture the different economic effects on different levels and units of the organisation. Studies have shown many different user outcomes flowing from decisions about the physical workplace and its management are influenced by many different aspects of the CRE and its management (e.g. Jensen and Van der Voordt, 2016; Appel-Meulenbroek *et al.*, 2018).

The high capital intensity of real estate implies that real estate can also have a high financial significance for corporates. This applies in particular to the real estate ownership of companies. Studies on listed firms in the US and Germany show that the book values of real estate account for approximately 20% of market capitalisation (UBS, 2005 cited by Pfnür, 2014[3]; Chaney *et al.*, 2012), although some studies also emphasise that there are large differences across industry sectors (Brounen and Eichholtz, 2005). Corporates are thus among the major real estate investors on the real estate market. In such situations, fluctuations in the value development of the properties influence the profit, risk and liquidity ratios of corporates. The same applies to the tax burden on companies.

Due to its nature, every property fulfils these three economic functions as an economic good at the same time. Efficiency criteria must therefore be applied to real estate decisions from all three perspectives. The degree of freedom in making decisions is reduced accordingly. Each property decision can only be made once, so the significance of the property in its three different functions must be clarified beforehand. This naturally results in conflicts of objectives, which is CREM's most important task to solve. Kämpf-Dern and Pfnür (2014) show that CREM does not have 'one best model', but only a 'best fit' depending on the target weights of the three perspectives. Empirical studies from the USA and Europe (Hartmann *et al.*, 2007a) on the relative importance of the success of the three CRE functions for corporate success support these theoretical considerations.

The decomposition of the three different perspectives of CREM profit contributions for the company allows the complete recognition of all success effects. However, decisions will be rather more difficult than easier to make if the effects of success compete with each other. Such competing success effects of the individual CREM performance mechanisms become clear when taking a closer look at the details of the three respective mechanisms.

[3] This ratio naturally depends on the market cycles of the capital and real estate markets. The year 2005 was deliberately chosen as the year before the financial and economic crisis, when both markets had comparatively average conditions.

2.2.1 Mechanism I USE: Operating performance of CREM

The purpose of non-property companies having real assets is to use them as a resource in the service and/or product creation process. These considerations are inseparable from the Resource Based View of the Firm (Penrose, 1959; Barnay, 1991); the success and the *raison d'être* of a company can be explained by its unique resources. Pfnür (2002) shows that a company's real estate resources can also be a source of long-lasting, unimitable competitive advantages and that resource decisions in general and real estate in particular can significantly impact both the benefits and costs for users. These benefits are also referred to as use values (Appel-Meulenbroek and Haynes, 2014). These use values of CREM differs according to the hierarchical levels of an organisation (already described by Lynch and Cross, 1992). The hierarchical levels can be described as normative, strategic, tactical and short-term level. At the normative level, the CREM contributes to success by supporting the corporate vision at the overall organisational level. At the strategic level, real estate-related decisions can open up potential for success while at the tactical and short-term level the focus lies on individual activities and the employee. There are numerous other studies discussing the benefit–cost relation of real estate assets at different levels of decision-making from the organisation as a whole to the individual employees of a company. The authors of such contributions may not explicitly mention these hierarchical levels of the companies, but implicitly they use them as well (see also Lindholm *et al.*, 2006 for a similar classification). Table 2 details the user-related value of CREM and show selected literature that supports them. The relationships are summarised systematically in Figure 5.

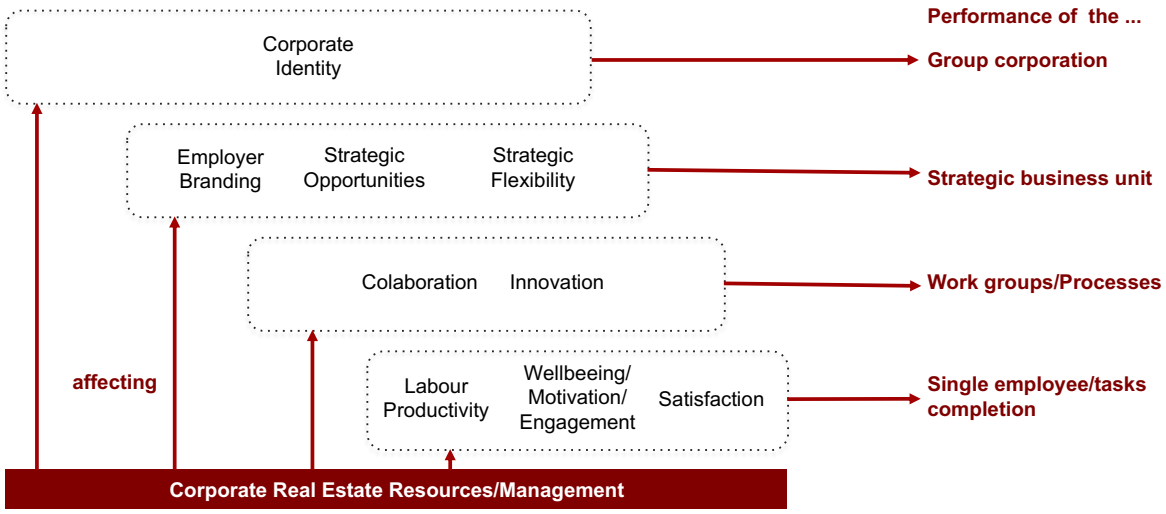
Table 2: Operating performance of CREM

Normative Value Contribution of CREM		
CREM Value in…	**Description**	**Lit. Sources (examples)**
Corporate identity value of CREM	Real estate acts as an instrument of environmental design impacting the corporate identity and brand of the company.	Appel-Meulenbroek *et al.*, 2010
Strategic Value of CREM		
CREM value in…	**Description**	**Lit. sources (examples)**
Creating and enhancing strategic opportunities	CREM could be a strategic enabler whether in response to strategic driving forces (Tregoe and Zimmerman, 1980) or in creating competitive advantages (Porter, 1985). To this end, corporate and real estate strategies must be aligned.	Nourse and Roulac, 1993; Roulac, 1999; Lindholm and Leväinen, 2006; Scheffer *et al.*, 2006; Lindholm, 2008; Liow and Nappi-Choulet, 2008; Gibler and Lindholm, 2012;

	The real estate assets owned or occupied by an organisation provide the opportunity to embrace the sustainability agenda. Through the effective management of buildings over their life cycle, building occupiers can reduce the negative impact that their buildings have on the environment, improve the impact that their buildings have on social well-being and provide economic benefits to the business through reduced maintenance and refurbishment costs.	Appel-Meulenbroek and Haynes, 2014 Hodges and Sekula, 2013; Falkenbach *et al.*, 2010; Brown *et al.*, 2010
Creating strategic flexibility	The forms of provision (rent/ownership) influence the degree of flexibility in realigning with the changing business environment.	Gibson and Lizieri, 2000; Appel-Meulenbroek *et al.*, 2019; Verhoeff *et al.*, 2014
Reinforcing employer branding	Companies increase their attractiveness in the war-for-talent by targeted site selection, attractive architecture, appealing office concepts and a range of additional services.	Khanna *et al.*, 2013
Tactical and Short-term Value of CREM		
CREM value in…	**Description**	**Lit. Sources (examples)**
Enhancing collaboration on process and workplace level	Real estate interventions can increase or hinder collaboration and other interactive processes. Following the argumentation of Roulac (1999), real estate and its location play a fundamental role in the value chain.	Bradley, 2001; De Vries *et al.*, 2008; Roulac, 1999
Enhancing the innovation capabilities	The spatial design of the work environment can support or hinder innovative processes such as creative thinking and knowledge sharing.	Appel-Meulenbroek *et al.*, 2017; Davis *et al.*, 2009
Enhancing labour productivity	The physical organisation of work has a significant impact on labour productivity. Several studies have empirically shown that CRE design could impact employee productivity by 5–15%.	Pfnür and Weiland, 2010; Abdou and Lorsch, 1994a + b; Clements-Croome and Li, 1997; Roelofsen, 2002
Enhancing individual wellbeing, engagement and motivation	Job performance at the workplace depends on many physical environmental factors impacting several different outcomes besides productivity and satisfaction. Appel-Meulenbroek *et al.* (2018) show the complexity of causal relationships and that research is only just beginning. Recently, interest in wellbeing and engagement has risen, which correlate with satisfaction and productivity (Bakker and Demerouti, 2008).	Appel-Meulenbroek *et al.*, 2018; Bakker and Demerouti, 2008; Engelen *et al.*, 2019
Enhancing employee satisfaction with the workplace	Abundant evidence for effects of specific physical work environment characteristics on employee satisfaction with CRE has been provided. CRE has become a major corporate real estate strategy in practice (Jensen, 2010).	Kim and de Dear, 2013; Bodin-Danielsson and Bodin,

		2008; Budie *et al.*, 2019

Figure 5: Impact of CRE resources on operating performance (strategic to operative)



2.2.2 Mechanism II PRODUCE: Real estate performance of CREM

Real estate performance measures the performance of economic tasks in the provision of real estate including planning, production, operation and exploitation. This is where the real estate success resulting directly from CREM's activities is measured and is also referred to as 'exchange value' (Appel-Meulenbroek and Haynes, 2014). Table 3 systematises the interdependencies in detail and cites selected literature.

Table 3: Real estate performance of CREM

CREM value in…	Description	Lit. Sources (examples)
Real estate value performance	Pfnür and Armonat (2004) and Louko (2004) show that in the past, corporates with their own real estate recorded high increases in value at times; however, as Mansfield and Pinder (2008) state: 'It is clear that the depreciation of value is a function of two distinct negative processes: physical deterioration and obsolescence', which come with age. Brounen and Eichholtz (2005) and Hartmann *et al.* (2007a) see the fact that non-property companies worldwide are reducing their real estate assets as an indication that they also see efficiency disadvantages compared with the market in terms of the performance of their own real estate management. There appears to be an increase in profitability for stockholders if CRE is sold (Glascock *et al.*, 1991). Buildings that are easier to adapt and suitable for	Louko, 2004; Pfnür and Armonat, 2004; Brounen and Eichholtz, 2005; Hartmann *et al.*, 2007a; Glascock, Davidson and Sirmans, 1991

	different types of users are easier to sell and for a better price than more specialised buildings (Nourse and Roulac, 1993).	
Optimising occupancy costs	Lindholm (2008) attributes CRE's contribution to the company's success to the reduction of real estate costs. Sourcing has a major influence on the costs incurred in CREM. The real estate costs can be divided into fixed (e.g. mortgage, taxes) and flexible costs (e.g. maintenance and energy). Both are influenced by the building`s materials, the location and structural aspects. Layout choices are also relevant because open layouts show lower refurbishing costs and faster moves of departments (Van der Voordt, 2004). The installation type can have a significant effect on energy costs (Todesco, 1998). However, CRE costs have been significantly related to overall company turnover and profit (Cooke *et al.,* 2019).	Heyden, 2005; Lindholm, 2008; Pfnür, 2014; Van der Voordt, 2004; Todesco, 1998; Cooke *et al.,* 2019

2.2.3 Mechanism III INVEST: Financial performance of CREM

Due to its high capital intensity, real estate ownership has a considerable influence on the financial management of the company, which is why real estate investments by corporates always require a valuation from the corporate finance perspective (Liow and Nappi-Choulet, 2008). Table 4 systematises the interdependencies in detail and cites selected literature.

Table 4: Financial performance of CREM

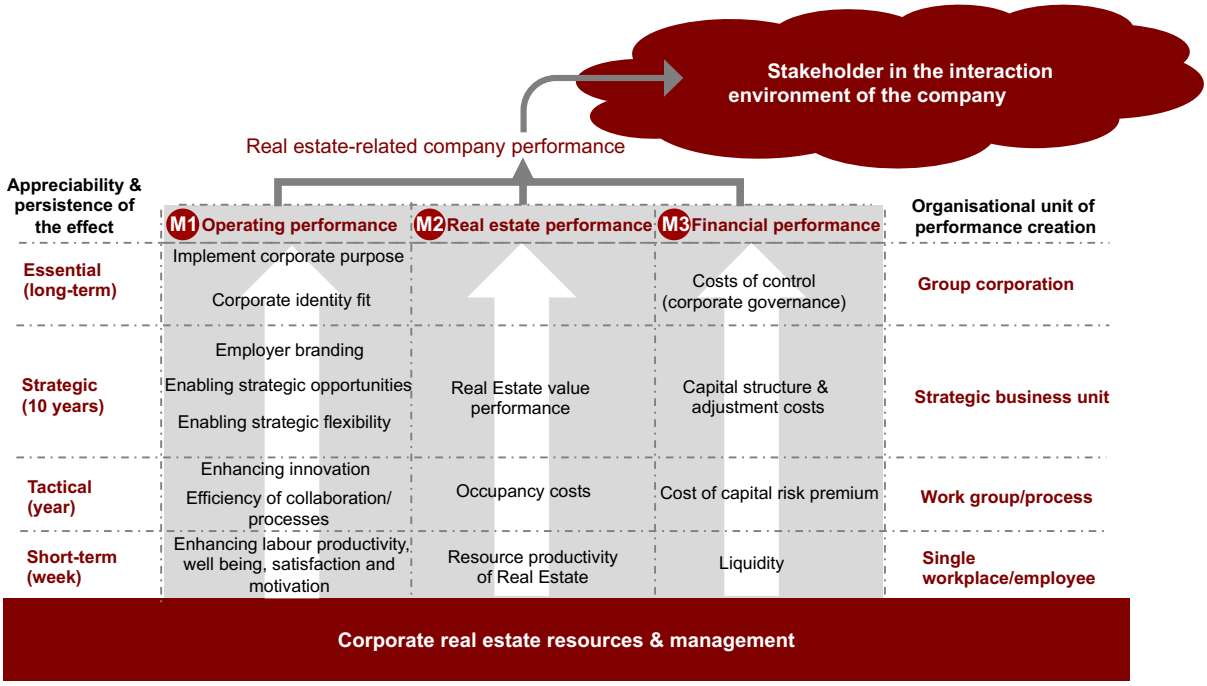
CREM value in…	**Description**	**Lit. Sources (examples)**
Optimising the capital structure	Due to the capital intensity of CRE, ownership decisions and the associated choice between debt and equity have a significant influence on the capital structure (Bosch-Badia *et al*., 2017). The capital structure correlates both with the property assets owned and with the company's performance (Du and Ma, 2012). The positive correlation between ownership and increased leverage can be explained, for example, by the collateral effect of real estate (Gan, 2007; Chaney *et al*., 2012; Cvijanovi , 2014). According to this, the lendability of CRE can reduce debt costs and increase the capacity to raise capital. The positive effect of property-related changes in the capital structure can also be explained by tax advantages and in relation to possible bankruptcy costs (Bosch-Badia *et al*., 2017). Accordingly, an optimal ownership strategy that takes capital structure into account can influence capital market performance (Du and Ma, 2012).	Gan, 2007; Tuzel, 2010; Chaney *et al*., 2012; Du and Ma, 2012; Cvijanovi , 2014; Zhao and Sing, 2014; Bosch-Badia et al., 2017; Mao, 2017

Optimising corporate risk and the risk premium on the cost of capital	Brounen and Eichholz (2005) demonstrate a negative correlation between ownership intensity and business risk, depending on the company's sector. Seiler *et al*. (2001) find no evidence that owner-intensive companies experience diversification advantages. The diversification potential of real estate property depends strongly on the extent to which companies are already diversified elsewhere (Du *et al*., 2014). If involved conglomerates are highly divergent, then the immobility-related diversification effects are significantly lower. Du and Ma (2012) also note that real estate ownership has a stronger diversifying effect for companies with a lower proportion of debt capital. Foto 1: Various studies come to the conclusion that the risk-adjusted capital costs of companies rise with growing real estate assets (Liow, 2004; Brounen and Eichholtz, 2005). Rising risk costs are identified as the reason for higher capital costs (Tuzel, 2010; Liow, 2010; Ling *et al.*, 2012; Rochdi, 2015). Deng and Gyorko (1999) attribute this effect to inefficiencies resulting from the mixing of real estate ownership and use. They also argue that large real estate assets dilute the risk profile of the core business of non-property companies. As a result, investors are becoming more uncertain about performance. Risk costs will rise.	Seiler *et al*., 2001; Liow, 2004; Brounen and Eichholz, 2005; Tuzel, 2010; Liow, 2010; Ling *et al.*, 2012; Du and Ma, 2012; Du *et al*., 2014; Rochdi, 2015
Optimising the liquidity	Liow and Nappi-Choulet (2008) argue that investments in CRE, for example, can lead to a mismatch between corporate cash flow (liquidity) and corporate liabilities. However, whether owner-intensive companies are less liquid depends on the conditions of local real estate markets. Thus, the factors of stability of value and saleability have a decisive influence on liquidity (Golan, 1999). Provided the real estate markets are liquid, CRE ownership can secure liquidity during recessions or when a company is in financial difficulties (Bryan, 2003). In times of positive business development, the release of capital tied up in CRE can serve to finance the necessary investments to exploit growth potential (Du *et al*., 2014).	Golan, 1999; Bryan, 2003; Liow and Nappi-Choulet, 2008; Du *et al*., 2014

The CREM impacts presented in the three mechanisms are evaluated by stakeholders based on their individual preferences. The strategic impact mechanisms of CREM, such as corporate identity measures, often have a long time horizon before achieving measurable success. Examples from corporate practice show that individual stakeholder groups rate short-term successes relatively higher. This evaluation of CREM success by stakeholders has so far been discussed primarily in the context of shareholder value management (e.g. Booth, 1999; Lindholm *et al.*, 2006), however, that concept only measures value from the provision of real

estate (PRODUCE). Regarding operating performance (USE), there are few approaches that can quantitatively account for the mostly qualitative success of operating performance in shareholder value. Finally, financial performance influences the level of shareholder value via the financing structure and its influence on the overall corporate financing. All three interdependencies between CRE and shareholder value converge at the top management level (see Figure 6).

Figure 6: Framework for the three mechanisms of CREM performance

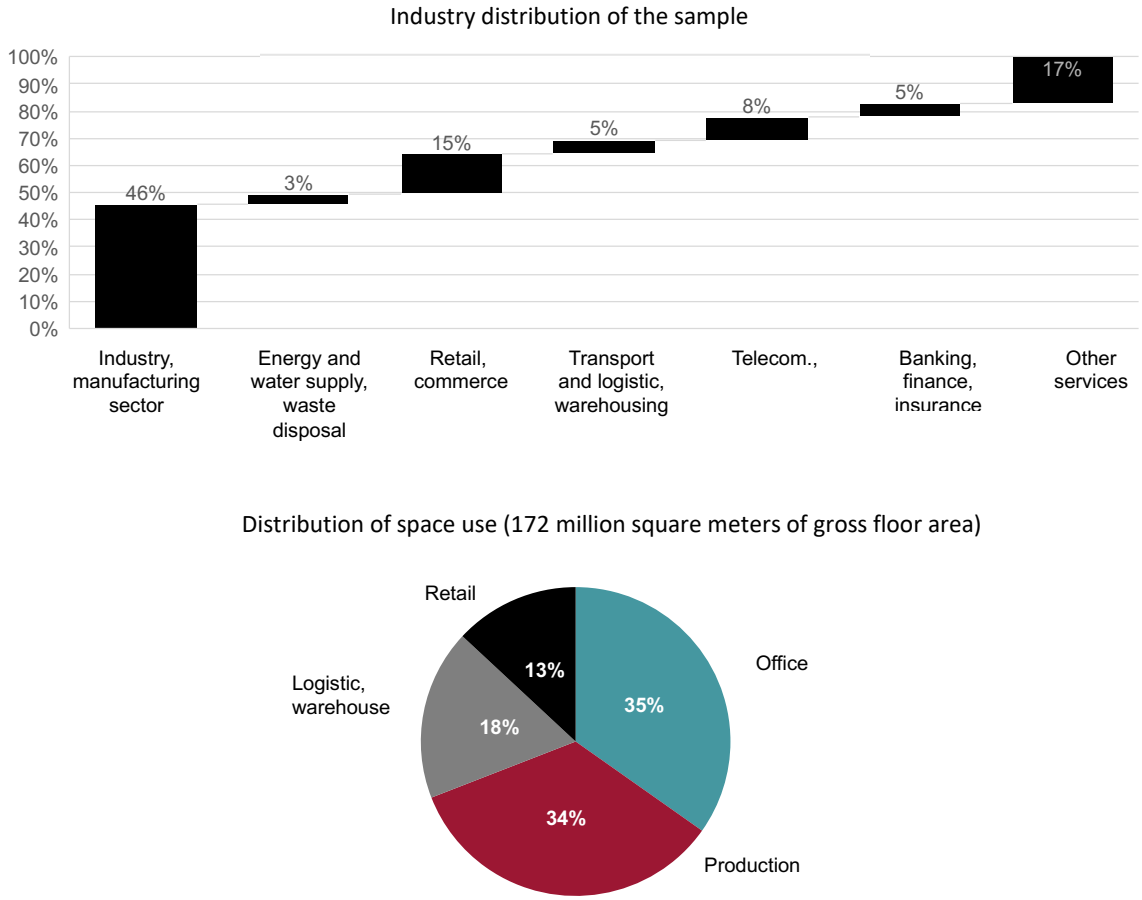


The following empirical analysis aims to provide deeper insight into the developed model and, finally, to confirm its validity.

2.3 Methodology of the empirical validation

A comparative assessment of the three mechanisms must be based on richer data than just balance sheet and capital market data, and spread over the diversity of all mechanisms. Therefore, direct questioning of the responsible decision-makers seemed particularly suitable for their assessment of the significance of the three mechanisms. The selection of participants was limited to CREM decision-makers of large German companies (> 10,000 employees) as they would manage substantial amounts of CRE. Those responsible for CREM were identified and interviewed in October/November 2018 during a 30-minute Computer Assisted Telephone Interview (CATI) using a structured questionnaire. A total of 196 companies were contacted by the market research institute Forsa. Reduced by random sample-neutral failures, the net population was 156 companies. At the end, 59 complete interviews were conducted (response rate = 38%). The sample was positively tested with the usual tests for representativeness for the population. The distribution of companies and their space uses are as shown in Figure 7:

Figure 7: Industry and space use distribution of the sample



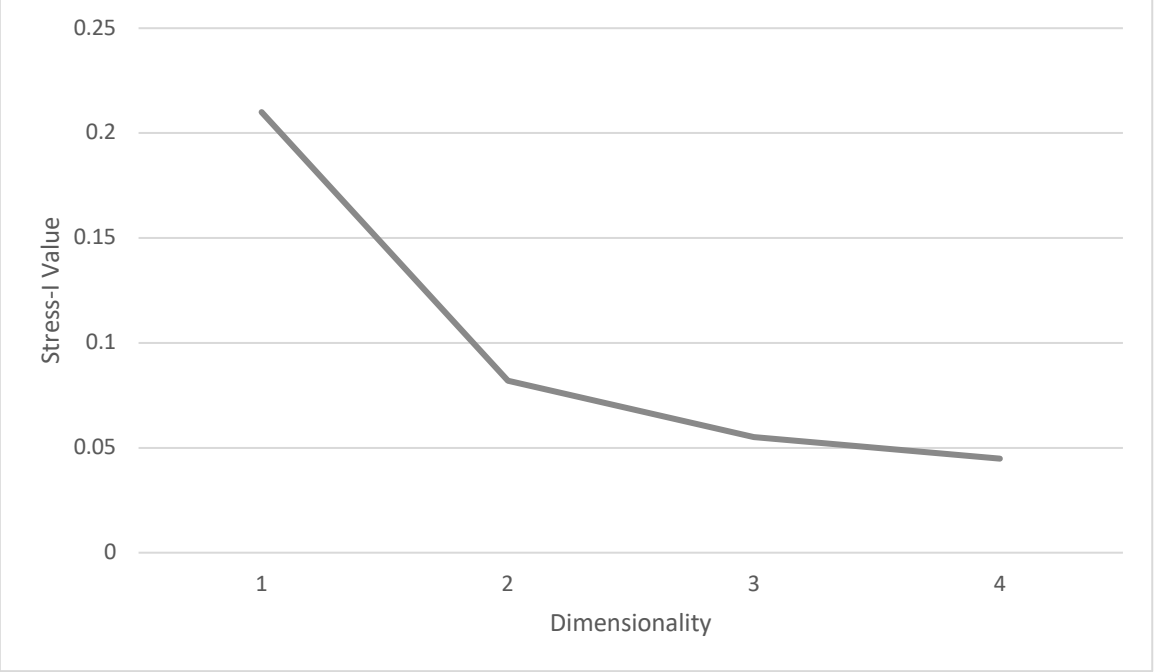
Notes: n = 59.

The performance drivers from the literature review and numerous control variables, such as the economic sector, number of employees, success of the company, size of real estate holdings, their distribution among the types of real estate use and their regional distribution, were surveyed. A report of the results together with the research strategy and the questionnaire is available for download on the Internet. (Note by the authors: For reasons of anonymity of the authors, we will only add the link here once the contribution has passed the review process.) The importance of the performance mechanisms was questioned on a Likert scale of 1 to 6 (1 as highest value). After lengthy theoretical consideration with the help of market research experts and initial tests in the population with different scales, it was concluded that a six-point Likert scale led to the best results to achieve a sharpened differentiation as to whether a CREM goal is important or not. At the same time, a six-point scale is comparatively very broad and correspondingly strongly differentiating.

To confirm or deny the separation of the effects of CREM in the different mechanisms, the dataset was analysed using multi-dimensional scaling (MDS) (Kruskal and Wish, 1984). Multidimensional scaling is a suitable method for this as it can cluster the performance drivers in a multidimensional space. MDS allows the positioning of performance drivers, as derived

above, according to their relative importance in multidimensional space. In comparison to traditional cluster models, it is not about the clustering of test persons, but about the relative distance of the performance drivers to each other. In this way, the empirical data can be used to test which performance drivers can be aggregated to consistent mechanisms and, thus, confirm whether the model derived above is supported. The result of the MDS is a reflection of the perception of the CREM performance drivers by management. For reasons of simplification, it should be possible to map the perceptual space in as few dimensions as possible. The application of the MDS method therefore starts with the determination of the number of dimensions at which the model exhibits the highest quality (Kruskal, 1964) in order to find the optimal solution between closeness to reality and complexity of the analysis in two-dimensional space. The Elbow criterion shows that in the case of the data available here, a two-dimensional solution leads to the best result (see Figure 8).

Figure 8: Stress values of different dimensions (Elbow criterion)



The absolute stress-I value of the two-dimensional solution is 0.08 and, thus, below the approximated limit value of about 0.24 expected for random variables, with a standard deviation of about 0.01. The boundary values for a two-dimensional solution with 11 items can be taken from the Spence and Ogilvie (1973) simulation tableau. This procedure allows a more differentiated evaluation of the quality than a simple comparison using the limit values proposed by Kruskal (1964). The quality criteria 'Dispersion Accounted For' (D.A.F.) and 'Tucker's Coefficient of Congruence' with values of 0.99 and 1.00 also indicated a good solution. SPSS was used as software to generate similarity matrices, with the Euclidean distance serving as a measure. Subsequently, MDS solutions were generated using the SPSS-PROXSCAL module.

2.4 Empirical results

2.4.1 Univariate analysis

A first descriptive evaluation of the data shows the relative importance of the CREM's performance drivers (Table 5). The number of cases (n) for each variable varies due to missing values.

Table 5: Descriptive statistics

Mechanism	Hierarchy	Performance driver	n	Mean	S.D.	Variance	Total Mechanism, mean (S.D./Variance)
Operating performance (USE)	Normative	Corporate identity fit	59	2.32	1.04	1.08	2.38 (0.53/0.28)
	Strategic	Enabling strategic opportunities	56	2.84	0.99	0.97	
	Strategic	Enabling strategic flexibility	59	2.32	1.22	1.50	
	Strategic	Employer branding	59	2.15	0.93	0.86	
	Tactical	Enhancing innovation	59	2.82	0,71	0.50	
	Tactical	Enabling collaboration/processes	59	2.27	0.96	0.93	
	Short-term	Labour productivity	59	1.93	0.85	0.72	
Real estate performance (PRODUCE)	Tact. & Strat.	Real estate value & occupancy costs	59	2.77	0.98	0.97	2.77 (0.98/0.97)
Financial performance (INVEST)	Strategic	Capital structure & adjustment costs	57	3.54	1.27	1.61	3.36 (1.10/1.21)
	Tactical	Costs of capital risk premium	56	3.05	1.38	1.91	
	Short-term	Liquidity	56	3.54	1.54	2.36	

When interpreting the results, it first becomes apparent that labour productivity, employer branding and enabling collaboration/processes are the most important performance drivers for the CREM decision-makers (lowest mean values). These are all drivers from the field of operating performance. The average rank of 2.38 (s.d. = 0.53) for all drivers in operating performance is higher as well than that of 2.77 (s.d. = 0.98) for real estate performance and 3.36 (s.d. = 1.1) for financial performance. Thus, the results show that the user function currently outweighs the corporate finance function according to surveyed German CREM executives. The contribution to success made by their role as real estate producers lies in between regarding its importance but clearly closer to the importance of the user function than the finance function.

In addition, the data provide insight into whether the success impact of CREM is seen to be more short- or long-term. For the strategic–tactical–operational relevance of CREM for corporate success, the results, however, present a less clear picture. The normative relevance is ranked highest at 2.33 (s.d. = 1.04) followed by short-term with 2.69 (s.d. = 0.85), strategic

with 2.70 (s.d. = 0.68) and tactical with 2.71 (s.d. = 0.72). This means that no clear pattern is currently discernible.

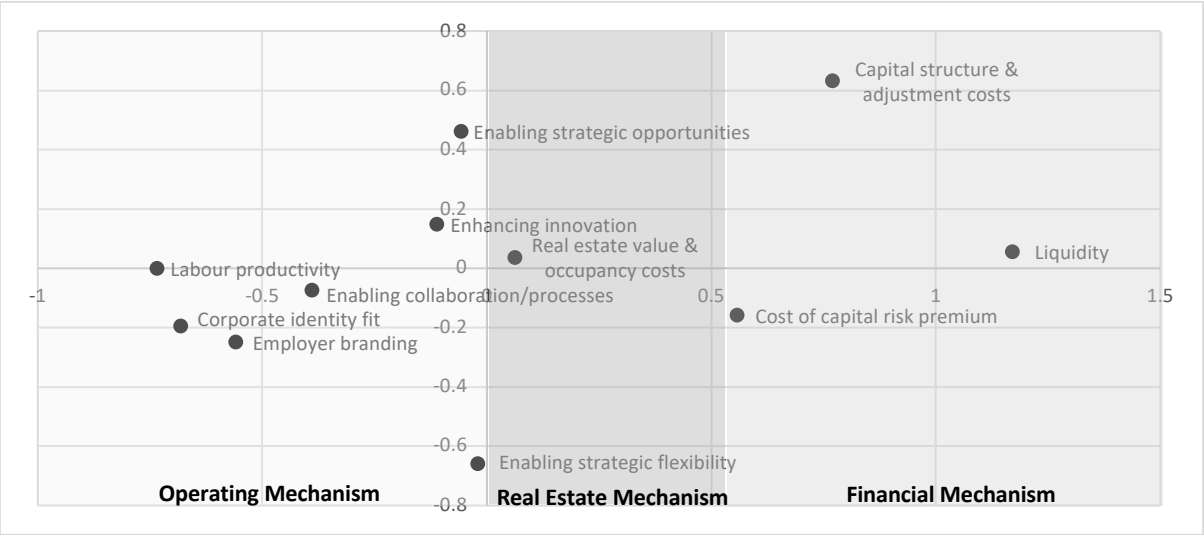
Last, the perception of importance of drivers by CREM managers might differ between industry, company size, portfolio size and structure. One could expect that companies with largely fungible office properties in metropolitan regions (e.g. from the insurance and banking sectors) attach greater importance to financial performance while companies from the manufacturing sector with a higher proportion of industrial real estate care more about operational performance. However, no significant difference between the sectors or company or portfolio sizes were present except for industry sector and liquidity (Chi-square (4, n = 56) = 10.67, p = .031). However, in the subsequent and more detailed pairwise *post-hoc* Dunn-Bonferroni test, no significant difference can be found after the Bonferroni correction has been carried out. Therefore, these CREM decision-makers appear consistent in their opinion across all included control variables.

2.4.2 Testing the theoretical model by multidimensional scaling

The main research purpose of the study is to provide empirical proof that the relationships between CREM decisions and business success follow the pattern of the three mechanisms developed in the literature chapter. As a result of the MDS analysis, the performance drivers are plotted as points in the two dimensional perception space of decision-makers as explained in the Methods chapter. The interpretation is done by two separate approaches. First, the perception space created can be subdivided into vertical areas (see Figure 9). If the performance drivers are positioned in a common area, then they are more related and, thus, could be said to form a common performance mechanism (Borg and Staufenbiel, 2007).[4] This subdivision shows that the variables can indeed be summarised in the corresponding mechanisms M1–M3. The developed theoretical framework therefore seems to be valid at this point.

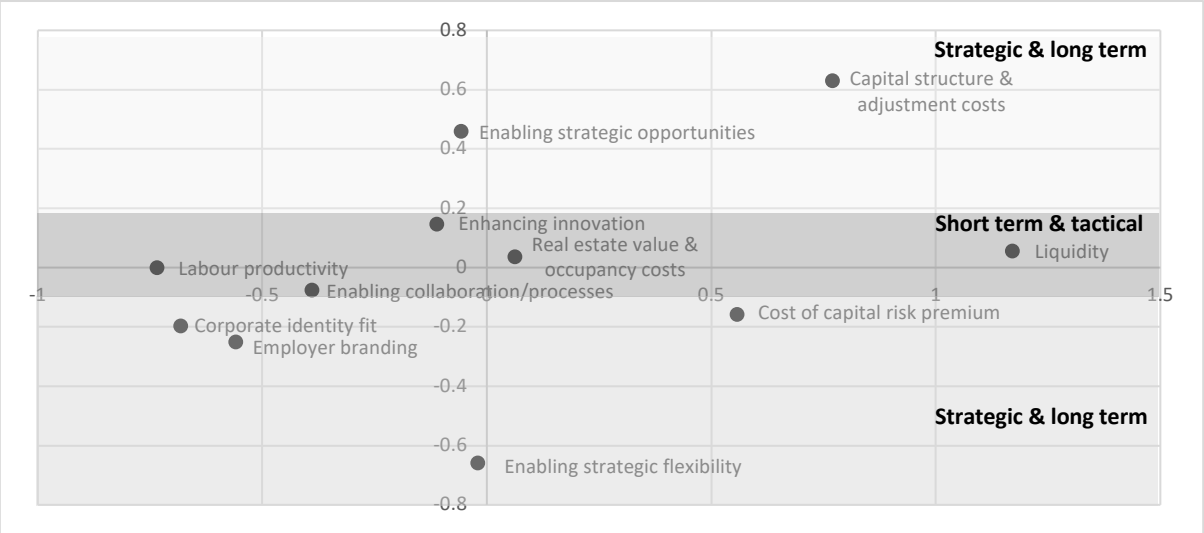
[4] To simplify interpretation, the spanned space was rotated.

Figure 9: Vertical interpretation



In the next interpretive step, the solution space was divided into horizontal layers (see Figure 10). The horizontal interpretation of the solution space indicates the hierarchical levels of the CREM performance (see also Figure 4). The resulting hierarchy is similar to the theoretically developed CREM performance framework. It becomes clear that the short-term and tactical drivers are centrally located and have spatial proximity to each other. In contrast, drivers with long-term effects are located in two different peripheral layers. This interpretation is supported by a closer look at the descriptive statistics of the three layers presented in Table 5. The peripheral variables have higher standard deviations on average than the more centrally located ones. The performance drivers summarised in Figure 10 as short-term and tactical have a mean of 2.650 and a standard deviation of 0.6425. The variables of the upper / lower peripheral layer have a mean value of 3.184 (s.d. = 0.874) / 2.481 (s.d. = 0.744). This increased standard deviation can be interpreted as uncertainty, which is particularly high in the case of long-term performance creation. This is a further confirmation of hierarchy as relevant dimension. However, the proof of the hierarchical arrangement into short- and long-term layers leaves one question unanswered: why are long-term effects divided into two layers? A possible answer to this question could be provided by the interpretation of the two axes as explained in the following.

Figure 10: Horizontal interpretation



Another interesting aspect of the analysis of the results of an MDS is the interpretation of the meaning of the axes (see Figures 9 and 10). The solution in two-dimensional space shows that dimension 1 separates the variables exactly into the three known performance mechanisms: operating performance (M1), real estate performance (M2) and financial performance (M3). The arrangement corresponds to that of a conflict line on which the CREM objectives of operating performance and financial performance are perceived as extreme points, and the objectives of real estate performance are classified between these extremes. The theoretical model of CREM performance is also confirmed in this alternative form of interpretation.

The interpretation of the second dimension is not quite as simple but it is also valuable. Comparison with the average agreement values from Table 5 shows that the items are arranged along the second dimension in a weak descending order of importance. The second dimension could, therefore, be interpreted as a management issue and pressure for action. This could also answer the question raised above as to why long-term performance drivers are divided into two horizontal layers (Figure 10). It seems that surveyed CRE managers not only distinguish between short- and long-term performance drivers. The latter are also divided into more and less important performance drivers according to their influence on the firm's success. A slightly decreasing relevance of the performance drivers from the negative to the positive value range of the ordinate can be observed. Particularly relevant drivers such as flexibility, employer branding or corporate identity tend to be located in the lower part of the figure while less important drivers such as capital structure and adjustment costs, strategic opportunities or liquidity are located in the upper part.

2.5 Practical and theoretical implications

From the development and empirical validation of the framework, quite fundamental suggestions for the further development of the CREM concept in theory and practice arise. First, the conceptual considerations and the empirical results show that the contribution of CREM to corporate success cannot be reduced to the success of a single performance mechanism. For the scientific discussion of CREM topics, the present analysis shows that it is obviously not sufficient to measure the connection between CREM and corporate success with balance sheet and capital market data. Even the simple addition of the contributions of the individual CREM performance mechanisms to corporate success does not go far enough. Rather, the complex interactions of the mechanisms must be taken into account systemically when measuring success. For the further scientific development of CREM, it follows that there is a need for more cross-reflection on the different strands of CREM success literature as described above. This is not intended to call into question the significance of this research in areas such as Workplace, Real Estate Corporate Finance or Real Estate Services. Rather, an important task in the future will be to continue the holistic discussion of CREM's contributions to success that has been extended here with two dimensions and empirical support. This analysis is challenging because it requires interdisciplinary and diverse research groups to be brought together around one table.

In practice, this means that the institutionalisation of CREM in the company needs to be critically examined. It is questionable whether organisational models in which CREM responsibility is distributed among the functional areas or centralised unilaterally in one functional area can be effective against the background of these results. Rather, organisational models that take into account the profit contributions from all performance mechanisms equally in all important decisions, such as portfolio investments or reorganisation of real estate management, seem more appropriate. Empirical studies on existing organisational models show that this is the exception rather than the rule (Hartmann, 2011). In particular, the splitting of central real estate responsibility into construction management, facility management, real estate financing, workplace management and other units appears counterproductive. Instead, a stronger centralisation and coordination of responsibility for success should be discussed. Irrespective of this, the operational and tactical tasks can remain distributed across the existing functional cross-section of functional areas.

Second, the results suggest placing more importance on managing the particular interests of the different internal and external stakeholders. Particularly in the case of competing contributions to success by the CREM performance mechanisms, a central CREM unit has the task of institutionalising the reconciliation of real estate interests. In practice, the CREM's self-image shifts away from the function of the provider of the property management services to a central management function, that is responsible for the coordination of property management interests of the stakeholders. This also requires additional skills as real estate performance fully lies within the expertise field of CREM departments; however, for operating and financial performance, it is necessary to synchronise with other business functions (e.g.

human resources, finance, marketing and sales) in order to deliver success. The effect of CRE(M) on the organisation's output is indirect for these mechanisms; therefore, as predicted by the resource-based management view, coordination is essential to achieve synergy.

This empirical study is time-related and the relative weighting of CREM's contributions to success via the different performance mechanisms might change significantly in the future. In the past, comparable empirical studies from Germany confirmed this dynamic. In 1998, German CREM managers still rated real estate performance (reduction of property use costs) as the most important contribution to CREM's success (Pfnür, 1998); however, financial performance gained the upper hand at the turn of the millennium (Pfnür and Hedden, 2002). Since the financial and economic crisis, the focus has been on operating performance (Pfnür and Weiland, 2010). German CREM currently mostly value labour productivity, employer branding and enabling collaboration/processes as outcomes of the CREM decisions they make. This might be typical for the German market. Several studies in other countries have consistently found that reducing real estate costs is the most important goal/strategy of CRE managers (Gibler, Lindholm and Anderson, 2010; De Vries *et al.*, 2008). Ultimately, only an international longitudinal analysis can clarify how the target priorities in CREM are shifting and why this is the case.

2.6 Limitations and future research

This research has limitations; for example, no longitudinal data were used, only the CRE managers of the companies were interviewed (not all stakeholders) and the study was limited to large companies in Germany. These results could differ significantly in different economic strata and different parts of the world; thus, further research is recommended on these aspects. There are also limitations to the available research results with regard to the further scientific processing of the data. In particular, the CREM's contribution to success, especially in times of structural change in companies, comes about in close cooperation with other corporate divisions that have not been surveyed here. These are on the one hand the users, but also the HR and IT departments. In order to obtain a complete picture of the effectiveness of CREM in a company, cross-departmental research designs will have to be increasingly used in the future.

The analysis of the various literature strands on the connection between CREM and corporate success has revealed a very complex picture when looking at it all together. The empirical confirmation of the model in all its complexity shows the interdisciplinary nature of CREM in companies. A reduction of CREM's goals, structures and processes solely to financial, user-oriented or real estate performance-based aspects appears to lead to inefficient solutions. Future research should measure actual corporate successes to confirm this.

In general, CREM's contribution to success is not only determined by the strategies and measures for the three mechanisms by those responsible in CREM, but also by stakeholders in the CREM environment (Dyllick, 1992). The results of the literature review imply that perhaps the most important challenge for CREM could be to solve the conflict of interest of

the various stakeholders. The above references to empirical works show that over time there can be considerable differences in the weights of the different performance mechanisms and there may also be regional differences. In Germany, sector, company size and portfolio composition do not appear to provide an explanation for the weights of the different performance contributions of the CREM respondents; however, this might be different in other regions. Last, the complexity of the model developed here confirms the insight that there can be no one best model for CREM, only one best fit.

3 Corporate real estate holdings, business segments and the firm return

Title:	Corporate real estate holdings and the stock market performance
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Abstract:

The aim of this paper is to examine the influence of corporate real estate holdings on the firm performance. Unlike previous studies, the paper does not only consider the firms primary business segment, but also their activities in different business fields. This is of particular interest because additional segments often have different requirements for the provision of space and thus for the ownership strategy, which could have led to a possible bias in previous studies. Furthermore, additional business areas are becoming more relevant through integrated solutions.

The study uses a balance sheet dataset of companies in the six largest European economies for the period from 2000 to 2016. Germany serves as a suitable laboratory for deeper analyses. Holdings of 490 firms are regressed to the stock market performance using a two-stage approach. This procedure is repeated by considering additional business segments.

The analyses reveal that ownership reduces stock market performance. Additional business activities also appear to influence the relevance of ownership for the firm performance.

The research shows that ownership is priced depending on its primary and additional business activities. First, this insight helps capital market players to choose the right investment strategy. Second, it provides corporate real estate decision makers with information on the optimal provision of real estate.

This is the first paper to examine the contribution of real estate ownership on firm performance in light of the fact that companies operate in more than one sector.

Keywords: Corporate Real Estate holdings, business segments, stock market performance

3.1 Introduction

Non-property companies are regularly confronted with the provision decision of corporate real estate. Numerous papers have already dealt with the question of whether the provision should be by ownership or rental solutions.[5] In the predominant scientific discourse, ownership[6] is increasingly seen as a burden on firm performance. This is regularly justified by the high capital and time commitment, lack of flexibility against fluctuations in demand and the associated inefficiencies (Ambrose *et al.*, 2017). It is evident that this insight has not yet been fully implemented as seen in the proportion of real estate holdings of European firms. Despite the fact that previous studies have already observed a slight decline in the proportion of real estate assets, corporates appear to be hesitant to use alternatives such as leasing or rental solutions (Seger and Pfnür, 2018).

A detailed view on the sectors in which the companies operate reveals considerable differences in ownership strategies (Brounen, 2005). While service companies mainly use generic office real estate and prefer rental solutions, companies from the manufacturing sector have a more specific space demand, which in turn is reflected in a higher share of ownership (Ambrose *et al.*, 2017). Equally high proportions of ownership can be seen in the retail sector and gastronomy (Demirer *et al.,* 2018; Nappi-Choulet *et al.*, 2009). In these industries, the real estate location is of particular importance as a success-critical factor, which must be secured in the long term through ownership. Accordingly, there is a general consensus that the role of real estate and its linkage with corporate strategy is predetermined by sector and business model (Park and Glascock, 2010). Following the resource-based view, these strategic corporate properties, which serve to generate long-term competitive advantages, must be kept within the company's control by ownership (Amit and Schoemaker, 1993; Zott and Amit, 2006).

Due to the varying importance of corporate real estate in respective industries, capital market performance of ownership-intensive companies also varies. In the service sector, for example, ownership is perceived more as a risk factor while in the retail sector, for example, studies suggest an opposing point of view (Liow, 2010). However, the differences in capital market valuations are sometimes contradictory across studies (e.g. Deng and Gyourko, 2000; Seiler *et al.*, 2001; Liow, 2004). This could be justified by the fact that all scientific papers focus on the primary business segment to assign a company to a sector. Ignoring secondary business segments in the context of increasingly diversified business models is problematic. Motivated by low product margins and new IT-supported possibilities, integrated solutions combine physical products and services (Windahl *et al.*, 2004). Automobile manufacturers suddenly become mobility service providers with all the consequences for the underlying real estate portfolio and its provision. In this case, the mere consideration of the industry to which the core business belongs neglects the higher demand for office space and dilutes the significance of ownership. This can lead to misinterpretations.

[5] A broad literature review of studies investigating the advantages of ownership or rental solutions is presented in Table 1.
[6] Ownership and holdings are taken as synonyms.

In line with the previous explanations, the paper pursues two objectives. First, to examine the impact of real estate ownership on capital market performance. Second, the sector classification of secondary business areas is included in the analysis in order to present the influence of property ownership on capital market performance in a more differentiated way. The study therefore answers two research questions:

1. Do the corporate real estate (CRE) holdings affect the firms' capital market performance?
2. Does the influence vary between primary and additional secondary business segments?

The first research question aims to validate the results of Rochdi (2016), Du *et al.* (2014), Dong *et al.* (2012) and Tuzel (2010). The second question expands the scientific discourse by including further business segments of the investigated companies.

3.2 Literature review

The research on ownership in the existing studies is almost entirely motivated by the question: what kind of influence do real estate holdings have on firm performance? The studies can be differentiated in terms of empirical procedures and the operationalization of firm performance. However, the majority of the studies concentrate on the impact on stock return. Table 6 lists the relevant studies of the last 20 years in a comprehensive overview.[7] The core statement is almost the same: ownership has a negative impact on firm performance. The most prominent reasons mentioned are the long-term nature of the provision and the associated inflexibility towards new space requirements (Ambrose *et al*., 2017), capital adjustment costs (Tuzel, 2010), inefficient management (Deng and Gyourko, 2000), impacts on the capital structure (Du and Ma, 2012) or high capital commitment and the resulting lower liquidity (Liow and Nappi-Choulet, 2008). In Germany, which later serves as a test laboratory, the relationship between real estate ownership and capital market performance was only examined explicitly by Rochdi (2016). The study proves that real estate ownership is priced in as a risk factor in the returns of firms inside the manufacturing and service sectors. The study thus confirms the prevailing opinion in the literature.

However, as shown in Table 6, some studies also come to partly contradictory results. Differences between study results can be explained, for example, by the fact that the benefits of ownership depend on other parameters such as country-specific conditions (Brounen and Eichholz, 2005), competitive structure (Diop, 2017), economic changes (Tuzel, 2010), uncertainties in the core business (Zhao and Sing, 2016), local real estate markets (Deng *et al.,* 2017) or macroeconomic conditions and crises (Ting 2006, 2007). A further important and often considered factor is the industry classification, which is usually based on the SIC coding of companies (see Table 6). However, the fact that companies also operate in more than one business segment is not taken into account. And this despite the fact that for example

[7] Studies that follow the event study approach were not considered. They have already been summarised by Rodriguez and Sirmans (1996) with a few newer exceptions (Groenlund *et al.,* 2008; Ting, 2006; Devaney *et al.,* 2004; Fisher, 2004; Ezzell *et al.*, 2001; Liow ,1997; Adams and Clarke, 1996).

companies are expanding their classic production-oriented business model by offering additional services. The additional business segments varying requirement for the provision of space can bias the empirical evidence as long as these are not taken into account.

Du *et al.* (2014) provide, in addition to the aforementioned methodological explanation, a contentual one. In their study the authors consider the number of other business areas and their impact on ownership intensity. They justify the consideration by arguing "that firms that focus on a small number of business lines may find holding real estate as a way to diversify their corporate risk", which differs from the argumentation pursued here but also assumes an impact on firm performance.

Table 6: An overview of the relevant existing literature

Study	Dataset	Research design	Results
Cheong and Kim (1997)	1319 firms from Korea, 1987-1991	• Sample includes listed manufacturing firms except wholesale and retailing firms • The holding ratio is calculated based on the book value of real estate to equity value • Two-stage regression approach from Fama-MacBeth;	Firm's real estate holdings represent a non-systematic factor, which are not reflected by the stock returns.
Deng and Gyourko (2000)	718 firms in an international context, 1984-1993	• Sampled firms are sorted in 57 non-real estate industries using four-digit SIC classification; • The real estate concentration ratio is measured by PPE/TA; • Two-stage regression approach from Fama-MacBeth;	The CRE ownership has a negative impact on the risk-adjusted returns, especially for risky firms. This negative impact is detected to be mostly significant in the Electronics Industry.
Seiler *et al.* (2001)	80 firms in US, 1985-1994	• Sampled firms are sorted in 4 non-real estate industries using two-digit SIC classification; • The percentage of real estate ownership is measured by PPE/TA; • Two-stage regression approach from Fama-MacBeth;	No significant relations are found between the CRE ownership and the risk-adjusted returns, or the systematic risks.
Liow (2001a)	71 firms from Singapore, 1995-1999	• Sampled firms are sorted in 6 non-real estate industries using SGX classification; • The real estate asset intensity is measured by the ratio of gross property asset value divided by gross total asset value or book value of equity; • Two-stage regression approach from Fama-MacBeth;	Real estate holdings affect common stock returns especially in the multi-industry, commerce and hotel sector.
Liow (2001b)	51, 61 and 82 firms from Singapore for the periods 1989-1991, 1992-1994, 1995-1998	• Sampled firms are sorted in two non-real estate industries (hotels and industrial/commerce using SGS classification; • The real estate asset intensity is measured by the ratio of gross property asset value divided by gross total asset value, book or market value of equity; • Arbitrage Pricing Model approach;	In the case of property intensive firms, the market risk for properties appears to be a specific factor in capital asset pricing, which is reflected in an ex ante premium in the stock market.
Liow (2004)	75 firms from Singapore, 1997-2001	• Sampled firms are sorted in 7 non-real estate industries using SGX classification; • The real estate asset intensity is measured by the ratio of gross property asset value divided by gross total asset value; • Two-stage regression approach from Fama-MacBeth;	No significant relations are found between the CRE ownership and the risk-adjusted returns, or the systematic risks. The lower returns, higher systematic risks and poorer abnormal returns could be possibly caused by including the CRE ownership assets in a corporate portfolio.

Study	Dataset	Research design	Results
Brounen and Eichholtz (2005)	4636 firms from 9 countries, 1990-2000	• Sampled firms are sorted in 18 non-real estate industrial sectors using two-digit SIC classification; • The corporate real estate ratio is measured by PPE/TA; • Two-stage regression approach from Fama-MacBeth.	The CRER is generally negative related to the systematic risks in all subsamples except for the Electronics industry. An insignificantly negative relationship between CRER and the risk-adjusted returns is found in the overall sample. This relationship is partly sector-specific and it is found significantly negative in the Communication and Business Services sectors, while insignificantly positive in the Transportation sector.
Brounen and Eichholtz (2005)	454 retail firms from 3 regions, 1993-2002	• Sampled retail firms are sorted in 7 sub-segments of retail trade using four-digit SIC classification; • The corporate real estate ratio is measured by PPE/TA; • Two-stage regression approach from Fama-MacBeth.	The CRER is significantly negative related to the systematic risks and positive related with the risk-adjusted returns.
Ting (2006)	83 firms from Bursa Malaysia, 1993-2001	• Sampled firms are grouped in 5 industry sectors: Consumer, Industrial, Plantation, Trading and Second Board; • 4 proxies for CRE ownership are adopted[1]; • Two-stage regression approach from Fama-MacBeth.	No significant relations are found between CRER and risk-adjusted returns, or systematic risks.
Farzana and Murtaza (2009)	5 hotel firms from Singapore, 1983-2001	• Only hotel sector included; • The property asset intensity is measured by the ratio of property value divided by total asset value; • Two-stage regression approach from Fama-MacBeth.	The CRE ownership has significant impact on the systematic risks in hotel sector; whether this impact is positive or negative could not be identified.
Yu and Liow (2009)	658 retail firms from Asia, Europa and North America, 2001-2006	• Sampled firms are grouped in 8 sub-segments of retail using SIC code classification • The corporate real estate ratio is measured by PPE/TA; • Construction of composite and a hypothetical business time series • Two-stage regression approach from Fama-MacBeth	Retail real estate ownership is associated with a better stock market performance. Due to diminishing scale of return this does not automatically mean, that higher ownership levels lead to higher benefits.
Park and Glascock (2010)	51 franchise firms from US, 2000-2006	• Sampled firms are grouped in 5 industry sectors (manufacturing, general stores, restaurants, services and hotel) using SIC code classification • The corporate real estate ratio is measured by PPE/TA; • Two-stage regression approach	CRE ownership has a positive impact on excess returns for firms in the franchise industry.
Tuzel (2010)	843 firms, 1969-2003	• The real asset ratio is the percentage of the real asset components of PPE to the total PPE value; • Industry-adjusted real asset ratio is calculated using two-digit SIC classification; • General equilibrium production model	Firms with more real asset components in the total property value are likely to have higher systematic risks as well as higher stock returns.
Liow (2010)	556 retail firms from 3 regions and 15 countries, 2001-2006	• Sampled retail firms are categorized in 8 retail sub-segments using two-digit SIC classification; • The relative CRE ownership is measured by PPE/TA; • Three-index Arbitrage Pricing Model.	The CRE ownership is an important pricing factor in the stock market for firms in retail sector. A significantly positive relation between the CRER and the systematic risks beta can be found in some retail sub-segments.

Study	Dataset	Research design	Results
Dong *et al.* (2012)	1218 firms from China, 2003-2007	• Sampled firms are categorized in 12 industries (unknown classification source); • The CRE ownership is measured by the ratio of fixed asset value divided by total asset value; • Panel data analysis.	The CRE ownership (fixed asset investment) is significantly negative related to the risk-adjusted returns and the systematic risks for firms in China.
Lee and Jang (2012)	57 firms from US, 2005-2009	• Sampled firms are grouped in 5 industry sectors (hotels, casino hotels, casinos, full-service restaurants and limited-service restaurants) using North American Industry Classification System (NAICS) • The CRE ownership is measured by the balance sheet figure buildings ratio divided by the book value of total assets • Jorion's two-factor model and two stage regression analysis	The real estate exposure of hospitality firms increases with the ownership.
Du and Ma (2012)	340 firms in China, 2003-2008	• Sampled firms are sorted in 6 non-real estate industries. (unknown classification source); • The CRE ownership is measured by the ratio of gross buildings value divided by total asset value; • Two-stage regression approach from Fama-MacBeth.	Only a significantly negative relationship between CRER and the abnormal returns can be found in the Information industry. The CRER is generally significantly negative related to the systematic risks.
Ling *et al.* (2012)	approx. 250 US firms, 1998-2008	• Sampled firms are grouped in a composite sample and in 8 retail sub-segments using the two-digit SIC industry classification system • CRE intensity is measured by PPE to total assets • Jorion's two-factor model and two stage regression analysis	Real estate intensity is not associated with higher market risk
Omokolade *et al.* (2013)	1070 firms, 1996-2009	• The sample consists of sharia compliant firms sorted in different industries by SIC classification; • The CRE ownership is measured by PPE to total assets; • Two-stage regression approach from Fama-MacBeth;	Negative relationship between systematic risk and ownership intensive Sharia compliant firms. The idiosyncratic component of the returns isn't influenced.
Du *et al.* (2014)	549 US firms, 1998-2002	• The sample is grouped by sector in mineral-construction-manufacturing and trade-service-others. • CRE intensity is measured by PPE to total assets • Two-stage regression approach from Fama-MacBeth	Stock market return is negatively associated with real estate holdings.
Rochdi (2015)	679 firms listed on the German stock market, 1999-2014	• Sampled firms are sorted in 10 non-real estate industries using two-digit SIC classification; • The CRE intensity is measured by (net land value + net buildings value)/TA; • Time series analysis based on Fama-French model;	The CRE ownership has a significantly negative impact on the excess stock returns for German firms. The CRE specific risk factor shows countercyclical patterns and is particularly relevant for firms in the manufacturing sector.

Study	Dataset	Research design	Results
Morri *et al.* (2017)	300 manufacturing firms from Italy, 2004-2013	• Sampled firms are divided into 6 manufacturing sub-sectors using Ateco code 2007; • The CRE ownership is measured by REW, REC[1]; • Descriptive and cluster analysis	The CRE ownership is negatively related to firm performance. Firms with lower CRE ownership lever and higher occupancy costs perform better.
Diop (2017)	7,736 US firms, 1973-2010	• Sample firms are classified into 171 industries according to their three-digit SIC codes including manufacturing, transportation & public utilities, wholesale trade and retail trade; • The real asset ratio is the percentage of the real asset components of PPE to the total PPE value; • Time series analysis based on Fama-French model;	Product market competition is a determining factor in the relation between real estate ownership and firm risk. In concentrated industries the relationship is nonpositive to negative and in competitive industries the relationship is positive.
Demirer *et al.* (2018)	149 restaurant firms from US, 1999-2014	• Sampled restaurant firms are selected using four-digit SIC classification; • The corporate real estate ratio is measured by PPE/TA; • Two-stage regression approach from Fama-MacBeth.	CRER is negative related to the total returns in the short run and significantly positive related to the abnormal returns in the long-term period; No significant relationship can be found between CRER and the systematic risks for restaurant firms.
Kim Noh Lee (2019)	43 US lodging firms, 2002-2016	• The sample firms were classified by NAICS codes; • The depreciation expenses were used as a proxy for the level of real estate asset ownership • Two-stage regression based on Fama-French 5-factor model	No significant relationship between ownership and exposure to real estate risk for lodging firms.

3.3 Sampling issues

3.3.1 Selection of a suitable laboratory for the empirical study

Answering the research questions requires a suitable empirical framework. The focus should be on a representative market with average CRE ownership shares. In the past, there have been a number of studies on the ownership rates of non-property companies in many parts of the world (see Table 6). However, an actual comparison of ownership rates between countries has only been made in sporadic cases, and if so, these studies are no longer up to date due to their age and changes in the business environment. This is because changed conditions lead to a realignment of business models, processes and products. As a result, the real estate strategy in turn has to be adjusted and thus affects the choice between the provision alternatives of ownership, rental and leasing (Seger and Pfnür, 2018). The importance of ownership thus changes over time. Decades-old studies may therefore have a limited transferability to the current situation.

Particularly in recent years, studies have focused only on individual countries. The selection of a suitable market therefore appears to be difficult. Holdings for the USA were most frequently reported (e.g. Diop, 2017, Ghent *et al.*, 2018), followed by Asian countries such as South Korea, Singapore or China (e.g. Du and Ma, 2012; Dong *et al.*, 2012; Farzana and Murtaza, 2009; Liow *et al.,* 2001; Cheong and Kim, 1997). European countries such as France, Great Britain, Germany and Italy were also the subject of mentioned studies, but rather underrepresented (Nappi-Choulet *et al.*, 2009; Rochdi, 2016; Morri *et al.*, 2017).

However, the comparison and choice of a representative market with average holdings revealed in the studies is problematic for three reasons. First, the studies cover varying time horizons. Second, studies often use different indicators to determine the holdings, which makes comparability difficult. Third, depending on the respective country, disparate accounting approaches can be used to determine the value of owned corporate real estate. While the first two obstacles could be overcome by a joint sample, the third is difficult to control. Only the results of the surveys conducted by corporate real estate managers, as carried out by several authors (e.g. Pfnür and Weiland, 2010; Hartmann *et al*., 2008; Roulac, 2003), could be used for comparison. However, this type of survey was carried out sporadically by a few researchers and allows only a glance at the current situation and not over time. Following the dominant opinion, US, Asian and as well as holdings of several European countries seem to be lower than those, for example, of German companies (Pfnür, 2019). The reasons for the varieties are numerous and can be explained by the share of small and medium-sized enterprises (SMEs) and large companies in the individual countries. According to Pfnür (2014), for example, the ownership ratio of SME in Germany is around three quarters, while large companies only hold two thirds. Correspondingly, in countries such as Germany or Italy with a large SME share, holdings are somewhat higher (Pfnür, 2014; Morri *et al.*, 2017). It is also important where the industry is located. Historically, in Germany, for example, industry has often grown in a decentralised manner. As a result, the options for non-property companies are rather limited when considering disposals, as follow-up use

seems unlikely and the interest in such transactions of investors is low. Further country differences can be the product of different governance structures, varying degrees of professionalisation of corporate real estate management (CREM) or conditions on the rental market (Graham *et al.*, 2014; Du *et al.*, 2014; Laposa and Charlton, 2002). Despite the above-mentioned characteristics of the German corporate real estate market, capital market and balance data based results from Brounen (2005) suggest that German companies have average ownership ratios. Accordingly, the German market seems to be a representative and suitable test laboratory for the following analyses. The question whether this assumption holds true will later be confirmed by a comparison of European property intensities.

3.3.2 Measure description

The Thomson Reuters Datastream database was used to obtain both balance sheet and stock price data. The dataset includes listed non-property companies for the period between the years of 2000 and 2016. The main variable in this study is the proxy for the real estate holdings of the firm. The literature provides different approaches for the measurement. The following analysis are based on three varying indicators, which are abbreviated to CRER1-3. CRER1 refers to the ratio of net property plant & equipment to net of total assets; CRER2 represents the ratio of net value of buildings to net total assets; and CRER3 is the ratio of net value of buildings and land to total assets.[8] For insights into the real estate ownership ratios of European companies, the above-mentioned indicators were collected for companies in the six largest economies of the EU. The countries were chosen on the basis of the highest GDP (gross domestic product) values, which leads to a selection of Germany, UK, France, Italy, Spain and the Netherlands. In 2016, the selected countries made up 75.6% of the total GDP of the European Union (Eurostat, 2019).

The dependent variable, capital market performance is measured with three proxies. The first variable, the total return to shareholder value (Return), is calculated from the Return Index (RI), which captures both the price movements as well as the dividend payouts. The latter two variables can be estimated through a two-stage regression approach when regressing the firms' stock excess returns on the market excess returns. The Jensen's index (Alpha) is the intercept and represents an abnormal return of the firm. The systematic risks (Beta) is the slope coefficients in this regression.

In addition, three control variables are also included: firm's leverage, size and book-to-market ratio. The firm's leverage is computed by dividing the firm's long-term debt by the total assets and could be used to assess the firm's ability to meet its financial obligations (Zhao and Sing, 2016; Du *et al.*, 2014). The firm's size is measured by the natural logarithm of market capitalization (Park and Glascock, 2010). This variable is considered to be important to the firm's decision between CRE ownership holdings or leasing holdings. Smaller firms generally demand more flexibility, especially when it comes to the real asset issue which is always associated with great commitment. The book-to-market ratio (BE/ME) is calculated

[8] As can be seen in the tabular literature overview of table 6, these are the most frequently used proxies for ownership intensity.

by dividing the common shareholders' equity by the market capitalization and helps to determine the market value of a firm compared to its actual worth (Zhao and Sing, 2016).

All the variables mentioned above, together with their calculation formulas and required original items in the database, are provided in Appendix A1.

Regarding the second research question, the investigated firms are categorized into different groups according to their primary and additional business segments listed on the Thomson Reuters Datastream. The categorization is carried out using SIC codes. Sectors such as agriculture, forestry, fishing, mining and construction are not taken into account, as their weight in the economy measured by GDP is negligible (Statista, 2019). Due to the focus on privately-owned non-property companies, companies with the SIC code "Public Administration" are not considered further. The five remaining sectors: manufacturing, retail trade, wholesale trade, services and transportation provide a robust database. But more importantly, the role of real estate holdings differs in the industries included. For example, specific production facilities are more likely to be owned than generic office space. This increases the chance that the inclusion of secondary business areas with a different role of ownership dilute capital market performance and thus confirm the second research question.

3.4 Empirical procedure

Consistent with most existing studies in Table 6, a two-stage regression approach is adopted to discern the relationship between the CRE ownership holdings and the market performance of German firms. In accordance with a previous study from Rochdi (2016), the annual national market return (Rm_t) and the annual risk free return (Rf_t) are obtained from the online data library from Brückner *et al.* (2015), which are considered to be well calculated and applicable specifically for German market. In the first-stage, the abnormal returns alpha and the systematic risks beta are estimated using a single index model based on the Capital Asset Pricing Model (CAPM), at which annually risk free firm returns ($R_{i,t} - Rf_t$) are regressed to annually risk free market returns ($Rm_t - Rf_t$):

Equation 1:

$$R_{i,t} - Rf_t = \alpha_{i,t} + \beta_{i,t} \cdot (Rm_t - Rf_t)$$

where:

i	1, 2, 3, …, 490, represents the firm
t	1, 2, 3, …, 17, represents the year
τ	1, 2, 3, represents the forward time lag of 1, 2, and 3 years
$R_{i,t}$	stock return for firm i in year t
Rf_t	risk-free rate of market return over year t
Rm_t	national market return over year t
$\alpha_{i,t}$	abnormal returns alpha, intercept matrix of CAPM regression
$\beta_{i,t}$	systematic risks beta, slope coefficient matrix of CAPM regression

After obtaining all the variables (including estimators of alpha and beta from regression results of Equation 1), some preliminary tests are conducted to determine which regression analysis method to apply: the LM Test is conducted for all regression models mentioned in this chapter, and the significant results ($p<0.001$) can make sure that a pooled ordinary least squares (OLS) is applicable and more suitable for this data sample. The traditional Hausman Test is employed to make a choice between random-effect or fixed-effect regression model, and the result is also significant ($p<0.001$), which suggests that a fixed-effects model should be better for the analysis.

In the second-stage, the estimators of the systematic risk (beta), Jensen's Index (alpha) and the total stock returns will serve then as the dependent variable representing the capital market performance ($MP_{i,t+\tau}$). The CRER, as the proxy for the CRE ownership holdings, is the independent variable, separately matching each measurement of the market performance. Additionally the firms' leverage, size and the book-to-market ratio are also included as control variables. Consistent with the research design of Demirer *et al.* (2018) a possible market information delay will be considered additionally using forward lags of 1, 2 and 3 years.

Equation 2:

$$MP_{i,t+\tau} = \gamma_0 + \gamma_1 \cdot CRER_{i,t} + \gamma_1 \cdot Leverage_{i,t} + \gamma_2 \cdot Size_{i,t} + \gamma_3 \cdot BE/ME_{i,t} + \varepsilon_{i,t}$$

where:

τ	1, 2, 3, represents the forward time lag of 1, 2, and 3 years
$MP_{i,t+\tau}$	represents the firm's market performance measured by the abnormal returns $\alpha_{i,t+\tau}$, the systematic risks $\beta_{i,t+\tau}$ and the total stock returns $R_{i,t+\tau}$ for firm i of time $t+\tau$
$CRER_{i,t}$	measured differently with CRER1 and CRER2, as proxy for CRE ownership holdings of firm i in year t
$Leverage_{i,t}$	ratio of long term debt to the total assets for firm i in year t
$Size_{i,t}$	natural log of market capitalization of firm i in year t
$BE/ME_{i,t}$	book-to-market ratio of firm i in year t

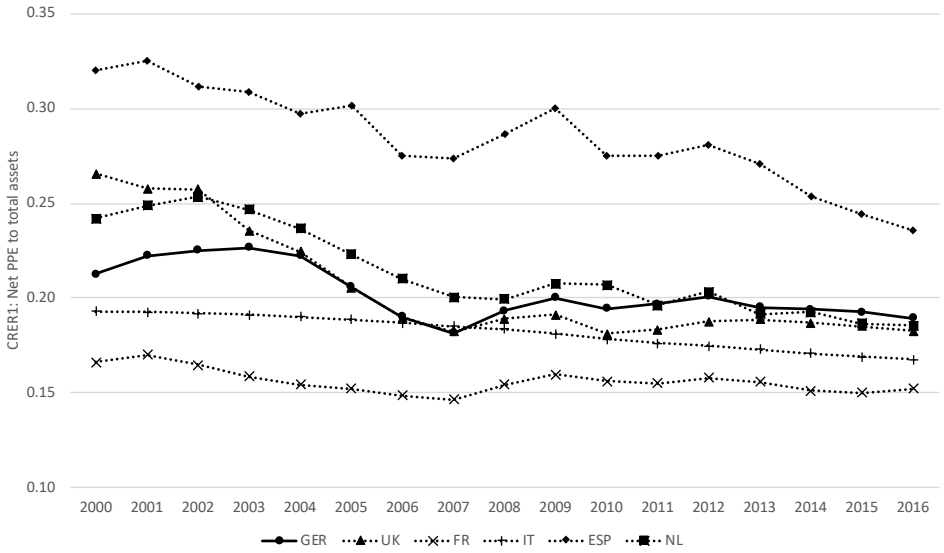
In order to identify the different impacts of CRE ownership on the firm performance in distinct business segments, the same set of regression process is conducted separately in five varying contrast group settings. In each contrast group, all the sampled firms are divided into two sub-groups based on the firms' primary and secondary business segments listed on the Thomson Reuters Datenbank. Taking the contrast group M (M stands for Manufacturing) as an example, the sub-group M1 includes firms that are only active in the manufacturing business; the sub-group M2 includes firms that are partially active in the manufacturing business and participating in other businesses.

3.5 Empirical results

3.5.1 International CRE ratios in comparison

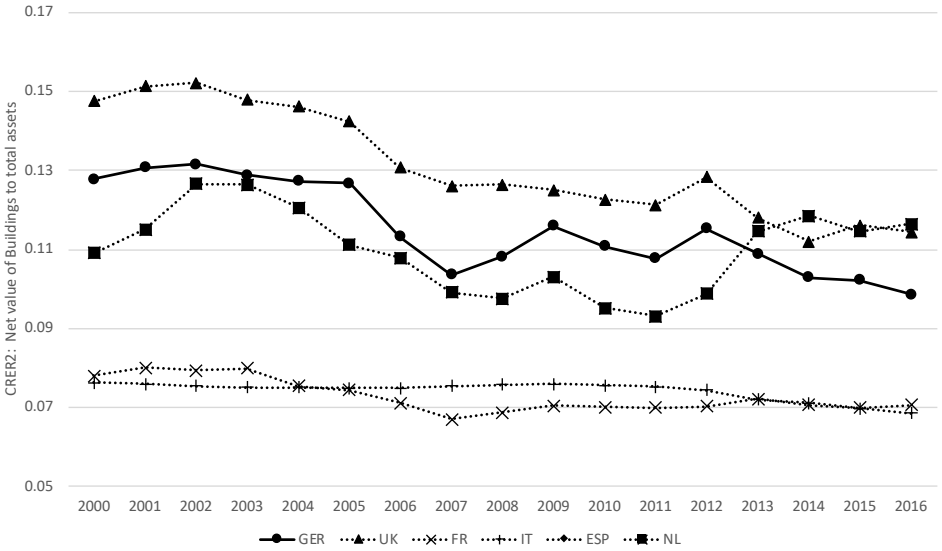
In this chapter, European ownership intensities will be examined descriptively. This aims to confirm the assumption that Germany has average ownership intensities in a European comparison and is therefore suitable as a test laboratory. Figures 11-13 show the three CRER indicators over the period 2000-2016. The following descriptive evaluations confirm the observations made by Brounen and Eichholtz (2005) that the ownership rates of German companies are still at an average level. This is still valid, despite the extension of the study period and the inclusion of the CRER2 and CRER3 indicators. The examination of the annual and average values of the CRER indicators reveal a decrease in European ownership ratios. Only the Netherlands show a slightly positive trend. It is also noticeable that at times of financial crises the ownership ratios of total assets increase and then revert to previous trends. Germany, the UK and Spain show substantial changes, while ownership situation in France and Italy changed only slightly. For example, German companies reduced their share from 12.26% to 10.22% (CRER3).

Figure 11: Ownership ratios CRER1 by country



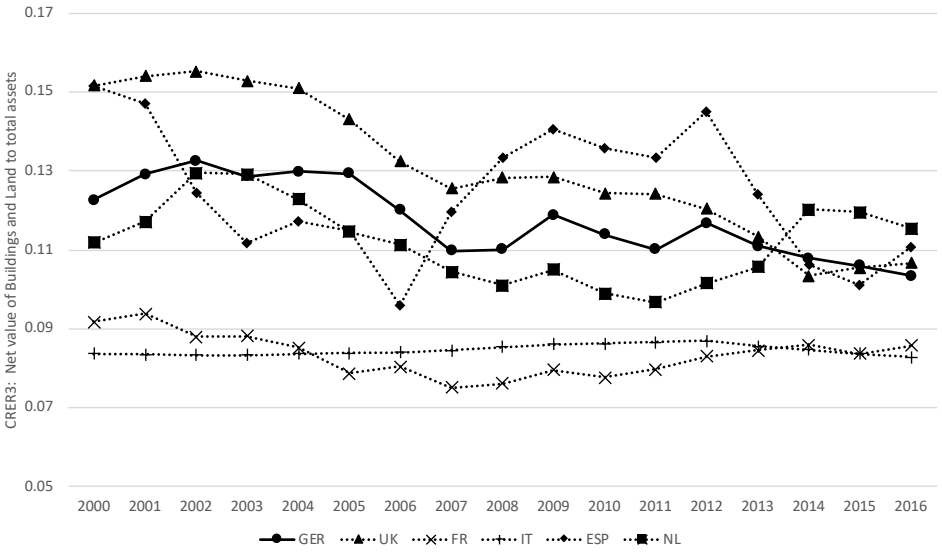
Notes: All industries with SIC-Codes SIC 01-SIC 89, excluding real estate industry. Firm-year observations: GER = 8,229; UK = 12,950; FR = 8,321; IT =3,225; ESP = 1,804; NL = 1,161.

Figure 12: Ownership ratios CRER2 by country



Notes: All industries with SIC-Codes SIC 01-SIC 89, excluding real estate industry. Firm-year observations: GER = 4,322; UK = 5,887; FR = 4,503; IT =2,023; ESP = 1,303; NL = 795.

Figure 13: Ownership ratios CRER3 by country

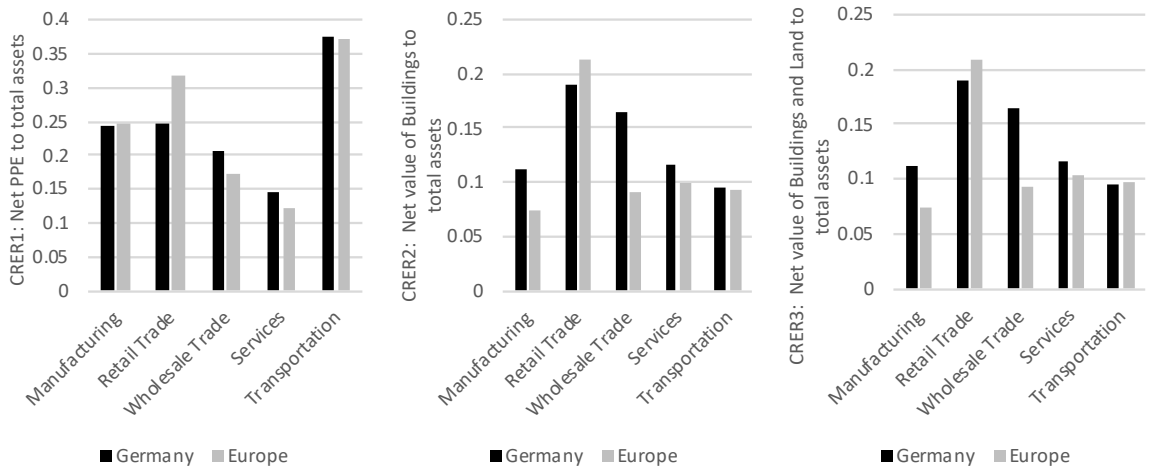


Notes: All industries with SIC-Codes SIC 01-SIC 89, excluding real estate industry. Firm-year observations: GER = 4,514; UK = 6,383; FR = 6,383; IT =2,197; ESP = 1,498; NL = 875.

In order to take into account possible sector differences in the countries, Figure 14 compares the ownership ratios of the manufacturing, retail trade, wholesale trade, services and transportation sectors of both German and other European companies. With only marginal deviations, ownership rates of German companies are in the European average. This confirms once again the assumption that German companies still hold an average level of ownership and therefore can be as test laboratories for further analyses. In addition, it becomes clear to what extent the ownership strategy depends on the sector to which the company belongs.

This makes it necessary to include in the analysis secondary business segments whose activity differs from the primary segment. The following chapter will examine whether high ownership shares have a positive or negative impact on capital market valuation and to what extent secondary business areas influence this.

Figure 14: Comparison of German and European ownership ratios by sector



Notes: Comparison of average ownership ratios in the period 2000-2016 between Germany and all other covered European countries and sectors

3.5.2 CRE holdings, stock performance and additional business segments

In a first step, the calculated performance data is examined with regard to its statistical characteristics. Table 7 provides an overview of the three market performance measurements: the total stock returns, the abnormal return alpha as well as the systematic risk beta. The latter two variables are estimated in the first-stage regression based on the CAPM, which is denoted in the previous Chapter 3.4 as Equation (1).

As shown in panel A of Table 7, the overall average annual return to shareholders' value of the whole sample is 13.36% with a standard deviation of 0.72. The abnormal return alpha, has an average value of -0.0769 with a standard deviation of 0.3335. The average value of the systematic risk beta is 0.0356 with a standard deviation of 0.1315. Together with the average variable sets sorted both by group in Panel B and by time in panel C in the same table, it can be concluded that the total stock returns and the abnormal returns alpha have experienced a great volatility in time as well as in business segments. On the contrary, according to the much lower standard deviation of beta as well as its cross-sectional and annual averages in Table 7, it can be inferred that the systematic risk beta of these firms did not vary a lot over time as well as in different business segments.

Table 7: Statistical description of return, alpha and beta

Panel A: overall

	# of firms	Firm*year	Mean	Std.	Min	Max
Return	465	6370	0.13	0.72	-1.00	14.19
alpha	438	5012	-0.08	0.33	-1.10	4.81
beta	438	5012	0.04	0.13	-1.76	1.45

Panel B: Average return, alpha, beta by contrast group

	M1	M2	R1	R2	W1	W2	S1	S2	T1	T2
Return	0.1346	0.1305	0.1338	0.1534	0.1420	0.0891	0.1264	0.1478	0.1428	0.1504
alpha	-0.0656	-0.0760	-0.1281	-0.0735	-0.0965	-0.1279	-0.1263	-0.0544	0.0006	-0.0110
beta	0.0267	0.0254	0.0195	0.0540	0.0302	0.0287	0.0630	0.0301	0.0427	0.0041

Panel C: Average return, alpha, beta by time

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Return	0.0190	-0.2273	-0.2610	0.7027	0.2495	0.4892	0.2142	0.0728	-0.3801	0.3321	0.3976	-0.1048	0.1387	0.2495	0.0530	0.238	0.09
alpha	/	/	-0.4013	-0.1569	-0.1021	-0.0666	-0.0898	-0.0737	-0.1411	-0.1042	-0.0411	-0.0545	-0.0434	-0.0035	0.0028	0.017	/
beta	/	/	0.0008	0.0559	0.0449	0.0587	0.0618	0.0634	0.0451	0.0553	0.0319	0.0262	0.0285	0.0176	0.0146	0.014	/

In a second step, the relevant variables adopted in the empirical models are correlated. This may provide initial hints for answering both research questions. Table 8 presents an overview of the pairwise correlations. Considering the heterogeneity of CRE ownership in different business segments, the pairwise correlation test is not only conducted based on the whole sample of 490 German firms, but also separately in five listed business segments.

In panel A of Table 8, both CRER1 and CRER2[9] are found to be significantly negatively correlated to the total stock returns, abnormal returns alpha as well as the systematic risks beta. These significant correlations confirm our assumption that the CRE ownership holdings should have an impact on the firm's market performance, regarding the first research question. These first findings of negative correlations also stand in line with the results of Brounen and Eichholtz (2005).

However, when considering sectoral differences, the significantly negative correlation between CRER and the total stock returns can only be detected in the retail trade and transportation business segments. More curiously, the correlations between CRER1 and systematic risks beta are found to be significantly positive in the manufacturing and wholesale trade business segments, which is just in the opposite. These contradictory correlation results among the five business segments emphasise the necessity of investigating the impact of CRE ownership on the firms' market performance on a deeper sectoral level, including secondary business segments.

[9] CRER3 was not considered in the regression models due to the insufficient sample size.

Table 8: Results of pairwise correlation tests overall and in each business segment

		CRER1	CRER2	Return	alpha	beta	Leverage	Size	BE/ME
Panel A: Overall	CRER1	1							
	CRER2	0.56***	1						
	Return	-0.03***	-0.03*	1					
	alpha	-0.01	-0.08***	0.38***	1				
	beta	-0.09***	-0.05***	0.13***	-0.01***	1			
	Leverage	0.02*	0.08***	-0.02	-0.02	0.01	1		
	Size	0.14***	0.02	0.09***	0.18***	-0.09***	-0.02	1	
	BE/ME	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.12***	1
Panel B: Manufac-turing	CRER1	1							
	CRER2	0.54***	1						
	Return	-0.02	-0.03	1					
	alpha	-0.03*	-0.11***	0.35***	1				
	beta	0.05***	-0.01	0.09***	-0.32***	1			
	Leverage	0.03**	0.04**	-0.04**	-0.04**	0.05**	1		
	Size	0.05***	-0.05**	0.11***	0.17***	-0.09***	-0.03*	1	
	BE/ME	0.09***	0.10***	-0.06**	-0.06***	-0.02	-0.42***	-0.09***	1
Panel C: Retail Trade	CRER1	1							
	CRER2	0.58***	1						
	Return	-0.11***	-0.07*	1					
	alpha	-0.16***	-0.10**	0.35***	1				
	beta	-0.19***	-0.05	0.14***	-0.30***	1			
	Leverage	0.34***	0.28***	-0.09**	-0.10**	-0.01	1		
	Size	0.12***	0.04	0.04	0.24***	-0.09**	0.03	1	
	BE/ME	-0.03	0.29***	0.03	-0.28***	-0.11***	-0.06*	-0.31***	1
Panel D: Wholesale trade	CRER1	1							
	CRER2	0.63***	1						
	Return	-0.07	-0.08	1					
	alpha	-0.20***	-0.34***	0.31***	1				
	beta	0.15***	-0.04	0.17***	-0.12**	1			
	Leverage	0.14***	0.33***	-0.07	-0.01	-0.21***	1		
	Size	0.09**	-0.13**	0.12**	0.37***	0.00	0.05	1	
	BE/ME	-0.04	0.02	-0.20**	-0.39***	-0.02	-0.02	-0.45***	1
Panel E: Services	CRER1	1							
	CRER2	0.62***	1						
	Return	-0.03	-0.03	1					
	alpha	-0.01	-0.06**	0.38***	1				
	beta	-0.15***	-0.07**	0.11***	-0.08***	1			
	Leverage	0.03	0.14***	-0.02	-0.02	-0.01	1		
	Size	0.10***	0.05**	0.13***	0.19***	-0.06**	-0.02	1	
	BE/ME	-0.01	-0.01	-0.01	0.00	-0.02	-0.01	-0.03	1
Panel F: Transpor-tation and public util-ities	CRER1	1							
	CRER2	0.47***	1						
	Return	-0.07*	-0.04	1					
	alpha	-0.02	-0.10**	0.39***	1				
	beta	-0.18***	-0.12***	0.20***	-0.32***	1			
	Leverage	0.18***	-0.03	-0.06*	-0.04	-0.02	1		
	Size	0.10***	-0.12***	0.03	0.05	0.04	-0.03	1	
	BE/ME	-0.07*	-0.02	-0.01	-0.01	-0.01	-0.02	-0.08**	1

To answer the first research question, the regression is first conducted while considering the 490 selected firms as a whole sample. The results of CRER1 and CRER2 to all three market performance measurements are sorted and presented in the first column of Table 9. Both CRER1 and CRER2 can significantly decrease the total stock returns in the short run, and decrease the abnormal returns alpha as well as the systematic risks beta in the long run. That is, higher CRE ownership holdings can generally lead to poorer stock returns but lower systematic risks for firms on the German stock market.

To answer the first research question and to identify the impacts of CRE ownership on an industrial level, the same set of regression analysis is conducted separately in five groups: M1 (manufacturing), R1 (retail trade), W1 (wholesale trade), S1 (services), and T1 (transportation and public utilities). For each group, there is a contrast group, for example M2, which includes firms that aren't only active in manufacturing business but also in other additional business segments.

The regression results over the entire sample show a significantly negative relation between the two ownership proxies (CRER1 and CRER2) and the total return, abnormal return and systematic risk. Forward lags highlight the importance of ownership with regard to its short and medium-term impact on capital market performance. For example, the almost constant negative correlation with the beta factor over all periods suggests a permanent diversifying effect of ownership. In contrast, the negative effect on total return and abnormal return appears to diminish or even reverse over time. A possible reason for this could be that ownership reduces liquidity in the short term due to the high capital commitment. But creates long-term strategic advantages which counteract this disadvantage. CREM must be aware of the varied timing of benefits and disbenefits associated with ownership. However, the findings listed above cannot be applied across all industries, which makes a differentiated analysis at industry level necessary.

Changing the scope on an industrial level, for firms that only operate in the retail trade business segment (Table 9, column R1), both CRER1 and CRER2 can significantly decrease the total stock returns and the abnormal returns alpha in the long-term. At the same time CRER1 has a significant negative impact on the systematic risks beta. Firms that are only active in services (subgroup S1) and transportation (subgroup T1) business segments, CRER1 has a significantly negative impact on the systematic risks beta, while results for outperformance aren't significant. In contrast CRER2 can significantly decrease the total stock returns as well as the abnormal returns alpha. The declining outperformance through ownership within the service and transport sectors can be explained by the low strategic importance of properties in these segments. However, the opposite effect would have been expected in the retail sector. This is not the case, possibly due to the exceedingly small sample size. For this reason, the results for the retail sector should be interpreted with caution.

The regression results of firms in manufacturing (subgroup M1) or wholesale trade (subgroup W1) business segments vary to that of the overall regression or the other three business segments. In these two segments, significantly negative relations can be found between

both CRERs and the stock returns. While a significantly positive relationship is detected between the CRER1 and the systematic risks in the long-term. That means, for firms engaged in these two business segments, holding a lower proportion of CRE ownership can help decrease the systematic risks and increase the market outperformance. A possible explanation could be that firms in these two segments are more likely to demand highly customized real estates, which are usually related to higher construction and transformation costs for reuse or transaction exposure in case of a disinvestment, when demand and production shocks occur. As a result of these higher adjustment costs the risk increases (Tuzel 2010). However, it is questionable whether investors have any interest in specific space. As a result, CREM must identify those sites in the portfolio whose location and design allow a follow-up use and are therefore eligible for potential investors.

The next step addresses the second research question. Here it seems that if the firm is active in one single business segment or has other additional businesses affects the impact of CRE ownership on its capital market performance. Comparing the regression results of subgroups M1 and M2, S1 and S2, or T1 and T2 in Panel A of Table 9, CRER1 can generally significantly decrease the total stock returns in the short run. For firms with additional business segments, no significant negative impact can be found in this study. CRER2 has a significantly positive impact on the systematic risks for firms that are only active in wholesale trade business (subgroup W1), while no significant result is detected for firms that have additional businesses (subgroup W2). Similar results can also be found when regarding the impact of CRER2 on the systematic risks for firms in services and transportation business segments. This suggests that when firms have additional businesses, the impact of CRE ownership on the firms' market performance can be decreased or offset. The results show that optimal target ratios for the share of ownership or leasing as proposed for example by Lasfer (2005) cannot be applied across all companies equally. This only makes sense, if the sectoral affilitation of the firms individual business segments are included. The same applies to shareholders and investors in the stock market. When acquiring company shares and valuing real estate ownership, the industry affiliation of all company segments must be fully taken into account. Otherwise, shareholders might experience inefficiencies. Finally, the analyses provide a possible reason why previous studies, as shown in Table 6, come to partially contradictory results.

Table 9: Regression coefficients of CRER1 to Return, Alpha and Beta

	Overall	M1	M2	R1	R2	W1	W2	S1	S2	T1	T2
Panel A: Regression coefficient of CRER1 to total stock returns											
# of firms	490	196	85	13	44	9	28	107	97	24	39
$Return_{i,t}$	-0.1802***	-0.05	0.005	-0.49*	-0.35***	-0.16	-0.09	-0.16*	-0.12	-0.19*	-0.10
$Return_{i,t+1}$	-0.1127*	-0.13*	-0.20	-0.37***	-0.79***	-0.06	-0.02	-0.01	-0.08	-0.09	-0.15
$Return_{i,t+2}$	0.0143	0.12	0.15	-0.29***	-0.60***	0.08	0.14	0.11	0.03	-0.10	-0.11
$Return_{i,t+3}$	0.0027	0.09	0.16	-0.23**	-0.34**	0.03	0.05	0.04	0.03	-0.20	-0.12
$\alpha_{i,t}$	-0.0931***	-0.03	-0.09*	-0.17***	-0.22***	-0.11*	-0.13**	-0.03	0.08*	-0.05	-0.01
$\alpha_{i,t+1}$	-0.1003***	-0.06*	-0.15**	-0.24***	-0.33***	-0.12**	-0.13*	-0.03	0.06	-0.04	-0.03
$\alpha_{i,t+2}$	-0.0801***	-0.05	-0.14**	-0.31***	-0.43***	-0.07	-0.06	0.003	0.05	-0.04	-0.06
$\alpha_{i,t+3}$	-0.0295***	-0.04	-0.11	-0.32***	-0.45***	-0.01	-0.01	0.02	0.02	-0.10	-0.08
$\beta_{i,t}$	-0.0295***	0.06***	0.06**	-0.12***	-0.12***	0.09***	0.11***	-0.09***	-0.09***	-0.10***	-0.10***
$\beta_{i,t+1}$	-0.0282***	0.05***	0.06**	-0.11***	-0.10***	0.08***	0.10***	-0.08***	-0.08***	-0.10***	-0.09***
$\beta_{i,t+2}$	-0.0272***	0.05***	0.08***	-0.10***	-0.08*	0.08***	0.09***	-0.07***	-0.07***	-0.11***	-0.08***
$\beta_{i,t+3}$	-0.0269**	0.05***	0.09***	-0.09***	-0.07*	0.07***	0.07**	-0.06***	-0.05*	-0.11***	-0.08***

	Overall	M1	M2	R1	R2	W1	W2	S1	S2	T1	T2
Panel B: Regression coefficient of CRER2 to total stock returns											
# of firms	351	170	63	9	30	6	21	47	64	21	29
$Return_{i,t}$	-0.1780**	-0.05	0.001	-0.02	-0.002	0.01	0.07	-0.20**	-0.23*	-0.25	-0.19
$Return_{i,t+1}$	-0.1105	-0.27**	-0.69***	-0.81***	-1.28***	-0.25	-0.84***	-0.21***	-0.26**	-0.38**	-0.32**
$Return_{i,t+2}$	-0.0304	0.03	-0.30	-0.66***	-1.16***	-0.002	-0.32	-0.19**	-0.16	-0.29	-0.27*
$Return_{i,t+3}$	-0.0884	0.06	-0.26	-0.42***	-0.64*	0.10	-0.08	-0.23***	-0.32***	-0.42**	-0.37***
$\alpha_{i,t}$	-0.2407***	-0.30***	-0.26	-0.03	-0.17	-0.28**	-0.49***	-0.19***	-0.26*	-0.44***	-0.34**
$\alpha_{i,t+1}$	-0.2368***	-0.28***	-0.41**	-0.19*	-0.37	-0.33***	-064***	-0.21***	-0.31**	-0.47***	-0.39**
$\alpha_{i,t+2}$	-0.2092***	-0.25***	-0.49***	-0.34***	-0.54**	-0.33***	-0.68***	-0.22***	-0.32**	-0.48***	-0.44***
$\alpha_{i,t+3}$	-0.2266***	-0.24***	-0.59***	-0.39***	-0.58**	-0.36***	-0.73***	-0.24***	-0.36***	-0.52***	-0.46***
$\beta_{i,t}$	-0.0637***	-0.03	-0.02	-0.03	0.06	0.04	-0.04	-0.06**	-0.08	-0.17**	-0.03
$\beta_{i,t+1}$	-0.0578***	-0.04	-0.04	-0.04	0.03	0.05	-0.04	-0.06**	-0.06	-0.14**	-0.01
$\beta_{i,t+2}$	-0.0480***	-0.03	0.01	0.01	0.08	0.07*	-0.01	-0.04	-0.03	-0.12*	0.01
$\beta_{i,t+3}$	-0.0353*	-0.01	0.06	0.02	0.09	0.07*	0.02	-0.02	-0.001	-0.09	0.02

3.6 Conclusion

The overall regression results confirm the assumption that higher CRE ownership holdings can generally decrease stock returns as well as systematic risks for firms listed on the German stock market. The findings are in contrast with those of e.g. Rochdi (2016), who identified a positive relationship between holdings and beta, but in line with the findings of Dong *et al.* (2012) and Du and Ma (2012). The differences could be explained by the extension of the sample including companies from the retail trade, wholsesale trade and transportation sectors. Furthermore, the reduced risk from ownership can be a result of diversification effects or special strategic importance.

The main finding of this research is that the advantageousness of real estate ownership depends on the industry. Previous studies have not taken sufficient account of this relation. For firms in the retail trade, services, transportation business segments, holding a higher proportion of owner-occupied corporate real estate assets may culminate in a worse stock market performance while also facing less systematic risks. It is suggested that these firms should carefully reallocate their CRE ownership holdings to an appropriate level. A moderate amount of CRE ownership can also be helpful to decrease the systematic risks and possibly offset the downturn in stock returns. In contrast, for firms of manufacturing and wholesale trade business segments, CRE ownership can decrease the stock returns and increase the systematic risks. This leads to the hasty assumption that renting and leasing are more efficient forms of provision and firms in these two segments should greatly decrease their CRE ownership. This is correct, but it does ignore certain challenges. The decentralised industrial structure in Germany, peripheral locations and specific design of the properties themselves reduce investors interest, as re-letting seems doubtful. It is therefore hard to reduce ownership, for example, in the production sector. However, if the sites are located in industrial agglomerations and have a less specific design, CREM should liquidate corresponding sites in order to optimize firm risk and return. In this context, it should be noted that demand for alternative investments, such as light industrial real estate, has been increasing in Europe.

The present empirical result also reveals that, whether the firm is active in one single business segment or has other additional businesses can not only affect the CRE ownership levels (CRER1 or CRER2), but also can, to some extent, affect the impact of CRE ownership on its market performance. It was found that the negative impact of CRE ownership on the firms' market performance might be decreased or offset through involvement in additional business activities. This is problematic because companies will increasingly offer integrated solutions and thus operate in additional business areas with all consequences for the provision of space. For example, automobile producers such as Daimler are adapting their business models to become mobility service providers by offering financing or car-sharing services. As a consequence, the proportion of office space in the portfolios must increase. This in turn means that ownership becomes less important, because mostly generic office space is more likely to be rented or leased. On the one hand, this means that CREM has to reconsider the composition of the portfolios with regard to ownership, rent and leasing in the light of

additional business segments. On the other hand, the results show that players in the stock market should always price the real estate holdings in accordance with the business areas in which non-property companies operate. Otherwise, inefficiencies and misallocations could arise.

The consideration of forward time lags in the regression analysis also provides interesting insights into the term with which the holding of property has an impact on the success of the company. In the short term, ownership has a negative impact on capital market performance, but this effect becomes less noticeable over time. One possible explanation is that short-term negative effects, such as reduced liquidity, may be offset by long-term benefits such as the creation of strategic advantages. CREM is therefore advised to make provisioning decisions with short and long term effects in mind.

The study also includes limitations; the results of models, in which CRER1 or CRER2 serve as an independent variable, are to some extent also found to be different. From the statistical significance perspective, CRER1 can better explain the systematic risks, while the relations between CRER2 and the stock return are clearer. This suggests that it is necessary to include more precise proxies for CRE ownership holdings in further studies. The approximation of capital market performance could also be made by extending it to Fama-French 4- and 5-factor models. In addition, future studies could examine different time lags, i.e. long-term effects of more than five years on capital market performance. An additional limitation is that the concrete proportions of the primary business or additional businesses components are unclear in the study, which implies that it would be better if following studies could investigate this issue with more detailed firms' data.

4 Corporate real estate holdings, business cycles and the firm return

Titel:	The pricing of corporate real estate holdings on the UK capital market
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Abstract

The purpose of the study is to find out if corporate real estate ownership is priced into the capital market performance of non-property companies in the UK. This is of particular interest because ownership still represents a significant weight on the balance sheets and is predominantly considered unfavourable due to its bulkiness and difficult revisability in the event of changes in space demand. This draws attention to the UK as one of the most important European economies that has been exposed to strong uncertainties and dynamics, for example, due to the BREXIT voting. A first look at the real estate assets reported in balance sheets provides insight into possible changes in ownership strategy. This serves as a basis for subdividing companies based on their real estate assets using a portfolio-based approach and that are then analysed using the Fama and French multi-factor model with regard to their influence on capital market returns. In general, the share of real estate assets has fallen over the past 10 years, although coinciding with BREXIT voting, some industries such as manufacturing show a turnaround. At the same time, ownership is priced in as a factor on the capital market, which applies to a sample across industries as well as to separately considered sectors in the manufacturing and service industries. The pricing also shows a counter cyclical pattern. Corporate Real Estate Management should be aware of the negative influence of ownership, especially against the background of economic fluctuations. The reduction of ownership can reduce the associated cost of capital and increase company success. Previous UK-related studies mostly refer to a period before the global economic crisis in 2008 and, therefore, are too old to reflect a changed view on CRE ownership due to new corporate environmental conditions, based on inaccurate proxies or mainly refer to the retail segment. This research gap is closed.

Keywords: Corporate real estate holdings, stock market performance, UK

4.1 Introduction

Numerous studies have shown that the proportion of capital tied up in real estate by non-property companies has been declining for years. Despite a partial halving of the share in recent decades (Ghent *et al.*, 2019; Seger and Pfnür, 2019), owned real estate can still amount to 10–60% of total assets depending on the sector and country (Hartmann *et al.*, 2007; Nappi-Choulet, 2002). Hartmann *et al.* (2007), for example, show that the ownership ratios of US companies are on average 25%, whereas European companies have a ratio of 55%. Depending on the industry, the ownership rates of European companies in banking, for example, are 45%, in transport and logistics 37% and in energy 80%. The high variation between countries can be explained by various factors ranging from a cultural preference for holding property, historically grown portfolios (Laposa and Charlton, 2002), corporate governance mechanisms (Du *et al.*, 2014; Dong, 2012), regional real estate market conditions (Du and Ma, 2012) and the industry composition in different economies (Brounen and Eichholtz, 2005). The industrial background of a company plays an important role as each industry attaches different strategic importance to real estate for its core business (Park and Glascock, 2010). In the manufacturing sector, for example, manufacturing real estate is more likely to be owned than the generic office spaces predominantly provided in the service sector.

A comparison of international ownership strategies shows that US companies are leading in implementing an asset-light strategy (Hartmann *et al.*, 2007; Nappi-Choulet, 2002). This can be explained by an early awareness of the high capital commitment in real estate, the ongoing professionalization of CREM (as mentioned by Joroff *et al.* (1993), from a technical taskmaster to a strategic unit) and a broader range of investment vehicles such as REITs (Laposa and Charlton, 2002). At the same time, different management attitudes also play a role. In Europe, stricter planning regulations reinforce the view that land is a scarce and, therefore, strategic resource; hence, land is more likely to be owned than in the US. European companies, such as in Germany and the UK, therefore follow this asset-light trend with a delay, but are increasingly considering leasing and rental solutions. This development is intensified by a significant structural change that on the one hand changes the requirements of space users toward a more flexible provision of space and, on the other hand, enables an increasing variety of ownership alternatives such as flexible rental solutions given by serviced, virtual or co-working space, especially in the office segment (Seger and Pfnür, 2019).

Considering the partly high share of ownership to total assets, it becomes clear that real estate ownership is likely to have an impact on companies' performance. The core argument for a negative impact is usually the high capital commitment combined with the long-term nature of the decision, which is difficult to revise in the event of economic fluctuations and, thus, increases inefficiencies (Ambrose *et al.*, 2017). In contrast, ownership ensures maximum control over the object. Compared with leasing, this means that the property can be adapted much more quickly in the event of qualitative changes in space requirements (Golan, 1999). There are also more benefits associated with ownership such as the lendability of

ownership (Gan, 2007a, b), participation in value growth (Louko, 2004), or the generation of rental income for operational non-required space (Pfnür, 2002). The question of whether the disadvantages outweigh the benefits or vice versa has been addressed by numerous articles (see Seger *et al.,* 2020 for a comprehensive literature review). The provided results are partly contradictory, which can be attributed to differences among countries. Against this background, there is a need to concentrate on individual national economies. However, current research focuses predominantly on the US or Asian countries. Specific studies of European countries are underrepresented, are based on inaccurate figures for the measurement of real estate ownership or are outdated. The example of Great Britain makes this particularly clear. Here, the most recent studies are almost two decades old, which can be considered outdated against the background of current events (economic crisis, BREXIT) and changed economic conditions (interest rate policy, structural change). Numerous studies have demonstrated that the benefits of ownership are influenced by external factors such as the competitive structure, fluctuations in demand, uncertainties, tax interventions or economic fluctuations in general. This raises the question of the extent to which past findings can be transferred to the present. Therefore, the present article first tries to answer the research questions if CRE ownership is priced in the stock returns. Thus, the article builds on older Great Britain-related contributions by authors Liow (1997), Devaney and Lizieri (2004) and Lasfer (2005), and attempts to confirm their current validity with the help of more exact ownership figures, methodology, and a current dataset. In addition, real estate ownership is often seen as inflexible to quantitative changes in space demand. It will be tested in a second step whether the pricing of ownership as a risk factor differs between economic upswings and downswings. Thus, the paper also builds on studies by Tuzel (2010) and Rochdi (2016), and attempts to demonstrate a cyclical dependence of ownership pricing for the UK.

The article shows that ownership rates have fallen steadily over the investigated period but that a countertrend has emerged in some sectors since the BREXIT vote. At the same time, real estate ownership seems to be priced as a risk factor in stock returns across industries and also in industries with contrary ownership strategies. In the course of economic upward and downward trends, a countercyclical pattern emerges in the pricing as a risk factor, which supports the thesis of real estate ownership inflexibility.

The remainder of this paper is structured as follows. After a literature review in Chapter 4.2 focusing especially on UK-related literature, a presentation of the methodology follows in Chapter 4.3. Chapter 4.4 describes the dataset followed by the multivariate analysis in Chapter 4.5. The findings are discussed and the paper concluded in Chapter 4.6.

4.2 Literature review

Discussion about the advantages of CRE ownership is almost as old as the research field of Corporate Real Estate Management in general. Although this question has been investigated in a large number of articles, it is impossible to make a general statement about positive or negative influences on company performance after reviewing the current study situation.

While the studies show a predominantly pessimistic opinion on ownership, various studies have shown the opposite effect.[10] The overall effect of CRE ownership on the company's success is just as difficult to show as it is to understand how it is created (Pfnür *et al.*, 2019). CREM influences the company success directly by the provision of real estate ownership and the related costs, income by letting non-necessary space or increases in property value. At the same time, the choice of ownership solutions is accompanied by considerable consequences for corporate finance, which in turn can impact overall success. Reduced liquidity, capital adjustment costs, tax aspects, effects on the capital structure, the possibility to collateralise and risk premiums in financing are all factors that play an important role. From the users' perspective, ownership enables the securing of space within the company's boundaries that is necessary to generate competitive advantage. At the same time, holding real estate leads to certain inflexibility due to its often high specificity and, hence, diminished opportunities for disposal when companies face changing quantitative demand for space. Some authors follow this flexibility argumentation and show a connection between the advantages of ownership and changes in the business environment represented by productivity fluctuations, productivity uncertainty, economic changes or demand dynamics (Ambrose *et al.*, 2017; Zhao and Sing, 2016; Tuzel, 2010). Beyond the flexibility issue, results indicate that tax legislation, the general competitive situation or even conditions in the real estate market may affect the importance of ownership (Dong, 2012; Diop, 2017; Fougère *et al.*, 2019; Zhao and Sing, 2016). More recently, the own vs lease debate has gained momentum due to new IFRS16 regulations under which leases are accounted as liabilities and can, thus, have a negative impact on a company's capital structure. Ownership could gain in attractiveness compared with long-term leases (Baltussen *et al.,* 2014), which underlines the importance of the underlying accounting standard. At the same time, the question of ownership or leasing is influenced by local real estate markets insofar as the demanded space is not always offered for rent or purchase. This again illustrates the complexity and also partly provides an explanation why studies have come to partly contradictory results. These contradictory results not only exist among countries but are also apparent when studies on a single national economy are considered, such as for the UK. Table 10 provides a corresponding overview of the research situation in the UK, summarising all studies that examine the influence of real estate ownership on capital market performance. A review of the studies that examine capital market reactions as a result of property-reducing activities such as sale-and-lease-back transactions illustrates the partly contradictory results. While Adams and Clarke (1996) show a negative reaction on the capital market, Devaney and Lizieri (2004) cannot identify any change in the development of returns. In contrast, Liow (1997) and Grönlund *et al.* (2008) show a positive correlation. Reasons for the deviations between the studies can be manifold. For example, industrial differences in the data samples may lead to inaccuracies. Equally problematic is the choice between different accounting methods. For example, accounting by book value only represents the actual market value when the property is purchased.

[10] Comprehensive literature reviews of the partly contradictory study results are provided by Sirmans and Rodriguez (1996) and for current studies, Seger et al. (2020).

Thereafter, the market value is represented to a limited extent, which can lead to incorrect interpretations. In the context of event studies, it is also questionable whether the examined disposals are even sufficiently high in relation to the overall market value of a company to be reflected in capital market performance. At the same time, there is also the possibility that the capital market does not price the reduction in ownership itself, but interprets it as a signal of possible illiquidity. The resulting effects on company performance may have contributed to the inaccuracy of past event studies.

Recent studies follow less the research design of an event study; rather, they try to show the relationship of real estate holdings from the balance sheet with performance indicators over time. However, an explicit discussion with the UK has not taken place. Although companies from UK are examined, they only form part of an international sample. In contrast, Lasfer (2005) takes an exclusive look at the UK. Here, however, it is not the influence of ownership but rather the leasing intensity on company performance that is the focus of the study. At the same time, it is noticeable that the majority of the UK studies concentrate on the retail segment although other sectors, such as the non-financial service sector, are more relevant. Manufacturing is almost as important as the retail sector in terms of GDP (gross domestic product). A special focus on the services and manufacturing sectors, therefore, seems to make sense. This sector selection also provides insight into whether the capital market valuation differs between the selected sectors. For example, real estate in the manufacturing sector is afforded higher strategic relevance due to its more company-specific design and stronger link to the business model than in the service sector with predominantly office space. The following empirical study aims to prove that ownership is generally priced as a separate factor on the capital market across all industries and especially in the service and manufacturing sectors. The focus on the two sectors mentioned above represents a first extension of the existing literature. Additionally, it will be examined if the pricing of ownership depends on economic ups and downs. Such differentiated consideration of the pricing during business cycles has not yet been explicitly carried out for the UK. Ultimately, the choice of study period, data selection and methodology also represents an extension of previous studies. For example, the most recent studies on the UK are more than ten years old, refer to periods before the global economic crisis in 2007, partly rely on inaccurate ownership figures and have small samples. The Fama and French multi-factor model provides even more accurate results.

Table 10: Overview of UK-related empirical research

Author (Year)	Period	Sectors	Sample Size	Performance Measure	Results
Event studies in the context of CRE acquisitions, disposals and sale-and-lease-back transactions					
Adams and Clarke (1996)	1982-1991	-	26	Capital market return	• Sale-and-lease-back transactions are associated with average negative returns • Stock market interprets sale-and-lease-back transactions as a signal for weak cash flows
Liow (1997)	1982-1991	Retail	181	Capital market return	• There are no abnormal returns after CRE acquisitions • Positive abnormal returns can be measured in the course of disposals, which are higher in the case of direct disposals than when they are sold as part of a business unit or subsidiary • Sale-and-lease-back transactions are also associated with average positive returns
Louko (2004)	1998-2002	Retail Telecommunication	European sample of 22 transactions (including firms of UK)	Return on total assets Equity ratio Current ratio Dividend per share Turnover growth	• Improved profitability and liquidity after disposals exceeding 10% of firms' total assets • Half of the companies were also able to increase return on assets, capital structure or even dividend payouts
Devaney and Lizieri (2004)	1997–2003	Telecommunication Retail Bank Oil	8 deals	Capital market return	• No evidence for a common impact of CRE outsourcing transactions and capital market performance
Grönlund *et al.* (2008)	1998-2003	Telecommunication Retail Government	European sample of 130 transactions (including 67 announcements of firms listed in UK)	Capital market return	• Sale-and-lease-back transactions are associated with average positive returns

Author (Year)	Period	Sectors	Sample Size	Performance Measure	Results
Studies focusing on CRE holdings and its influence on firm performance (not event-related)					
Brounen and Eichholtz (2005)	1992, 1995, 1998, 2000	Agriculture, Mining, Food and tobacco, Textile, Publishing, Chemicals, Petroleum, Electronics, Transportation, Communication, Utilities, Restaurants, Food-stores, Hotels, Personal services, Business services, Healthcare business, Business advisory	International sample of 4.636 firms (including firms from UK)	Capital market return Jensen Alpha Systematic risk	• A negative influence of real estate holdings on systematic risk can be identified for a wide range of industries • For communication and business service sectors there is a significant negative relationship between real estate ownership and risk-adjusted stock performance
Brounen et al. (2005)	1993-2002	Retail	International sample of 454 firms (including a subsample of European firms)	Capital market return Jensen Alpha Systematic risk	• Significant negative correlation between ownership and systematic risk • Significant positive correlation between ownership and risk-adjusted return
Lasfer (2005)	1989-2002	Resources, IT, Basic Industries, General industrials, Cyclical and non-cyclical consumer goods, Cyclical and non-cyclical services, Utilities	2,343 firms	Capital market return	• Firms should aim for an optimal leasing level of 65% to maximise the return for shareholders
Yu und Liow (2009)	2001-2006	Retail	556 firms (including 43 UK firms)	Capital market return Total risk Systematic risk Sharpe Index Jensen Alpha	• For retail companies, there is a positive correlation between property ownership and the performance indicators return, total risk, systematic risk, Jensen Alpha and the Sharpe Index.
Liow (2010)	2001-2006	Retail	556 firms (including 43 firms from UK)	Capital market return Systematic risk	• Retail firms' CRER ownership is a priced factor in the stock market • Positive and significant relation between CRER ownership and the systematic risks beta in some retail subsegments

4.3 Methodology

To analyse the relationship between CRE and stock market returns in Great Britain, the selected companies are divided into three (terzil) portfolios according to their calculated CRER levels. The strategy to divide these companies into three CRER terzil-based portfolios is chosen due to the high number of companies with a CRER of 0%, which does not allow for a larger number of, e.g. CRER quartile-based portfolios with a sufficiently large sample size. Based on the CRER level in December of year *t*-1, the portfolio composition is determined in June of year *t* and maintained for one year. This six-month interval gives the investors enough time to consider the published accounting data in their investment strategy.

As a next step, the extent to which the standard Fama and French three-factor model is able to explain stock market variations along the time series from 2007 to 2017 is examined. Based on this three-factor model, the following least squares time-series regressions for each of the test portfolios are performed:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \cdot MRP_t + s_i \cdot SMB_t + h_i \cdot HML_t + \varepsilon_{i,t} \qquad \text{for } i = 1, 2, 3 \text{ and } t = 1, 2, ..., 120$$

where:

$R_{i,t}$	Return of portfolio i in month t
$R_{f,t}$	Risk-free rate in month t
MRP_t	"Market Risk Premium" / excess return of market portfolio in month t
SMB_t	"Small Minus Big" / return difference between companies with low and high market capitalisation in month t
HML_t	"High Minus Low" / return difference between companies with high and low book-to-market-ratio in month t
α_i β_i s_i h_i	Estimated factor loadings on portfolio i
$\varepsilon_{i,t}$	Error term of portfolio i in month t

In order to explore the influence of CRE on a company's stock return, a further factor that reflects real estate intensity is added to the three-factor model. This CRER factor is calculated according to Rochdi (2016) using a three-sequential sorting procedure. The companies are subdivided into 18 portfolios to represent different levels of size (split: 50:50 | S1, S2), book-to-market-ratio (split: 30:40:30 | B1, B2, B3) and CRER (split: 30:40:30 | CRER1, CRER2, CRER3). Analogous to the classification of the test portfolios, the portfolios are formed in June of year t on the basis of the data available in December of the previous year t-1 and maintained for one year. Using the equally weighted monthly return for each of the 18 portfolios, the CRER factor is calculated as follows:

$$\mathrm{CRER} = \frac{1}{6} \cdot \big((\mathrm{S1/B1/CRER3} - \mathrm{S1/B1/CRER1}) + (\mathrm{S1/B2/CRER3} - \mathrm{S1/B2/CRER1}) + (\mathrm{S1/B3/CRER3} - \mathrm{S1/B3/CRER1}) + (\mathrm{S2/B1/CRER3} - \mathrm{S2/B1/CRER1}) + (\mathrm{S2/B2/CRER3} - \mathrm{S2/B2/CRER1}) + (\mathrm{S2/B3/CRER3} - \mathrm{S2/B3/CRER1})\big)$$

where:

CRER	CRER factor
$S1, S2$	sorting by level of size (split 50:50)
B1, B2, B3	sorting by level of book-to-market ratio (split 30:40:30)
CRER1, CRER2, CRER 3	sorting by level of CRER ratio (split 30:40:30)

The CRER factor thus results from the equally weighted differences among the six portfolios with the highest CRER (CRER3) and the six portfolios with the lowest CRER (CRER1) while the influence of the risk factors size and book-to-market-ratio is kept constant. This ensures that the CRER factor is neither dependent on the size effect nor on the book-to-market-ratio effect.

The extended Fama and French model can be represented by the following equation:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \cdot MRP_t + s_i \cdot SMB_t + h_i \cdot HML_t + c_i \cdot CRER_t + \varepsilon_{i,t}$$

for $i = 1, 2, 3$ and $t = 1, 2, \ldots, 120$

where:

$R_{i,t}$	Return of portfolio i in month t
$R_{f,t}$	Risk-free rate in month t
MRP_t	"Market Risk Premium" / excess return of market portfolio in month t
SMB_t	"Small Minus Big" / return difference between companies with low and high market capitalisation in month t
HML_t	"High Minus Low" / return difference between companies with high and low book-to-market-ratio in month t
$CRER_t$	Return difference between companies with high and low CRER in month t
α_i β_i s_i h_i c_i	Estimated factor loading on portfolio i
$\varepsilon_{i,t}$	Error term of portfolio i in month t

In order to check for multicollinearity, the Variance Inflation Factors (VIF) of Belsley *et al.* (2005) are calculated for each regressor, measuring the share of increased variance of an estimated regression coefficient that can be associated with collinearity. In line with several recent studies, the Gibbons Ross Shanken (GRS) F-Test is used to compare and assess the specification of the two applied models. The GRS F-test verifies the null hypothesis that the intercepts of the test portfolios are jointly equal to zero (Gibbons *et al.*, 1989).

4.4 Data description

The initial sample includes balance sheet and capital market data of non-property companies listed on the British stock exchange. Both were collected from the Thomson Reuters Datastream database. The sample covers the period between Q4 2006 and Q2 2017. The period choice has several reasons. As Table I shows, Great Britain (GB) was only investigated until 2006. Since then, no further investigations have taken place; hence, this research gap has to be closed. At the same time, the chosen period of investigation allows long-term insight and offers a sufficiently large sample. The industry differentiation is based on the usual Standard Industrial Classification Code (SIC code).

The company's ownership intensity *(CRER)* serves as a central parameter for the analysis. In the past, numerous different proxies were used for this purpose. Particularly in the above-mentioned Great Britain-related literature, the balance sheet ratio *Property, Plant & Equipment (PPE) in relation to the total assets* of a company was frequently used. This may be practicable for industries such as retail due to their low plant and equipment position. However, this computation is likely to lead to inaccuracies in industries with a high proportion of plant and equipment such as manufacturing. Instead of the inaccurate aggregated balance sheet item PPE, its balance sheet sub-items "*Land*" and "*Building*" minus the corresponding accumulated depreciation (AD) should be included and, according to Rochdi (2016), set in relation to the total assets *(TA)* of a company:

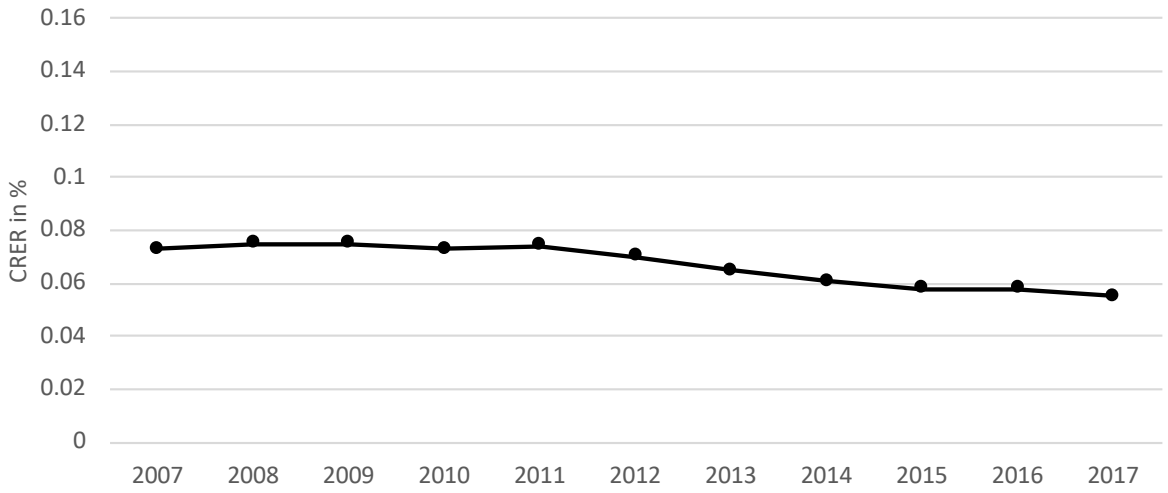
$$CRER_{i,t} = \frac{(Land_{i,t} + Buildings_{i,t}) - (AD\ Land_{i,t} + AD\ Buildings_{i,t})}{TA_{i,t}}$$

In addition, data are collected to determine market capitalisation ("Share Price" x "Number of Shares"), the book value of equity ("Common Equity") and the monthly share price for the selected analysis period. The systematic risk factors *market (MRP), size (SMB)* and *book-to-market-ratio (HML),* applied later, are derived from the continued database of Gregory *et al.* (2013) in cooperation with the University of Exeter. The applied risk-free rate is the monthly return on three-month Treasury Bills while the market portfolio is represented by the FTSE All Share Index. If any observation on the mentioned indicators was missing, the corresponding company was removed from the sample. The initial data set of 1,491 companies yielded a final sample size of 599 companies.

A first descriptive observation of the average CRER across all industries shows a decreasing trend (Figure 1). This is consistent with the observations of Seger *et al.* (2020) for Europe and with studies conducted on the US market (e.g. Ghent *et al.*, 2019; Diop, 2017). The reasons for this can be manifold. For example, the decreasing share of ownership can be partly explained by a growing awareness about the capital commitment associated with ownership. The idea of investing capital in more profitable core businesses has become popular. At the same time, non-property companies are receiving increasing interest from the capital

market in the event of sales efforts. Asset classes such as 'light industrial real estate', which have received less attention in the past, are now attracting more investors. Studies have also shown the influence of external factors, such as structural change, fluctuations in demand, the intensity of competition or uncertainties, on real estate holdings (e.g. Seger and Pfnür, 2021).

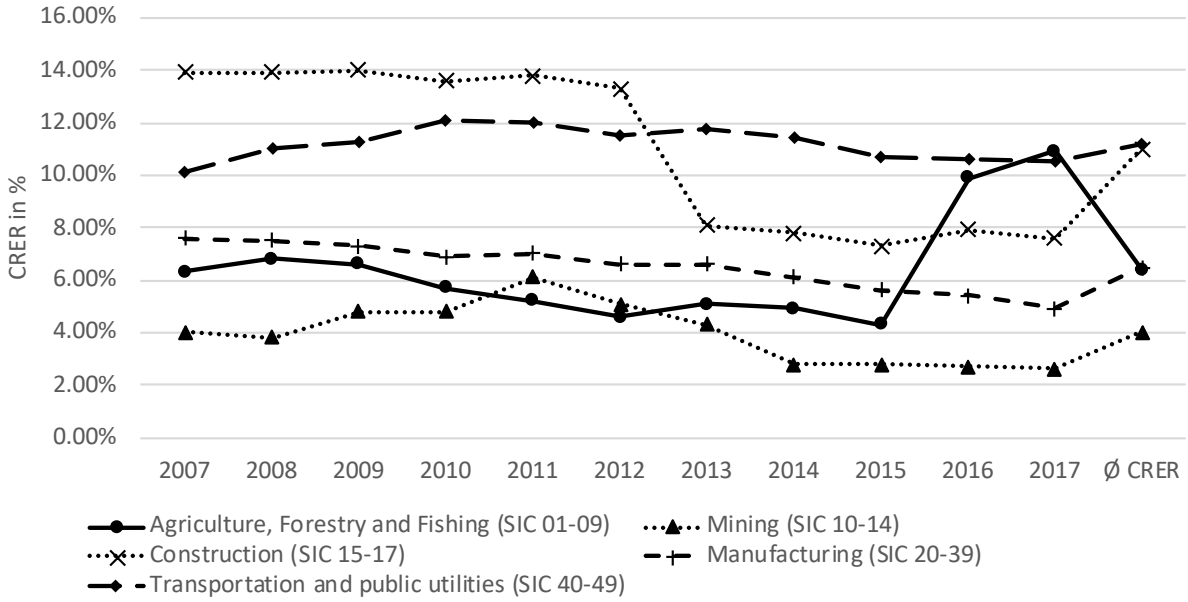
Figure 15: Average ownership ratios across all industries of listed companies in the UK



Note: All industries with codes SIC 01–SIC 89, excluding real estate industry

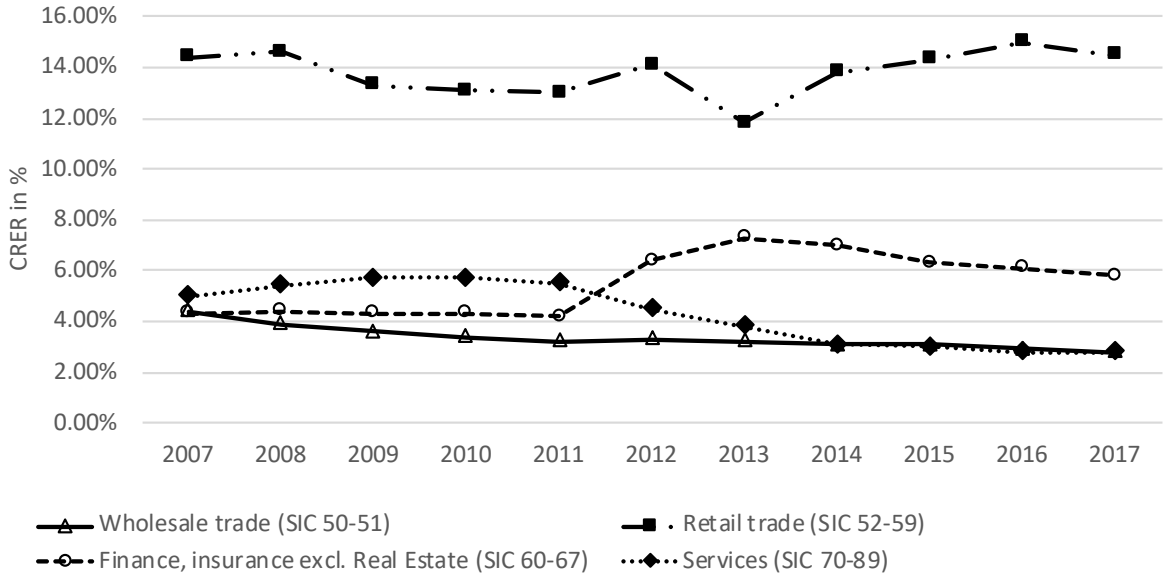
However, a differentiated analysis by sector (see Figures 17 and 18) shows that a decreasing trend in ownership does not apply equally to all sectors. Especially in the retail segment, with its comparatively high ownership shares, the level remains stable. One reason for this might be the strategic importance of space for the core business, which implies the company's tendency of preferring ownership solutions to alternative types of provision. In the wholesale and service sectors, ownership shares are steadily declining. The decline in the service sector in particular can be explained by the fact that office space is mostly generic and can be rented due to the well-developed rental market. Furthermore, a turnaround in ownership strategy has been evident in some sectors since 2016. This may have been triggered by the BREXIT decision, which may have induced non-property companies to increasingly hold property as collateral. Since 2016, the ownership share has been rising in sectors such as construction, mining and manufacturing, although the initial level observed in 2007 has not yet been reached.

Figure 16: Average ownership ratio CRER by industry



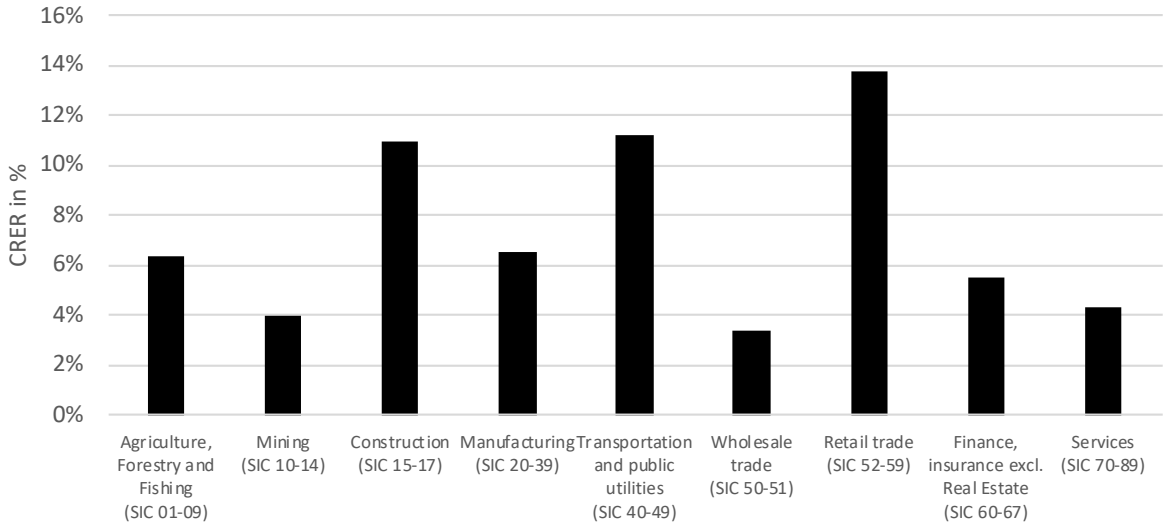
Note: All industries with codes SIC 01–SIC 39

Figure 17: Average ownership ratio CRER by industry



Note: All industries with codes SIC 50–SIC 89, excluding real estate industry

Figure 18: Average ownership ratio CRER by industry



Note: All industries with codes SIC 50–SIC 89, excluding real estate industry

The average number of companies allocated to the first portfolio counts 268 while the second and the third portfolios contain 131 and 200 companies, respectively. Table II summarises the most important capital market and balance sheet data for the three portfolios:

Table 11: Stock market and balance sheet data for the three test portfolios

Portfolio	CRER	Ø Number of shares (in millions)	Ø Market capitalisation (in € million)	Ø Book-to-market-ratio	Ø CRER (in %)	Ø Return (in %)
CRER I	low CRER	1,505.86	1,767.01	1.23	0.33	0.93
CRER II	medium CRER	1,056.51	4,577.55	1.06	2.08	0.78
CRER III	high CRER	383.64	2,397.62	0.98	18.40	0.83

Companies with a low CRER own a comparatively high number of shares while the number of shares decreases with increasing real estate intensity. The same applies to the average book-to-market-ratio, which drops from 1.23 for companies with a low CRER to 0.98 for companies with a high CRER. Companies with a high market capitalisation tend to have medium real estate intensity, whereas companies with low market capitalisation generally have low CRERs. The average CRER increases by definition within the three portfolios. The first and second portfolios have an average CRER of 0.33% and 2.08%, respectively, while in the third portfolio the average CRER rose significantly to 18.40%. The monthly average return shows a slightly falling trend of 0.93% for companies with a low CRER of 0.83% for companies with a high CRER and a low of 0.78% for companies with a medium CRER. An overview of the characteristics of the risk factors applied in the regression analysis is shown Table III.

Table 12: Characteristics of the explanatory variables

	MRP	SMB	HML	CRER
Mean	0.0043	0.0004	-0.0035	0.0002
Median	0.0089	0.0025	-0.0025	0.0014
Maximum	0.0990	0.1561	0.0901	0.1097
Minimum	-0.1361	-0.1478	-0.0701	-0.1249
Standard deviation	0.0409	0.0359	0.0253	0.0325
Skewness	-0.5624	-0.2971	0.3715	-0.2445
Kurtosis	0.9245	4.6106	1.7132	2.0741

From 2007 to 2017, the UK market had a positive market and size effect, suggesting that on average higher returns are achieved if the overall market portfolio develops positively. In particular, companies with lower market capitalisation achieve higher returns. Conversely, the HML factor predicts lower returns for companies with a high book-to-market-ratio. The UK market, therefore, does not follow the behaviour predicted by Fama and French regarding the HML factor. The CRER factor has a positive effect, suggesting that companies with higher CRERs achieve higher returns. Table IV shows the correlation between the systematic risk factors and the computed CRER factor.

Table 13: Correlation coefficients of the explanatory variables

	MRP	SMB	HML	CRER
MRP	1.00	-	-	-
SMB	0.08	1.00	-	-
HML	0.53	0.17	1.00	-
CRER	-0.04	-0.02	-0.13	1.00

The correlation coefficients range from −0.02 between the factors SMB and CRER to 0.53 between the factors MRP and HML. The table shows that the CRER factor has a slightly negative correlation between −0.02 and −0.13 with all other factors.

In order to test whether the explanatory variables are subject to multicollinearity, a distinct test according to Belsley *et al.* (2005) is applied. Given values between 1.01 and 1.39, the VIFs are well below the critical thresholds of 10 or 5. Consequently, there is no evidence of multicollinearity or dependence between the explanatory factors.

This first assessment within the descriptive statistics indicates a slightly negative relationship between CRER and average returns (see Table I), suggesting that CRE could be a priced determinant in the return of non-property companies. This forms the basis for further research using a time-series analysis.

4.5 Empirical results

In a first step, the time-series regression applying the three-factor model of Fama and French was conducted without considering the CRER risk factor. This step aims to determine whether the Fama and French model is suitable for the UK stock market. A subsequent GRS test aims to show whether there may be other risk factors (e.g. the CRER factor) that would increase the explanatory power of the model. Table V shows the results of the time-series regression and corresponding coefficients.

Table 14: Time-series regression results of the Fama and French three-factor model

	CRER I	CRER II	CRER III
Intercept	0.007** (2.20)	0.003** (2.00)	0.004*** (2.65)
MRP	0.634*** (6.95)	0.832*** (17.23)	0.829*** (19.57)
SMB	0.725*** (8.12)	0.571*** (12.10)	0.624*** (15.04)
HML	0.522*** (3.50)	0.120 (1.52)	0.148** (2.15)
Observations	120	120	120
F-Statistic	70.06	216.94	300.05
Adjusted R^2	0.64	0.84	0.88
GRS	2.81		
p(GRS)	0.04		

Note: Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The systematic risk factors (except for HML) show a consistently high significant influence on the excess return of the portfolios. The influence of the HML factor fluctuates strongly between an insignificant and a strongly significant effect on the return. The factor loadings of the respective risk factors vary between the three portfolios formed, with the smallest and largest coefficients belonging to the portfolio with medium real estate intensity. It should also be noted that all regression coefficients have positive values. The Adjusted R^2 values are comparatively high and range from 0.64 to 0.88. In contrast, the GRS test points to 5% significance of all intercepts, rejecting the null hypothesis that all intercepts are equal to zero. All in all, the results confirm the applicability of the Fama and French three-factor model to the British stock market. However, the results of the GRS test indicate that there may be another risk factor that would improve the explanatory power of the model. For this reason, a time-series regression based on the four-factor model extended by the CRER factor is conducted (see Table VI).

Table 15: Time-series regression results of the model extended by the CRER factor

	CRER I	CRER II	CRER III
Intercept	0.007*** (2.71)	0.003** (2.01)	0.004*** (2.70)
MRP	0.655*** (9.31)	0.836*** (17.78)	0.827*** (19.65)
SMB	0.728*** (10.58)	0.572*** (12.44)	0.623*** (15.15)
HML	0.391*** (3.38)	0.093 (1.21)	0.163** (2.36)
CRER	-0.681*** (-8.99)	-0.138*** (-2.73)	0.075* (1.66)
Observations	120	120	120
F-Statistic	108.86	173.61	229.12
Adjusted R^2	0.78	0.85	0.88
GRS	3.00		
p(GRS)	0.03		

Note: Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

There is a consistently significant impact of the CRER factor on stock market returns at 1% and 10% significance. In addition, the CRER coefficients follow a regular pattern. Contrary to the initial assessment within the descriptive statistics, the CRER coefficient increases with higher property intensities. Non-property companies with a small share of CRE holdings (CRER I) thus appear to have an average significant risk discount of −0.20% per annum (−0.02% per month). On the other hand, non-property companies with a large real estate intensity (CRER III) have a low risk premium; however, this has no visible impact on the return on average due to the very small regression coefficient. The significance of the other systematic risk factors remains unchanged compared with the three-factor model previously examined. However, the GRS test rejects the null hypothesis that all intercepts are jointly equal to zero. With regard to the explanatory power, the inclusion of the CRER factor increases the adjusted R^2 for all portfolios by an average of 8.2%. Therefore, CRE holdings indeed serve as a priced determinant in the UK stock market.

In order to determine the impact of CRE in certain industries, all sectors with a dataset of more than 60 companies in manufacturing and services are examined further. In the median (low) portfolios, CRE holdings cause a risk discount of −0.17% pa (−0.01% per month) and −0.14% pa (−0.01% per month). The median (high) portfolios again show a slightly positive but insignificant risk premium, with no visible impact on the return (see Table VII). In conclusion, CRE holdings are an important priced determinant in the UK stock market, irrespective of the industry in which a company operates.

Table 16: Time-series regression results of sector portfolios

	Manufacturing (SIC: 2.000-3.900)		Services (SIC: 7.000-8.900)	
	Median (Low)	**Median (High)**	**Median (Low)**	**Median (High)**
Intercept	0.007** (2.40)	0.005*** (2.91)	0.006** (2.10)	0.003* (1.69)
MRP	0.741*** (9.20)	0.875*** (19.76)	0.699*** (8.17)	0.836*** (16.42)
SMB	0.703*** (8.92)	0.633*** (14.62)	0.767*** (9.17)	0.616*** (12.37)
HML	0.298** (2.25)	0.118 (1.62)	0.573*** (4.07)	0.192** (2.30)
CRER	-0.575*** (-6.62)	0.025 (0.52)	-0.474*** (-5.15)	-0.005 (-0.10)
Observations	120	120	120	120
F-Statistic	79.69	218.95	80.42	161.43
Adjusted R^2	0.73	0.88	0.73	0.84

Note: Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

During phases of economic downturns, investors may value stocks of non-property companies and their respective CRE holdings differently (see Table VIII). The analysis is based on the approach of Pettengill *et al.* (1995), which divides the sample into rising and falling markets on a monthly basis as identified by positive and negative market risk premiums. Overall, rising markets were observed in 67 months and falling markets in 53 months.

Table 17: CRER factor and monthly return impact of CRE in rising and falling markets

	Number	CRER Factor	CRER I	CRER II	CRER III	Mean
Total	120	0.0002	-0.02%	0.00%	0.00%	-0.01%
Rising markets	67	0.0036	-0.24%	-0.05%	0.03%	-0.09%
Falling markets	53	-0.0040	0.27%	0.05%	-0.03%	0.10%

The average CRER factor yields a value of 0.0036 for rising markets and a value of −0.0040 for falling markets. Applied to the three (terzil) portfolios formed, this means that companies with a low real estate intensity (CRER I) achieve a return reduced by −0.24% per month in rising markets while falling markets generate an additional return of 0.27% per month. For companies with medium property intensity (CRER II), this effect weakens, whereas companies with high property intensity (CRER III) experience a low risk premium in rising markets and a low risk discount in falling markets. On average, CRE has a negative impact on a company's return in rising markets and a positive impact in falling markets, indicating that the CRER factor might be an countercyclical risk factor.

4.6 Discussion

An analysis of CRE holdings during the observation period confirms the assumption that the share of real estate ownership has fallen across all sectors between 2007 and 2017. These observations are in line with international studies (Seger *et al.*, 2020). However, a closer examination of individual sectors over the last few years shows that a turnaround has begun in some cases and British companies are once again increasingly holding real estate in their balance sheets. Only speculation can be made about the reason for this. However, the turning point in 2016/2017 coincides exactly with the BREXIT voting, which may have increased uncertainty about future developments. Although other articles found a negative correlation between uncertainty and ownership, an opposite effect is also imaginable. This could be explained by the not yet defined trade regulations and the isolation from the European domestic market. As a consequence, space could again become more scarce and, according to the resourced-based view, more strategic. It would also be conceivable that companies hold property as a backup due to the continuing uncertainty. This could be capitalised, let or collateralised in the event of liquidity bottlenecks. Another possible explanation could be that companies took advantage of stagnating commercial real estate prices during this period to acquire space at lower prices.

Contrary to this positive preference on ownership by non-property companies, the capital market prices it negatively. This is evident across the entire sample as well as in the two selected manufacturing and service sectors. These results are, thus, in line with those of Rochdi (2016) for Germany. The results for the service sector are not surprising. Here, the office space commonly used in service sector is mostly of a generic nature and can be provided more efficiently through rental or leasing solutions. Decreasing ownership rates and the negative valuation as a risk factor of CRE holdings in the service sector indicate a continuing increase of the market volume on the capital market for office property. Although the capital market valuation in the manufacturing sector is also negative, it is contradictory to the recently increasing share of ownership. It could be possible that manufacturing companies are accepting risk premiums in connection with holding property in order to secure this as a strategic resource in uncertain BREXIT times in the short to medium term. Investors in the 'light industrial real estate' market should be aware of this and consider a possible decrease in demand for rental and leasing solutions. Although the observations are similar to those for Germany (Rochdi, 2016), they differ particularly with regard to the rising ownership ratios in the manufacturing sector.

At the same time, the second research question can be answered that capital market valuation varies for different economic phases. In particular, an anti-cyclical pattern can be identified; accordingly, the risk premium is higher in phases of economic downturn than during an upswing. The reason for this is probably the lack of owner's flexibility if property is difficult to sell when it is no longer in use and can only be sold at a discount. This insight makes clear that the benefits of ownership ultimately depend on the firm's external conditions and that the ownership strategy should be regularly adapted to these. This result should

encourage CREM managers of property-intensive companies operating in turbulent markets to critically reflect on ownership. In this context the aim of management must be to provide a portfolio that is able to "breathe" continuously, with a balanced mix of core (owned) and non-core (leased) properties. If the portfolio does not meet the current and future requirements of a dynamic business environment, then CREM has two options to adjust the share of ownership. In the case of new space demand, it can either choose between the provision alternatives (own vs lease) or, in the case of occupied space, opt for an exit strategy like a direct disinvestment, sale-and-lease-back transactions, redevelopment or ending the lease. Although this study has demonstrated the vulnerability of CRE ownership to market fluctuations, increasing or reducing the share of CRE ownership only from a flexibility perspective would come too short. Rather, the provisioning decision should be made holistically, also against the background of space control or corporate financial implications. Nevertheless, the results show that real estate ownership and its impact on corporate flexibility and success should be an important argument in weighing provisioning alternatives.

4.7 Conclusion

The highly dynamic nature of the corporate environment and the resulting uncertainty for companies conflicts with the long-term nature and high capital commitment of ownership. It is, therefore, questionable whether the capital market will reward real estate ownership in these turbulent times. Previous studies provide only a fragmented picture and the respective capital market valuations differ significantly among countries (Brounen, 2005). Particularly when looking at the study situation in the UK, it is noticeable that there are already articles on this topic. However, the studies refer to periods before the global economic crisis in 2007, partly rely on inaccurate ownership figures, have small samples and focus on the retail segment. This illustrates the necessity to take a closer look at the ownership strategy of non-property companies and its valuation by the capital market in the UK. The analyses conducted close this gap and provide a new, more detailed insight into the importance of ownership in the UK; for example, ownership rates in recent years reveal a turnaround. The previously continuously decreasing ownership rate of companies has been rising again in some sectors since 2016. The background for this could be the BREXIT vote, which falls exactly on this period. Companies might be tempted to keep their property as a kind of backup for uncertain times in order to capitalise on it in times of distress. The results also show that CRE ownership is priced in as a risk factor. This applies to the cross-industry sample as well as to the service and manufacturing sectors, which have been analysed in detail. The further decline in ownership intensity in the service sector and the negative pricing of ownership indicate possible opportunities for investors in the office segment. For the manufacturing sector, this conclusion can only be applied to a limited extent. Here, the negative pricing of ownership is opposed to increasing ownership rates. This development could dampen the recently steadily growing light industrial market volume. The results also illustrate that the capital market valuation of ownership depends not only on the sector to which it belongs but also on external influences. A differentiated analysis according to economic

phases shows that ownership is valued with a risk premium during a downturn, whereas the opposite effect is seen during an upswing. This counter cyclical pattern should be taken into account in the CREM's ownership decision as well as in the portfolio structure on the investor side.

The study also includes limitations. As almost all studies with the same or similar research questions, the analyses are based on the companies' real estate balance sheet assets and not the actual market value due to different valuation approaches. At the same time, the article does not answer the sudden increase in real estate owned by some industries in recent years. In this case, it can only be assumed that this might have something to do with the BREXIT vote. This could be the starting point for future research in order to investigate the above-mentioned connection more closely or to find an alternative explanation for it. Also of interest for further studies would be considering longer bull and bear market phases for pricing of ownership during cycles rather than using ups and downs on a monthly basis.

5 Corporate real estate ownership, business uncertainty and the firm return

Titel:	Corporate real estate ownership and its contribution to firm performance under business uncertainty: Empirical evidence from European non-property companies
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Published in:	Review of managerial science, under review.

Abstract

Structural and dynamic changes, intensified by the current pandemic situation, confront companies with high levels of uncertainty. This becomes a challenge especially when decisions have to be made about resources that are critical to success and difficult to revise, such as ownership of corporate real estate. This article examines how uncertainty affects the holding of specific property and whether corporate real estate ownership has a positive or negative impact on firm performance under consideration of business uncertainty. Two studies have been conducted. In the first study, multivariate cross-sectional regression analysis is used to test the link between specificity and corporate real estate (CRE) ownership under business uncertainty. Balance sheet data of non-property companies of the six biggest European economies is used. For the second study, the sample was expanded to all companies listed in Europe and their capital market data to investigate the influence of the corporate real estate ownership on firm performance under uncertainty. The empirical results show a positive link between specificity and CRE ownership. Additionally, companies seem to adjust their investment behaviour in specific properties under uncertainty by avoiding or postponing investments or even writing-off specific real estate assets due to their transfer to a new use. Furthermore, the results show that the excess returns decrease in the medium term as CRE ownership under uncertainty increases. Our findings also indicate that regardless of the uncertainty situation, CRE ownership reduces the systematic risk. Thus, ownership seems to have a diversifying effect. This paper expands the scientific discourse by explicitly linking real estate specificity with the choice between ownership, leasing or rental solutions and firm performance. The article clarifies that in order to avoid inefficiencies, the irreversibility of specific real estates should be considered in the CRE ownership decision especially by firms operating in a structurally changing business environment.

Keywords: Corporate real estate ownership, corporate real estate management, European real estate ownership, business uncertainty, corporate real estate and financing

5.1 Introduction

Corporates are increasingly facing structural and dynamic changes in their business environment (Buliga *et al.,* 2016; Mühlroth and Grottke, 2018). These dynamics are further intensified by the current COVID pandemic situation, which firmly confronts companies with a higher uncertainty (Sharma *et al.*, 2020). As a reaction to growing business uncertainty, in all industries strategic responses from companies are required, especially the adaptation of capabilities and resources to dynamic capabilities and resources (Teece *et al.,* 2016; Randhawa *et al.,* 2020). Successful management of the current changes and uncertainties requires a special focus on resources critical to success and difficult to adjust.

This directs the attention to corporate real estate (CRE) as an immobile company resource, which comprises approximately 5–15% of total company costs (Pfnür, 2011). As a result, real estate is both crucial for the overall success of the company and a comparatively expensive resource in terms of adaptation due to the high proportion of tied-up capital (Louko, 2004; Liow and Nappi-Choulet, 2008; Rochdi, 2015). In addition, as an immobile resource, it can be an obstacle to the strategic flexibility of companies. In addition, real estate as a physical environment is crucial for the work carried out therein. If work and working methods change, then this results in high pressure on CRE portfolios to align to new user demands. Pfnür (2019) shows that due to new work on account of the structural change, German corporates expect to align approximately 50% of their portfolios to new user demands in the next 10 years. This increases the need to evaluate CRE portfolios and their provision against the background of growing business uncertainty, which can be seen as one central challenge alongside megatrends in the real estate industry (Pfnür and Wagner, 2020).

In Europe, approximately 60% of CRE portfolios are owned. This is a particularly high share compared to US and Asian companies with only 30% and 20%, respectively. If the high proportion of tied up real estate assets is used inefficiently, then negative effects on the firm success are the consequence (Tuzel, 2010). Accordingly, it should be scrutinised to what extent a high share of ownership conflicts with rising uncertainty. Recent studies have shown that especially uncertainties originating from the market of the core business influence the ownership strategy and its contribution to firm success. The argument most frequently given in this context is that the ownership decision is long-term and difficult to revise (Tuzel, 2010; Ambrose *et al.,* 2017). Accordingly, the investment decision should be well-considered, especially under uncertainty. The difficulty in revising ownership directs attention to the characteristics of the real estate resource. Owned CRE are company-specific and highly linked to the current use. A change of use is usually costly and resale is only possible with discounts (Gier, 2006; Hartmann *et al.*, 2007; Pfnür and Weiland, 2010). The share of specific properties in CRE portfolios is roughly estimated at about one-third (Roulac, 2003), which only gives an idea of the risk under rising business uncertainty.

In its overarching research question, this article aims to investigate the influence of ownership on firm performance under business uncertainty. However, the role of uncertainty cannot be considered in isolation from the specificity of a real estate. Therefore, an upstream

analysis aims to create a deep understanding about the extent to which specificity affect the ownership strategy of non-property companies, taking into account business uncertainty. In order to achieve these objectives, the paper addresses the following two research questions:

1. What role does the specificity of CRE play in the real estate ownership strategy under business uncertainty?
2. Does the pricing and risk of corporate real estate ownership on the capital market differ between uncertainty situations?

To answer these research questions, two studies have been conducted. The first study addresses research question 1. The results provide insight into the extent to which CRE ownership is affected by specificity and business uncertainty. The findings then serve as a theoretical basis for the second study, which answers research question 2 and investigates the influence of CRE ownerships on firm performance and risk under different uncertainty situations. The methodological approach and the results of the two studies are presented separately. Subsequently, the results are discussed in their overall context in order to derive both scientific findings and implications for business practice.

5.2 Literature review and research model

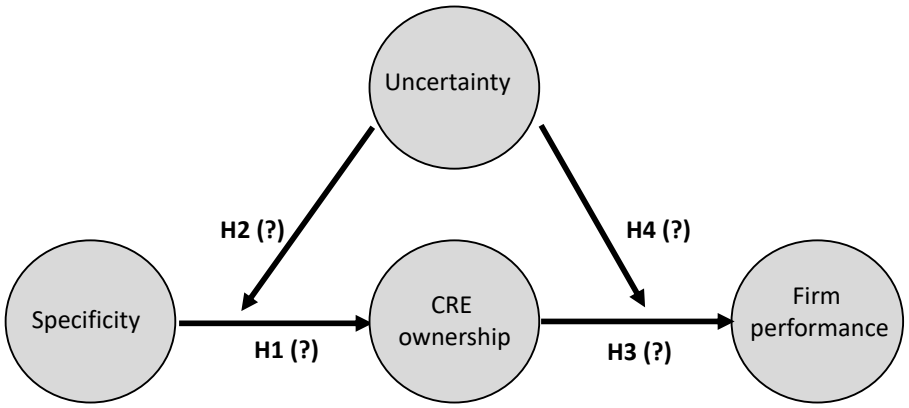
In order to present the current state of research, we draw on the literature strands of general management theories and prepare the corporate real estate literature in the context of real estate ownership and its impact on firm performance and risk-incorporating factors relevant to this context. Based on this, we developed a research model to investigate the relationship between real estate ownership and firm performance under the consideration of business uncertainty. While the general relation between CRE ownership and firm performance is already the subject of numerous research approaches (e.g. Deng and Gyourko, 1999; Brounen and Eichholtz, 2005; Tuzel, 2010; Rochdi, 2016; Seger *et al.,* 2020), there is a lack of empirical research that takes uncertainty into account, especially for Europe. Only articles based on US data have addressed the uncertainty (e.g. Ambrose *et al.,* 2017; Zhao and Sing, 2016). Due to (1) the high resource input of immovable assets, (2) the high importance of real estate in changing core business activities, (3) the long-term nature and (4) difficult reversibility of real estate ownership decisions, we argue that its consideration under business uncertainty becomes more relevant. Therefore, this is our main focus.

As mentioned earlier, the strategic decisions over provision of space are substantially affected by the real estate characteristics as immobile resources. Numerous studies have shown that real estate ownership differs according to the industry in which a firm operates (e.g. Seiler *et al.*, 2001; Nappi-Choulet *et al.*, 2009). The requirements placed on real estate by the core business seem to determine the strategic decision of real estate provision. The more specific the requirements for real estate, such as production or laboratory facilities, the more likely it is that the real estate will be held in ownership. As mentioned above, a significant share of CRE portfolios is specific and can usually only be transferred to new use at a value loss. It should be obvious that in order to avoid negative consequences, corporate real estate

management (CREM) carefully considers investments in new specific properties in particular or, in the case of already held real estate holdings, must depreciate their value after transferring them to a new use. However, so far in the discussion about uncertainty and the difficulty of revising the ownership decision, little attention has been paid to the fact that it depends on the CRE specificity.

As a result of these considerations, it becomes clear that it is first necessary to examine the impact of specificity on the real estate strategic decisions of real estate space provision as ownership (H1) under business uncertainty (H2), before the impact of real estate property on company performance is examined (H3) as well as under consideration of business uncertainty (H4). Figure 19 shows our corresponding research model with the relations and impacts to be investigated.

Figure 19: Relations to be investigated in the general cross studies research model

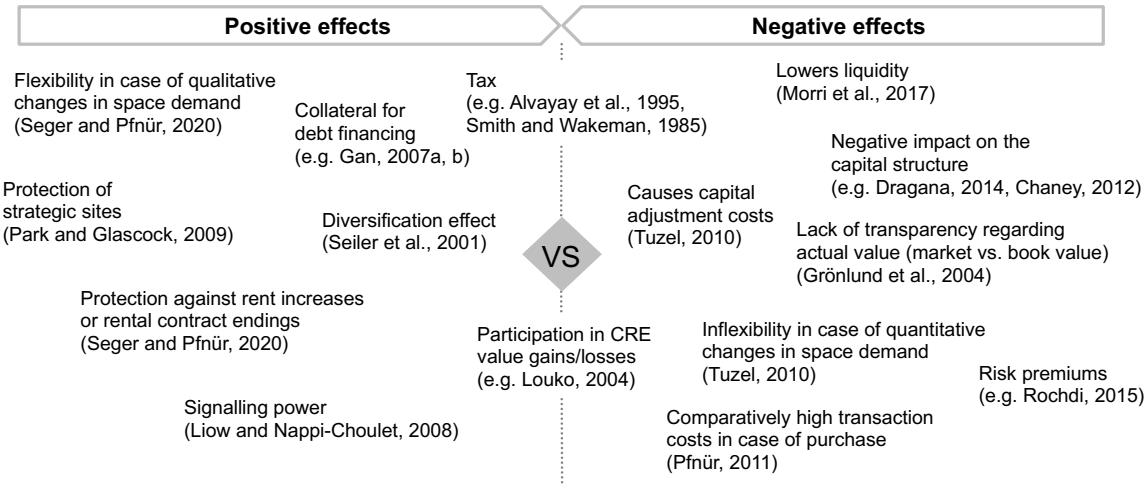


The four investigated hypotheses are derived theoretically in the following chapters.

5.2.1 Real estate ownership and its impact on firm performance

The discussion about the benefits of ownership and provision alternatives such as rent or leasing is almost as old as the CREM research field itself. Basically, corporates have the choice between rental, leasing and ownership solutions when providing space. Each of these space provision forms is associated with unique advantages and disadvantages. In order to make a general statement about the most appropriate provision variant, the effect of CRE ownership on capital market performance was examined in numerous studies. For this purpose, event studies were used to conduct capital market reactions after announcements of CRE acquisitions or sales (e.g. Rodriguez and Sirmans, 1996; Devaney and Lizieri, 2004; Ting, 2006; Gronlund *et al.*, 2008). Alternatively, balance sheet-accounted real estate assets were examined with regard to their effect on capital market performance. The study situation regarding the influence on capital market performance is partly contradictory (see Seger *et al.,* 2020 for an overview). Nevertheless, a review of the literature shows that the majority of studies classify ownership as a factor that tends to reduce success. However, there are also studies that come to different results. Reasons for negative or positive effects are shown in Figure 20.

Figure 20: Comparison of the advantages and disadvantages in the case of CRE ownership.



Which of these effects outweigh depends on further factors such as the country or industry in which a firm operates (Seger *et al.,* 2020), growth opportunities (Du *et al.,* 2014), firm size (e.g. Yu *et al.,* 2009; Liow, 2010), corporate governance (Sing and Sirmans, 2008; Du *et al.,* 2014) and business environmental conditions (e.g. Tuzel, 2010; Ambrose *et al*., 2017). Thus, the industry in which a company operates is not only crucial for its ownership strategy as described above, but also for its success. This can be traced back to the fact that in some industries the importance of real estate for the core business can vary greatly (Park and Glascock, 2009). Wherever real estate is closely linked to the core business, the real estate is held in ownership. Thus, it is precisely in industries such as the manufacturing sector, with highly company-specific real estate, that ownership is valued more positively than, for example, in the service sector, where the use of real estate is limited to mostly generic and exchangeable office properties (Nappi-Choulet, 2009). A first indication, therefore, that the property with its generic or specific characteristics influences the CRE ownership strategy due to its impact on firm performance.

The business environment of the enterprise also must be taken into consideration. For example, conditions on the real estate markets (Fougère *et al.,* 2017), competition or fluctuations in demand (Ambrose *et al.,* 2017) and associated uncertainties (e.g. Zhao and Sing, 2016) have a demonstrable influence on the benefits of ownership. Especially with regard to a dynamic business environment, ownership is considered to be unfavourable. A frequently mentioned argument is the lack of flexibility of ownership in the face of quantitative changes in space demand. Ownership can therefore only be disposed of with a delay, which can be attributed not least to the lack of third-party usability due to the high specificity of many properties (Tuzel, 2010). A theoretical discussion about CRE specificity and its relation to the provision by ownership and how this affects capital market performance has so far only been carried out superficially in the literature. To the best knowledge of the authors, a focused empirical investigation under consideration of business uncertainty has not been done so far. This will be explained in more detail below and then empirically tested.

5.2.2 Theoretical relevance of specificity, uncertainty and ownership

The previous explanations have shown that there are first considerations in the literature about the specificity of a CRE and its holding in ownership. So far, a detailed examination of the term and proof of a connection has not been provided. A positive correlation between the specificity of a property and its provision in ownership is simply assumed. In this context Ambrose *et al.* (2017: p. 1), for example, note that "a firm can strategically invest in real estate when it plays a special or irreplaceable role; firms typically own such firm-specific facilities". It requires a more detailed explanation as to why such properties are owned.

Generally, a resource or asset, like corporate real estate, is defined as specific "when they yield greater value if they are deployed in activities by one firm than if they are deployed in the same activities by another" (Zott and Amit, 2006: p. 11). The degree of specificity represents the value difference between first- and second-best use. According to this resourced-based view-related definition, specificity is a resource characteristic that generates abnormal rents and, thus, leads to strategic competitive advantages. Zott and Amit (2006) explain this with their high immobility, not imitability (Rumelt, 1984) and higher efficiency (Jacobides, 2004). These strategic assets have to be held "locked-in" within the firm's boundaries (Zott and Amit, 2006). In the context of CRE provision, this means that due to their physical design and location, company-specific real estate should be held in ownership (Park and Glascock, 2009). This can also be supported by principal agent and transaction theory. Accordingly, companies should own assets when potentially incomplete contracts expose them to future opportunistic behaviour. This would serve as protection against the lessor being able to extract above-normal values by increasing the lease/rent payments in the amount of the added value that a specific area generates for the lessee (user). More detailed contracts and negotiations to avoid such conflicts would cause agency costs (Smith and Wakeman, 1985).

These theoretical considerations lead us to Hypothesis 1 (H1):
The higher the demand for specific resources, the greater the corporate real estate holdings.

However, these considerations do not take into account that companies usually operate in a dynamic and uncertain business environment. "Locking-in" of specific resources also means that companies are tied to specific resources in the case of changing business conditions. The higher the level of uncertainty the greater the risk that a specific resource will have to be transferred from first- to second-best use. This can be argued with the loss of the current best possible use. If the benefit or value of the resource in second-best use is lower than the investment cost, then sunk costs arise. In times of high dynamics and uncertainty, companies adapt their investment behaviour to specific resources (Ghemawat and Del Sol, 1998).

Transferred to the CRE ownership decision, the question arises whether ownership is more likely to be held with increasing specificity and whether this relationship is weakened by uncertainty. This is in line with Tuzel (2010) who argues that the capital adjustment costs caused by real estate ownership are based on its specificity and the resulting lower resale price. These are incurred when companies are forced to sell their properties due to changing business conditions.

These theoretical considerations lead us to Hypothesis 2 (H2):
Uncertainty weakens the link between specific real estate and the ownership of CRE.

5.2.3 Theoretical relevance of CRE ownership, uncertainty and firm performance

As mentioned in Chapter 5.2.1, the negative effect of real estate ownership on company performance has been proven in numerous studies (see Seger *et al.*, 2020 for a complete literature review). Consequently, only a few studies will be mentioned here. According to Deng and Gyourko (2000) as well as Brounen and Eichholtz (2005), ownership has a negative influence on risk-adjusted return, whereas according to Seiler (2001) and Ting (2006), no significant correlation can be demonstrated. Du and Ma (2012) can generally demonstrate a negative correlation to abnormal returns, which Demirer (2018) confirms in the short term but identifies as positive in the medium term. At the same time, the studies of Tuzel (2010) and Rochdi (2016) show that ownership is priced in as a risk factor on the capital market.

These theoretical considerations lead us to Hypothesis 3 (H3):
The higher the ownership, the lower the firm performance.

Especially, the inflexibility and difficult reversibility of ownership under uncertainty serves as an important argument proposed by Tuzel (2010), Zhao and Sing (2016) and Ambrose *et al.* (2017). One reason for this was discussed in Chapter 5.2.2 with the specificity of ownership. However, this is only one explanation as to how uncertainty could increase or reduce the importance of ownership for firm performance. Thus, in the discussion about the appropriateness of ownership, CREM managers frequently refer to its function as a source of financial resources, especially in uncertain times. Accordingly, if companies experience liquidity bottlenecks in times of crisis, cash flows could be stabilised by selling property, by letting it or even by using it at as collateral. Following this anecdotal reasoning, ownership under uncertainty does not necessarily impact firm performance negatively, but could ultimately have a positive effect.

These theoretical considerations lead us to Hypothesis 4 (H4):
Uncertainty weakens/improves the influence of corporate real estate ownership on firm performance.

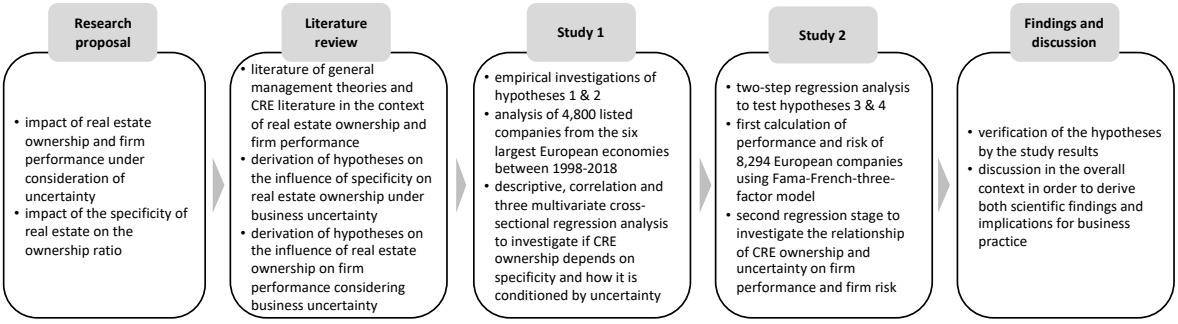
In summary we can complement our research model with the hypotheses derived from the literature. We suspect a positive link between specificity and CRE ownership (H1:(+)), which is moderated under uncertainty with a negative effect (H2:(-)). Furthermore, we expect a negative relationship between CRE ownership and firm performance (H3:(-)). This relationship could be affected both positively and negatively by business uncertainty (H4:(+/-)). The following chapters describe the research design and methodology used to test the cross-studies research model and verify the four hypotheses.

5.3 Research design and methodology

5.3.1 Two consecutive studies as research design

To test the general research model, we conducted two studies. The first study focuses on the left half of the research model and examines the influence of specificity on CRE ownership, taking into account business uncertainty. Based on these findings, the second study centres on the right side of the research model and investigates the impact of CRE ownership on firm performance under consideration of business uncertainty. Figure 21 summarises the entire research design.

Figure 21: Research design



5.3.2 Methodology of study 1: Specificity, CRE ownership and business uncertainty

For the first study, the Thomson Reuter Datastream was used to collect balance sheet data. The dataset includes listed non-property companies of the six biggest European economies (according to their level of GDP), including Germany, UK, France, Italy, Spain and Netherlands, for the period 1998–2018. The data were collected quarterly. One of the key variables in this study is the ownership ratio (CRER), which is measured by two proxies. CRER1 is the ratio of the net value of buildings and land to total assets (Rochdi, 2015). CRER2 is based on CRER1 by measuring the relative level of the previously determined ownership ratio to companies in the same industry (Zhao and Sing, 2016). Another key variable is specificity. This turns out to be difficult because such information is not shown in the balance sheets and is not measured in CREM. We use as a proxy: how often can specificity be found in studies on capital structure theory? For example, numerous studies measure asset specificity by research and development (R&D) expenditures in relation to total assets (Anderson and Schmittlein, 1984; Kedia *et al.*, 2011; Bhaduri, 2002).[11] This is based on the assumption that "firms that invest heavily in R&D introduce new products and technologies, use nonstandard inputs and require investments in equipment or inventory that are specific to the firm" (Cavanaugh and Garen, 1997: p. 42). Following Ambrose *et al.* (2017), the uncertainty is determined per period using a rolling standard deviation of the sales figures of the past five years. In addition, the control variables firm size, debt ratio and growth opportunities are included. All variables with their calculation formulas are provided in Appendix Table B2.

[11] As a second and additional measure of specificity, SGA expenses (sales, general and administrative expenses) are used in relation to total assets. This is based on the assumption that the more unique and specific products, services and, thus, resource inputs are, the higher the SGA expenses will be (based on Berger et al., 1997 or Lev and Radhakrishnan, 2002).

To confirm or reject the first two hypotheses, three models (1.1–1.3) are tested by conducting multivariate cross-sectional regression analysis. Model 1.1 informs if the ownership choice depends on the specificity of resource demand and uncertainty (H1). The repeated running of Model 1.2 on subsamples divided into firms with high and low uncertainty (by dummy variable UC) and Model 1.3. provides information about the extent to which the relationship between the specificity of resource demand and the holding of property changes under uncertainty (H2).

Model (1.1):

$$CRER1_{i,t} = \alpha + \beta_1 SPEC_{i,t} + \beta_2 UC_{i,t} + \delta X_{i,\,t-1} + \lambda_i + \tau_t + \varepsilon_{i,t}$$

Model (1.2):

$$CRER1_{i,t} = \alpha + \beta SPEC_{i,t} + \delta X_{i,\,t-1} + \lambda_i + \tau_t + \varepsilon_{i,t}$$

(for firms under low and high uncertainty)

Model (1.3):

$$CRER1_{i,t} = \alpha + \beta_1 SPEC_{i,t} + \beta_2 UCDummy_{i,t} + \beta_3\left(SPEC_{i,t} * UCDummy_{i,t}\right) + \delta X_{i,\,t-1} + \lambda_i + \tau_t + \varepsilon_{i,t}$$

where:

$CRER1_{i,t}$	represent relative CRE holdings
$SPEC_{i,t}$	measures of the specificity of resource demand
$UCDummy_{i,t}$	dummy representing high uncertainty and low uncertainty
$X_{i,\,t-1}$	control variables (debt ratio, firm size, growth opportunities)
λ_i, τ_t	time/industry-fixed effects

The data gaps within the initial sample of listed companies of the six largest European economies were too large for multivariate regressions. The models are therefore examined using the German subsample. The sample includes 799 non-property companies and covers the period 1999–2019.

CRE in non-property companies are often debt-financed; thus, a positive correlation between the real estate ownership ratio and the debt ratio is assumed, making it necessary to control the level of debt. In addition, large companies can generally borrow at more favourable conditions, which is why a positive correlation is also assumed here. The size factor is expressed and controlled in terms of market capitalisation. In addition, ownership is considered problematic in growth phases due to its high capital tie-up, which cannot be spent for the core business. This is controlled by including the variable growth, which is considered with the ratio of shareholder equity to market capitalisation.

5.3.3 Methodology of study 2: CRE ownership, firm performance and uncertainty

The second study has a two-step approach. In the first step, we calculate the performance and risk for every European company available at Thomson Reuters Datastream between 2000 and 2020, and whose core business is not real estate. The second step is a multivariate regression analysis to address our aim of finding the influence of the CRE ownership under uncertainty on firm performance and risk.

We calculate the performance and risk for every company and every year in our time span using the Fama–French three-factor model (Fama and French, 1992). Compared to more widely used methods like CAPM, the Fama–French three-factor model may have greater explanatory power.[12]

Model (2.1):

Fama–French three-factor model

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i * (R_{m,t} - R_{f,t}) + \gamma_i * SMB_t + \delta_i * HML_t + \varepsilon_{i,m}$$

where:

$R_{i,t}$	return on company share *i* in month *t*
$R_{f,t}$	return on risk-free investment alternative *f* in month *t*
$R_{m,t}$	return on market portfolio *m* in month *t*
α_i	*Alpha* or excess return of company *i*
β_i	*Beta-factor* or company risk of company *i*
SMB_t	size factor in month *t*
HML_t	factor for the book/market value ratio in month *t*
$\varepsilon_{i,m}$	error term of portfolio *i* in month *t*.

Within the regression model, Alpha, also known as Jensen's alpha, describes an excess return of the individual share compared to the market portfolio. Thus, Alpha corresponds to a portion of the return that cannot be directly explained by the market factors and, therefore, is independent of the return on the market portfolio. Therefore, Alpha can be understood as the corporate performance of a company that is independent of external factors. The Beta-factor is referred to as 'company risk'.[13]

The raw data for the return of a company is calculated using its total return index. The exact formula of this and other variables is given in Appendix B5. We use the *total return index* as it takes into account not only the price fluctuations of a share but also dividends or distributions, interest, the possibility of subscription to preference shares and a share split. The monthly return of the market portfolio and the monthly return of the risk-free investment

[12] As a robustness check, we also calculated the firm's risk and performance using CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966) within the first regression stage. Due to similar results and a lack of space, we present the Fama–French three-factor model only.

[13] However, due to the added variables in the Fama–French three-factor model, the Beta-factor has fundamentally different values from the Beta-factor in the CAPM. The interpretation of the coefficient remains the same (Womack and Zhang, 2003).

alternative used in this work as well as the monthly size factors (SMB) and the monthly factors for the book/market value ratio (HML) are provided by Dartmouth.[14]

The second regression stage is carried out in order to further investigate the relationship and, above all, the explanatory power of CRE ownership and uncertainty on company performance and company risk. Furthermore, the control variables firm size, debt ratio and growth opportunities are included. This results in the following regression model:

Model (2.2):

$$\alpha_{it}/\beta_{it} = \gamma_0 + \gamma_1 * CRER1_{it} + \gamma_2 * UC_{i,t-\tau} + \gamma_3 * (UC_{i,t-\tau} \cdot CRER1_{i,t-\tau}) + X_{i,t-1} + \lambda_i + \tau_t + \theta_i + \varepsilon_i$$

where:

α_{it}/β_{it}	excess return $\alpha_{i,t}$ or the systematic risk of company i in year t
$CRER1_{it}$	average corporate real estate ratio of company i in year t
$UC_{i,t-\tau}$	uncertainty of firm i in year t
$X_{i,t-1}$	control variables (debt ratio, firm size, growth opportunities)
$\lambda_i, \tau_t, \theta_i$	time/industry/firm-fixed effects
ε_i	error term of portfolio i.

The average CRER1 is calculated by summing up all land and buildings of a company minus the accrued depreciation of land and buildings and divided through the total assets of a company. Uncertainty is calculated in different ways. In the regression models without an interaction term, uncertainty is the rolling standard deviation of the last five years for the net sales of a company. In regression models with an interaction term, uncertainty is a dummy variable. This dummy variable is 1 if the average rolling net sales of the last five years of the company is lower than the median of the net sales of all companies and 0 otherwise.

The initial data sample comprised all listed companies in Europe that Thomson Reuters Datastream offers. After data cleaning, 8,294 companies remain whose core business is not real estate management. We collected the data in February and March 2020 for the period 2000–2020.

5.4 Results

In the following chapters, we show the results of each study individually. These results are used to test the research model and verify the hypotheses. We then discuss the results in the overall context. This enables us to present the theoretical relationships beyond the current state of research and to derive implications for business practice.

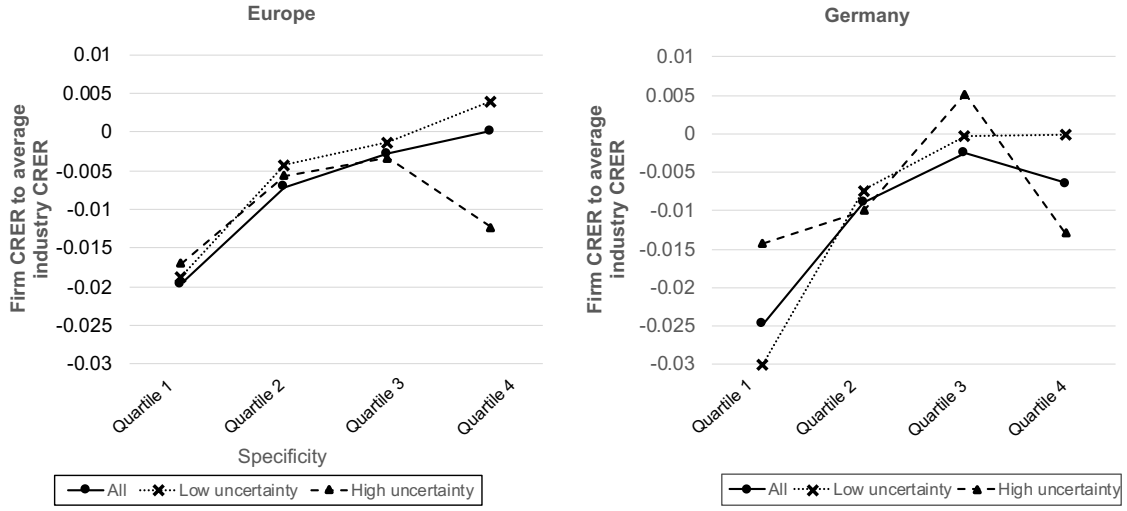
[14] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

5.4.1 Study 1: Specificity, CRE ownership and uncertainty

Results of descriptive and pairwise correlation analysis

Descriptive and graphical evaluations provide first hints on whether there is a link between the specificity and CRE ownership in general, and in consideration of business uncertainty. For this purpose, the companies were divided into four quartiles with regard to specificity. The specificity increases from quartile 1 to quartile 4. The companies were subsequently divided into two sub-groups with regard to their business uncertainty based on the median. The ownership rates relative to the industry average were then visualised in Figure 22. This was done once on the basis of the six largest European economies and on the basis of Germany, which is the largest economy in terms of GDP, but is averaged and representative of the other five countries in terms of ownership rates (Seger *et al.,* 2020).

Figure 22: Illustration of real estate ownership, specificity and uncertainty



Note: Europe=5,939 observations, Germany = 1,967 observations. CRER = CRER1 and Specificity = SPEC1

These descriptive results indicate that with increasing specificity, real estate ownership increases. A differentiated consideration according to business uncertainty also shows that this trend applies especially to companies that operate under stable conditions with low uncertainty. For firms under high uncertainty, a deviating picture emerges. Initially, the ownership ratio increases with an increasing demand for specific space, but then decreases again. This is a possible indication that investments in specific real estate in particular are being held back under high uncertainty or are decreasing in value and, therefore, are being depreciated.

The results of the pairwise correlation matrix in Table 18 indicate a strong correlation between the two specificity proxies. Nevertheless, the proxies exhibit a positive as well as negative, and thus contrary, relationship to ownership. Uncertainty, on the other hand, seems to have only a weak significant negative effect on real estate ownership.

Table 18: Correlation matrix between specificity, CRE ownership and uncertainty

Variables	CRER1	SPEC1	SPEC2	Uncertainty	Debt Ratio	Size	Growth
CRER1	1.000						
Spec1	0.056***	1.000					
	(0.000)						
Spec2	0.062***	0.788***	1.000				
	(0.000)	(0.000)					
Uncertainty	-0.013*	0.024**	-0.008	1.000			
	(0.102)	(0.035)	(0.260)				
Debt ratio	0.058***	-0.036***	-0.005	0.002	1.000		
	(0.000)	(0.000)	(0.437)	(0.700)			
Size	-0.025***	-0.064***	-0.020***	-0.012**	0.001	1.000	
	(0.000)	(0.000)	(0.000)	(0.032)	(0.906)		
Growth	0.007	0.003	0.001	0.002	0.000	-0.002	1.000
	(0.297)	(0.743)	(0.864)	(0.776)	(0.978)	(0.732)	

Note: Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Results of the multivariate regression analysis

In the first study, we investigate how specificity is related to the ownership ratio under uncertainty. Models (1.1–1.3) are run with the two specificity measures and, therefore, subdivided in the case of Model 1.1 (for example, as 1.1.1 and 1.1.2). The regression of the variable specificity to ownership ratio shows a positive relation in both Models 1.1.1 and 1.1.2 but is only significant in the second (Table 19). The results are significant at the 5% level. Hypothesis 1 can thus be confirmed. In contrast, uncertainty does not seem to have a direct impact on CRER.

A calculation of Model 1.2, with two sub-samples subdivided into firms with high and low uncertainty, is intended to give an indication of the extent to which the uncertainty has a possible indirect influence on the CRE ownership by meditating on the previously demonstrated positive relationship between specificity and CRE ownership. A similar pattern is shown as previously illustrated in Figure 4. Under low uncertainty, a high positive relation can be identified (Table 20). According to this, under low uncertainty, firms seem to rely on ownership when specific resource demands increase. If the analysis is repeated with companies under uncertainty, then a contrary relationship emerges for both specificity proxies similar to the pairwise correlation. However, the negative relationship is much stronger than the positive one. It seems that the link between specificity and ownership is rather negative when companies operate under high uncertainty.

This picture is confirmed after the calculation of Model 1.3. Uncertainty was included here as a dummy variable (UCdummy) with a value of 1 for companies with high uncertainty and a value of 0 for companies with low uncertainty in interaction with specificity (Table 21).

Model 1.3.1 shows significant values for the specificity variable, the uncertainty dummy variable and the interaction term between specificity and uncertainty. The specificity is significant on the 10% level and indicates a positive influence on CRE ownership under low uncertainty. The interaction term considering high uncertainty reverses the positive link between specificity and CRER1. Thus, the positive effect of specificity on CRER1 only applies with low or no uncertainty. Hypothesis 2 (uncertainty weakens the link between specific real estate and CRE ownership) can be confirmed.

Table 19: Results of regression Model 1
concerning the influence of specificity on real estate ownership under high and low uncertainty

Variables	(1.1.1)	(1.1.2)
SPEC1	0.1822986	
	(0.1761342)	
SPEC2		0.033835**
		(0. .0142208)
Uncertainty	0.0003204	-0.0001664
	(0.0000215)	(0.0002208)
Debt ratio(-1)	-0.0045528	0.0025454
	(0.0031706)	(0.0027957)
Size(-1)	-1.04e-09	-9.74e-10**
	(3.32e-10)	(3.74e-10)
Growth(-1)	-0.0000987	-0.0000385***
	(0.0000197)	(8.79e-06)
Constant	-0.0095936	-0.0117415**
	(0.0063796)	(0.0034656)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	1,983	3,474
R-squared	0.1171	0.0232
Adj. R-squared	0.1044	0.0153

Note: Standard errors in parentheses and *** significant at ***p < 0.01,** p < 0.05, * p < 0.1.

Table 20: Results of regression Model 2
concerning the influence of specificity and uncertainty on real estate ownership

	Low uncertainty		High uncertainty	
Variables	(1.2.1)	(1.2.2)	(1.2.3)	(1.2.4)
SPEC1	0.3926995*		-0.1221225***	
	(0.2080137)		(0.0203183)	
SPEC2		0.0469518*		0.0231198***
		(0.0249385)		(0.0050637)
Debt ratio(-1)	-0.005329**	0.0012195	-0.002076	0.0053179
	(0..0020188)	(0.0022345)	(0.0056698)	(0.0045575)
Size(-1)	-1.03e-09**	--9.54e-10**	-9.60e-10***	-7.10e-10***
	(4.35e-10)	(3.72e-10)	(1.43e-10)	(1.83e-10)
Growth(-1)	-0.0002981*	-0.0005988	-0.0000923***	-0.0000252***
	(0.0001317)	(0.0003941)	(0.0000207)	(4.84e-06)
Constant	-0.0186155*	-0.0121228**	0.0056748***	-0.013521**
	(.0090829)	(0.0051864)	(0.0014443)	(0.0041252)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	1,189	2,091	794	1,383
R-squared	0.2036.	0.0403	0.0897	0.0601
Adj. R-squared	0.1850	0.0277	0.0588	0.0414

Note: Standard errors in parentheses and significant at *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 21: Results of regression Model 3
testing the interaction between specificity and uncertainty on ownership

Variables	(1.3.1)	(1.3.2)
SPEC1	0.3670757*	
	(0.1732194)	
SPEC2		0.0376875
		(0.0254867)
UCDummy	0.0214893**	-0.001596
	(0.0068821)	(0.0123535)
SPEC1*UCDummy	-0.4462623***	
	(0.0858887)	
SPEC2*UCDummy		-0.009033
		(0.0287991)
Debt ratio(-1)	-0.0044365	0.0025394
	(0.0031909)	(0.0028152)
Size(-1)	-1.02e-09**	-9.93e-10**
	(3.39e-10)	(3.80e-10)
Growth(-1)	-0.0001128***	-0.0000336**
	(0.0000238)	(0.0000111)
Constant	-0.017723**	-0.0114092*
	(0.0072221)	(0.005874)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	1,983	3,474
R-squared	0.1226	0.0202
Adjusted R-squared	0.1095	0.0120

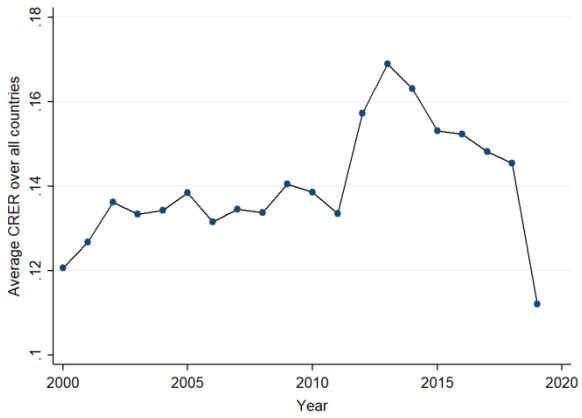
Note: Standard errors in parentheses and significant at *** p < 0.01, ** p < 0.05, * p < 0.1.

5.4.2 Study 2: CRE ownership, firm performance and uncertainty

Results of descriptive analysis

A descriptive analysis of CRE ratios allows first insights into the importance of CRE ownership in the European context of 34 included countries. Figure 23 shows the average CRE ratio over all countries over the last 20 years. Contrary to a frequently shared opinion of falling ownership ratios, these have increased in Europe as a whole.[15] If the European-wide ownership intensities per industry are included, then a similar trend emerges although the levels per industry differ. For reasons of space, however, they are not presented here.

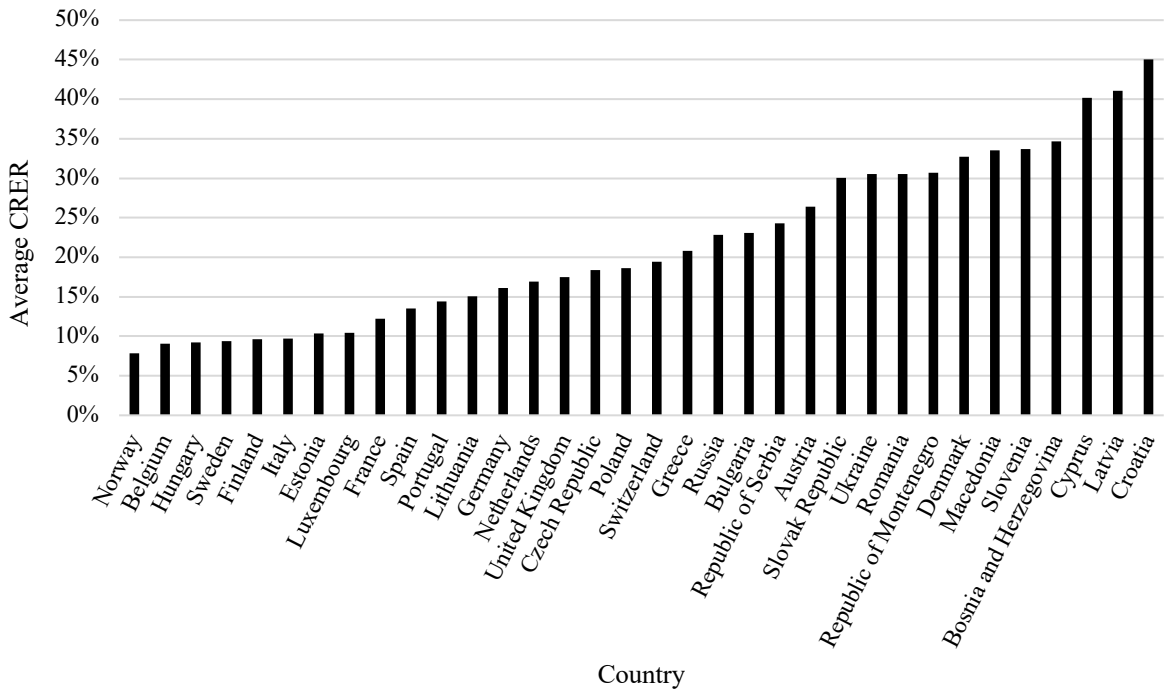
Figure 23: Illustration of average real estate ownership in Europe since 2000.



Remarkable is the initially slight upward trend from about 2000 to 2012, which is interrupted by an abrupt rise in 2012, only to fall again continuously until 2020. A presentation over time for each country can be found in the Appendix B1. According to these, the economically strongest countries in particular have shown stable to very slightly declining ownership ratios over the last 20 years (Germany, France, UK, Netherlands, Spain, Italy, Switzerland, Poland, Hungary, etc.). Particularly strong declines in this ratio can be seen in countries such as Russia, Denmark and Ukraine. In countries such as Slovenia, Cyprus, Croatia, Bulgaria, Latvia and Lithuania, real estate assets have increased in proportion to total assets. Further insights can be gained by comparing countries according to their average ownership intensities in a bar chart (Figure 24). According to this, companies in countries such as Norway, Belgium, Hungary, Sweden, Finland and Italy have the lowest ownership ratio (below 10%). In contrast, companies from Cyprus, Latvia and Croatia have the highest intensities (over 40%). Possible reasons for these variations are addressed in the discussion chapter.

[15] The low ratio in 2019 is due to the data sample being collected at the beginning of 2020. Most companies publish their balance sheets not on the reporting date but in the course of the next year, so the sample is not complete for this year.

Figure 24: Illustration of average CRE ownership in Europe per country since 2000.



The results of the pairwise correlation matrix in Table 22 indicate a strong correlation between CRER2 and Alpha and Beta although the relation to the risk is negative. Further, the Growth and Size variable and all other variables are significantly correlated to all other variables. Debt ratio does not seem to show any significant relationship with the other variables.

Table 22: Correlation matrix of all variables

Variables	α_{it}	β_{it}	CRER1	Debt ratio	Size	Growth	Uncertainty
α_{it}	1.000						
β_{it}	-0.5349***	1.000					
	(0.000)						
CRER1	0.0339***	-0.0290***	1.000				
	(0.0019)	(0.0080)					
Debt ratio	0.0000	0.0000	0.0094	1.000			
	(0.9972)	(0.9987)	(0.3751)				
Size	-0.0075**	0.0071**	-0.1292***	-0.0109***	1.000		
	(0.0301)	(0.0423)	(0.0000)	(0.0019)			
Growth	0.1108***	-0.0729***	0.0817***	-0.0031**	-0.0359***	1.000	
	(0.000)	(0.000)	(0.000)	(0.4259)	(0.906)		
Uncertainty	-0.0001	0.0000	0.0202*	-0.0005	0.1420***	-0.0002	1.000
	(0.9835)	(0.9993)	(0.0682)	(0.8830)	(0.0000)	(0.9562)	

Note: Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Results of the multivariate regression analysis

As explained in Chapter 5.5.3.3, in a first step, Jensen's alphas and systematic risk-Betas were estimated. In a second step, the CRER and various control variables were regressed under consideration of firm, industry, country and time fixed-effects, and lagged by one and two years. The analysis is initially performed without the interaction term specified in Model 2.2. This serves to prove a general relationship between ownership and firm performance to confirm Hypothesis 3.

In Table 23, the regression results with Alpha as a dependent variable show a negative and partly significant relationship between the CRER and excess return. It seems that in the short run, the negative effects of CRE ownership outweigh the positive ones (Figure 20). The debt ratio is also negative and, in 5 out of 10 specifications, significant. Not surprisingly, the growth variable has, in all specifications, a positive and in half of the cases significant influence on Alpha. The sign of the uncertainty variable of a company changes throughout the models; however, only the positive values have a significant influence on the return of a company.

Table 23: Regression on Fama–French three-factor Alpha

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CRER1	-0.0417	-0.0437	-0.000436	-0.0368	-0.0634*	-0.00335	-0.0565*	-0.00196	-0.00644	-0.00492
	(0.0334)	(0.0373)	(0.0136)	(0.0336)	(0.0331)	(0.0134)	(0.0332)	(0.0135)	(0.0134)	(0.0134)
Debt ratio	-0.0136	-0.0154	-0.0202***	-0.0134	-0.0109	-0.0205***	-0.0106	-0.0204***	-0.0201***	-0.0200***
	(0.0114)	(0.0116)	(0.00423)	(0.0114)	(0.0113)	(0.00424)	(0.0114)	(0.00424)	(0.00423)	(0.00423)
Size	-0.0302***	-0.0341***	-0.00212*	-0.0301***	-0.0294***	-0.00270**	-0.0291***	-0.00258**	-0.00236**	-0.00221*
	(0.00253)	(0.00290)	(0.00119)	(0.00256)	(0.00255)	(0.00117)	(0.00258)	(0.00117)	(0.00117)	(0.00117)
Growth	0.000134	0.000114	0.000107***	0.000134	0.000112	0.000109***	0.000118	0.000109***	0.000109***	0.000110***
	(0.000103)	(0.000107)	(3.88e-05)	(0.000104)	(0.000103)	(3.89e-05)	(0.000103)	(3.89e-05)	(3.88e-05)	(3.88e-05)
Uncertainty	9.30e-10***	8.75e-10**	-1.59e-10	9.18e-10***	8.43e-10**	-1.51e-10	8.28e-10**	-1.51e-10	-1.58e-10	-1.59e-10
	(3.32e-10)	(3.44e-10)	(1.26e-10)	(3.33e-10)	(3.30e-10)	(1.26e-10)	(3.30e-10)	(1.26e-10)	(1.25e-10)	(1.25e-10)
Constant	0.347***	0.392***	-0.0981***	0.353***	0.297***	-0.0787***	0.307***	-0.0813**	-0.0970	-0.0879
	(0.0364)	(0.0404)	(0.0161)	(0.0481)	(0.106)	(0.0193)	(0.109)	(0.0351)	(0.0995)	(0.103)
Company FE		Yes	Yes							
Year FE			Yes			Yes		Yes	Yes	Yes
Branch FE				Yes			Yes	Yes		Yes
Land FE					Yes		Yes		Yes	Yes
Observations	7,455	7,455	7,455	7,455	7,455	7,455	7,455	7,455	7,455	7,455
Adj. R-squared	0.0106	-0.1540	0.8470	0.0188	0.318	0.0387	0.325	0.0491	0.342	0.351
R-squared	0.0222	0.0223	0.8709	0.0222	0.0222	0.8709	0.0222	0.8709	0.8709	0.8709

Note: Standard errors in parentheses and significant at ***p < 0.01, **p < 0.05, *p < 0.1.

In contrast, a repetition with lagged variables shows a significant positive relationship between the CRER and Alpha as shown in Table 24 for one-year lagged variables in the Appendix B6 for two-year lagged variables. Even though not all values are positive in Table 24,

there are more positive significant values than negative. Appendix B6 presents a clearer picture of the positive influence with nearly all values positive. It seems that in the medium term the effect is reversed and the positive effects of CRE ownership outweigh the negative ones. The one-year lagged variables for debt ratio are mixed and for size are mostly negative; in particular, size seems to have a significant influence in the medium term, whereas uncertainty does not play a significant role (Table 23).

Table 24: Regression on Alpha with one-year lagged independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CRER1 (-1)	0.0290***	-0.0606*	-0.0119	0.0260***	0.00617	-3.57e-05	0.00359	-0.00212	0.00294	0.00190
	(0.00955)	(0.0353)	(0.0123)	(0.00976)	(0.0106)	(0.00507)	(0.0109)	(0.00518)	(0.00554)	(0.00564)
Debt_ratio (-1)	0.00409	0.00246	-0.0178***	0.00437	0.00416	-0.00868***	0.00348	-0.00921***	-0.00943***	-0.0102***
	(0.00681)	(0.0113)	(0.00392)	(0.00686)	(0.00707)	(0.00304)	(0.00712)	(0.00306)	(0.00311)	(0.00312)
Size (-1)	-0.00335***	-0.0373***	-0.0225***	-0.00367***	-0.00413***	-0.00125***	-0.00455***	-0.00155***	-0.00227***	-0.00275***
	(0.000628)	(0.00278)	(0.00109)	(0.000653)	(0.000736)	(0.000357)	(0.000779)	(0.000369)	(0.000418)	(0.000436)
Growth (-1)	5.13e-05	-2.22e-05	-2.16e-05	3.92e-05	-2.14e-05	-1.66e-05	-3.12e-05	-1.99e-05	-4.07e-05	-4.60e-05*
	(6.34e-05)	(0.000105)	(3.63e-05)	(6.36e-05)	(6.46e-05)	(2.60e-05)	(6.48e-05)	(2.61e-05)	(2.65e-05)	(2.66e-05)
Uncertainty	2.17e-10	4.18e-10	-1.30e-10	1.98e-10	-6.03e-11	0	-0	0	-0	-0
	(1.54e-10)	(3.28e-10)	(1.14e-10)	(1.55e-10)	(1.68e-10)	(7.45e-11)	(1.68e-10)	(7.47e-11)	(7.80e-11)	(7.81e-11)
Constant	-0.0431***	0.422***	0.163***	-0.0379***	-0.0377**	-0.112***	-0.0337**	-0.107***	-0.101***	-0.0937***
	(0.00888)	(0.0387)	(0.0149)	(0.00997)	(0.0151)	(0.00588)	(0.0160)	(0.00642)	(0.00960)	(0.0100)
Company FE		Yes	Yes							
Year FE			Yes			Yes		Yes	Yes	Yes
Branch FE				Yes			Yes	Yes		Yes
Land FE					Yes		Yes		Yes	Yes
Observations	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601
Adj. R-squared	0.0355	-0.145	0.862	0.0400	0.124	0.761	0.122	0.763	0.771	0.772
R-squared	0.0144	0.028	0.883	0.0168	0.0242	0.8759	0.0251	0.8761	0.8766	0.8769

Note: Standard errors in parentheses and significant at ***p < 0.01, **p < 0.05, *p < 0.1.

With regard to the regression on systematic risk (Beta), the findings are not clear. Thus, a significant and negative influence can only be identified for a one-year lag (see Table 25). The lagged CRER has a negative and partly significant influence on risk. As expected, the debt ratio has a positive and significant influence on the systematic risk meaning that companies with a high share of debt are more prone to systematic risk, whereas the influence of the uncertainty variable is very small and nearly zero. The positive and partly significant sign of the growth variable could be interpreted as strong growing companies becoming more dependent on the market, resulting in a higher Beta.

Thus, Hypothesis 3 can only be confirmed for Alpha in the short term and for Beta in the medium term. For Alpha in the medium term, the benefits of having real estate predominate.

Table 25: Regression on Beta with one-year lagged independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CRER2 (-1)	-0.00611***	-0.000161	0.00163	-0.00539***	-0.00329	-0.00548***	-0.00271	-0.00481**	-0.00220	-0.00163
	(0.00190)	(0.00433)	(0.00424)	(0.00195)	(0.00207)	(0.00183)	(0.00211)	(0.00187)	(0.00198)	(0.00203)
Debt_ratio (-1)	0.00275**	0.00269*	0.00218	0.00283***	0.00199*	0.00296***	0.00211*	0.00300***	0.00210*	0.00215**
	(0.00109)	(0.00138)	(0.00135)	(0.00109)	(0.00111)	(0.00106)	(0.00111)	(0.00106)	(0.00107)	(0.00108)
Size (-1)	0.000498***	0.00242***	0.000964**	0.000547***	0.000722***	0.000187	0.000770***	0.000219	0.000298**	0.000312**
	(0.000132)	(0.000341)	(0.000377)	(0.000137)	(0.000154)	(0.000130)	(0.000160)	(0.000135)	(0.000151)	(0.000158)
Growth (-1)	1.56e-05*	3.30e-05**	2.96e-05**	1.70e-05*	2.05e-05**	1.40e-05	2.15e-05**	1.54e-05*	1.68e-05*	1.76e-05*
	(9.28e-06)	(1.28e-05)	(1.25e-05)	(9.33e-06)	(9.47e-06)	(9.01e-06)	(9.51e-06)	(9.05e-06)	(9.19e-06)	(9.22e-06)
Uncertainty	-4.12e-11	-1.97e-11	-2.38e-11	-3.93e-11	-2.12e-11	-3.68e-11	-2.13e-11	-3.54e-11	-1.93e-11	-1.95e-11
	2.72e-11	4.02e-11	3.94e-11	2.74e-11	2.84e-11	2.63e-11	2.85e-11	2.65e-11	2.74e-11	2.75e-11
Constant	7.50e-05	-0.0266***	-0.00254	-0.00116	-0.00254	0.00829***	-0.00353	0.00758***	0.00660*	0.00637*
	(0.00184)	(0.00474)	(0.00513)	(0.00210)	(0.00351)	(0.00208)	(0.00369)	(0.00230)	(0.00350)	(0.00366)
Company FE		Yes	Yes							
Year FE			Yes			Yes		Yes	Yes	Yes
Branch FE				Yes			Yes	Yes		Yes
Land FE					Yes		Yes		Yes	Yes
Observations	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601	7,601
Adj. R-squared	0.00774	-0.167	-0.115	0.00903	0.0562	0.0415	0.0560	0.0415	0.0888	0.0892
R-squared	0.0041	0.009	0.056	0.0046	0.0071	0.0542	0.0073	0.0544	0.0550	0.0550

Note: Standard errors in parentheses and significant at ***p < 0.01, **p < 0.05, *p < 0.1.

The inclusion of uncertainty allows a differentiated look at how the before-mentioned short-term negative and then medium-term positive effects on the excess return (Alpha) are caused. As before, uncertainty is included as a dummy variable and is 1 if the standard deviation of the net sales is above the median and 0 otherwise. Across most models in Table 26, the results indicate that ownership and excess return (Alpha) show a positive relationship. This applies both to a short-term view without time-lag and to a view with a one–two-year lag.

The regression coefficients of the interaction term indicate that under uncertainty the positive effect between CRE ownership and the excess return is significantly lower. A repetition of the analysis with one–two-year lags even shows that the negative effect becomes significant in some cases. In regard to Hypothesis 4, this means that uncertainty in combination with a high CRER leads to a lower valuation by the capital market.

Table 26: Regression on Alpha with interaction and two-year lagged independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CRER1 (-1)	0.0453***	-0.0235	0.00235	0.0433***	0.0299*	-2.64e-05	0.0300*	-0.00137	0.00674	0.00756
	(0.0152)	(0.0452)	(0.0156)	(0.0153)	(0.0161)	(0.00754)	(0.0163)	(0.00762)	(0.00791)	(0.00801)
UCDummy (-1)	0.0171***	0.0499***	0.000528	0.0180***	0.0208***	0.000320	0.0219***	0.000641	0.00157	0.00211
	(0.00491)	(0.00886)	(0.00308)	(0.00493)	(0.00503)	(0.00226)	(0.00505)	(0.00226)	(0.00228)	(0.00228)
UCDummy (-1) # CRER1 (-1)	-0.0195	-0.0543	-0.0142	-0.0212	-0.0351*	0.000768	-0.0393*	-0.000451	-0.00537	-0.00827
	(0.0197)	(0.0402)	(0.0138)	(0.0198)	(0.0204)	(0.00925)	(0.0206)	(0.00927)	(0.00944)	(0.00949)
Debt_ratio (-1)	0.00316	-0.00198	-0.0191***	0.00336	0.00206	-0.00903***	0.00144	-0.00954***	-0.0101***	-0.0108***
	(0.00692)	(0.0115)	(0.00395)	(0.00697)	(0.00720)	(0.00308)	(0.00725)	(0.00309)	(0.00314)	(0.00316)
Size (-1)	-0.00446***	-0.0414***	-0.0229***	-0.00491***	-0.00611***	-0.00123***	-0.00663***	-0.00155***	-0.00244***	-0.00295***
	(0.000693)	(0.00288)	(0.00112)	(0.000721)	(0.000836)	(0.000384)	(0.000881)	(0.000396)	(0.000452)	(0.000471)
Growth (-1)	3.61e-05	-2.87e-05	-2.16e-05	2.27e-05	-4.99e-05	-1.65e-05	-6.12e-05	-2.01e-05	-4.12e-05	-4.65e-05*
	(6.39e-05)	(0.000105)	(3.62e-05)	(6.41e-05)	(6.53e-05)	(2.61e-05)	(6.56e-05)	(2.61e-05)	(2.66e-05)	(2.67e-05)
Constant	-0.0394***	0.443***	0.176***	-0.0327***	-0.0216	-0.0999***	-0.0168	-0.0951***	-0.0864***	-0.0790***
	(0.00894)	(0.0402)	(0.0151)	(0.0101)	(0.0157)	(0.00587)	(0.0166)	(0.00643)	(0.00981)	(0.0102)
Company FE		Yes	Yes							
Year FE			Yes			Yes		Yes	Yes	Yes
Branch FE				Yes			Yes	Yes		Yes
Land FE					Yes		Yes		Yes	Yes
Observations	7,401	7,401	7,401	7,401	7,401	7,401	7,401	7,401	7,401	7,401
Adj. R-squared	0.0330	-0.139	0.865	0.0385	0.122	0.761	0.121	0.763	0.770	0.772
R-squared	0.0221	0.037	0.886	0.0237	0.0275	0.8791	0.0280	0.8793	0.8799	0.8802

Note: Standard errors in parentheses and significant at ***p < 0.01, **p < 0.05, *p < 0.1.

5.5 Discussion of the results in the related context

The results of the first study in Chapter 5.4.1 show that no clear link can be identified between the uncertainty and CRE ownership. For example, the correlation matrix indicates a weak negative relationship. This is in line with the findings of Zhao and Sing (2016) and Ambrose *et al.* (2017). However, the multivariate regression analyses cannot confirm this. This could be due to the characteristics of the CRE itself, especially its specificity. Thus, long-term ownership decisions under uncertainty are not problematic per se. It should only be made with particular caution if the property is specific. In this case, the ownership decision is difficult to revise and the property can only be put to a new use at a value loss. Hypothesis 1, which suggests a positive relationship between specificity and CRE ownership, can be generally confirmed; however, if companies operate under high uncertainty, then particularly specific investments should to be considered critically. A corresponding behaviour can be observed in the data and regression analysis. With increasing specificity, CRE is also increasingly held under stable business environment. Uncertainty has the opposite effect, as the proportion of real estate held falls (H2). This could be explained by the fact that companies avoid specific investments in the case of new CRE investments due to an increased sunk-

cost risk, or postpone them into the future or, in the case of existing properties, have to depreciate real estate assets due to a change of use.

The previous argumentation also represents a possible explanation as to why CRE ownership under uncertainty could have a negative impact on firm performance (study 2). A first look at the proportion of real estate assets in Europe shows significant changes. Remarkable is the initially slight upward trend from about 2000 to 2012, which is interrupted by an abrupt rise in 2012, only to fall again continuously until 2020. The abrupt rise in 2012 can possibly be explained by two effects. The strong increase coincides exactly with the peak of the euro crisis. It is reasonable to assume that this caused firms' total assets to decline. These total assets serve as a quotient for calculating the CRE ratio. A decrease in total assets thus increases the ratio of ownership. Another explanation for the sharp increase could be the sample itself. For example, in the period around 2012, companies from more property-intensive countries in particular show corresponding data for the first time (e.g., Macedonia, Serbia, Latvia, Cyprus and Montenegro). The wide range could be related to the sector composition in the respective countries. Accordingly, companies in countries with strong primary and secondary sectors are more likely to own real estate than companies in countries with a highly developed tertiary or service sector.

Considering the high proportion of real estate assets to firms' total assets, it is obvious that their inefficient use will have an impact on firm performance on capital markets. The results of the general model (without taking the interaction between CRER and uncertainty into account) give an indication of this by decreasing Alpha when ownership rises in the same year. This would confirm H3. However, the relationship turns positive for a one-year lag and positive for a two-year lag. This delayed effect could be attributed to information asymmetries. For example, real estate assets are usually only reported on an annual rather than quarterly basis on the balance sheet, whereas procurement costs may already be included quarterly. A full pricing by the capital market is therefore only carried out with a delay. It is also conceivable that the mostly strategic advantages of ownership will only become apparent in the medium to long-term and that a positive correlation to the company's success will therefore only be discernible after a time lag (Seger *et al.,* 2020). The negative relation to the systematic risk (Beta) identified with a two-year lag can be explained by the deviating risk/return profile of real estate and the associated diversifying effect of ownership (Seiler *et al.,* 2001).

Repeated analysis with the interaction term has shown that under low uncertainty, Alpha is positive related to the CRE ratio without and with time lags. In the case of high uncertainty ownership, it seems to have a weak negative effect in the short term and in the medium term with a one–two-year lag on Alpha.

It seems that ignoring uncertainty in the provision of ownership has a negative impact on firm performance. The fact that ownership under uncertainty has a delayed effect on firm performance with annual lags also fits into the picture. This could be explained by the fact that the provided properties under uncertainty initially match the current demand; over

time, however, the probability of a changing demand increases, making partly specific real estate ownership a problem. Thus, specific and owned CRE are often difficult to revise, can only be sold at a discount and are a source of sunk costs. In contrast, under a stable business environment, the positive effects of ownership outweigh the negative effects. For example, strategic competitive advantages are more likely to be realised by holding specific property in such an environment. This is in line with the findings of the first study, according to which companies avoid the aforementioned disadvantages and negative effects on firm performance under uncertainty and adjust the provision of specific space. Especially in uncertain times, CRE ownership in Europe seems to act as a kind of unnecessary ballast. This shows that CREM, with a well-considered ownership strategy, can have a decisive influence on the success of a company in phases of structural changes or during the coronavirus crisis.

For CREM, but also for investors, it should be interesting that by holding ownership it is possible to reduce the systematic risk regardless of the uncertainty in which a company operates. Especially interesting is that companies under high uncertainty underperform (lower Alpha) with increasing ownership. These two insights can help shareholders optimise their portfolio strategy.

5.6 Conclusion, further research needs and limitations

Especially in times of broad structural change and the current pandemic situation, companies are confronted with increasing uncertainty. This becomes a challenge when companies have difficulties in estimating their future space requirements. There is a lack of clarity about the optimal form of provision: ownership, leasing or rental. Ownership is considered particularly bulky in uncertain times when there is an increased risk that the property has to be used for other purposes. Such a generalised statement is problematic, however. Ownership becomes a problem in dynamic times when it is company-specific and a sale is only possible via discounts. Companies seem to anticipate this in their investment behaviour by avoiding or postponing investments in specific properties under uncertainty or even writing-off specific real estate assets due to their transfer to a new use. This serves to avoid negative consequences for firm performance when holding property under uncertainty as demonstrated in relation to excess return. With regard to capital market performance, it appears that positive influences of ownership are overlaid under uncertainty by negative ones. Additionally, it can be observed that the excess returns decrease in the medium term as ownership under uncertainty increases. The results also indicate that regardless of the uncertainty situation ownership reduces the systematic risk. Thus, ownership seems to have a diversifying effect.

However, the study also contains limitations. For example, the key figure used here to measure the ownership ratio is somewhat imprecise. This is due to the fact that the real estate assets shown in balance sheets were accounted differently across Europe for the study period. In addition, the figure calculated here to measure specificity represents a first attempt. A broader selection and alternative proxies could be the starting point for further studies.

6 Structural changes and corporate real estate ownership

Title:	The impact of structural changes on corporate real estate ownership: Evidence from Germany
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Abstract

Although real estate resources represent a high percentage of the corporate assets of non-property companies, their future role is unclear. Longevity and difficulty in revising property-related decisions clash under dynamically changing environmental conditions. This makes it necessary to consider the ownership strategy and its altering role in order to avoid inefficiencies and not to hinder companies in mastering structural change successfully. In a first step, data from a telephone company survey (CATI) among 69 corporate real estate managers of German companies are grouped by performing a two-step cluster analysis according to the degree to which they are affected by structural change. The resulting clusters are then tested regarding differences in their ownership strategy. The empirical analysis shows that firms highly affected by structural change exhibit a higher willingness to decrease the proportion of ownership. The decline in real estate assets is particularly evident in the office segment and in increased acceptance of sale-and-rent-back solutions. First hints show that structural change and associated new business requirements change the relevance of CRE ownership. To avoid competitive disadvantages, especially European firms should scrutinise their high ownership ratios.

Keywords: structural change, corporate real estate ownership, firm performance, corporate real estate finance

6.1 Introduction

Since the early 2000s at least, the economies and societies of industrial nations have been undergoing massive structural change. This structural change is caused by megatrends such as digitalisation, socio-demographic change, globalisation and increasing intensity of competition. The huge impact of structural change and the adjustment processes required in companies are widely discussed in academic and political circles as well as in practice. The real estate-related discussion to date has focused primarily on such topics as the future of work and the further development of the digital infrastructure and its efficient use. So far, the effects of corporate transformation on the demand for real estate resources in the context of structural change have not yet been scientifically investigated. This has occurred despite the fact that the first companies have begun to rethink their real estate strategy in light of the radical changes and have announced drastic adjustments. For example, over the next 10 years, the 200 largest German companies are planning to change more than 50% of their real estate resources due to structural change (Pfnür, 2019). In general, although decision-makers in Germany responsible for the provision of real estate resources in companies are aware of the challenge of structural change to real estate management, an adjustment of resources still seems to be broadly pending. In an empirical survey in 2016, for example, only 12% saw their company well positioned for structural change in the real estate industry: 58% answered 'to some extent' while 30% gave a negative response to the question (Pfnür and Seger, 2017).

After such announcements and survey results, research and practice should be aware of the possible consequences for corporate real estate management (CREM) resulting from structural change. One valuable contribution to manage structural change could be made by CREM through the appropriate provision of real estate. Numerous articles have shown that the ownership strategy, i.e. the choice between ownership, leasing and renting, has considerable influence on the success of the company (Ambrose, 1990; Brounen and Eichholtz, 2005; Deng and Gyourko, 1999; Grönlund *et al*., 2008; Liow and Ooi, 2004; Nappi-Choulet *et al*., 2009; Ting, 2006; Liow, 2010; Ling *et al*., 2012; Rochdi, 2015; Rodriguez and Sirmans, 1996; Rutherford, 1990; Tuzel, 2010). As a result, for example, the long-term nature of ownership decisions in contrast to the changing business environment could have a negative impact on ownership-intensive firms. This becomes particularly clear when the long life cycle of a property is considered in relation to dynamic changes in the corporate environment (e.g. business cycles). On the other hand, ownership allows faster adjustments in the event of qualitative changes in space demand. In this case, rented or leased space provides less flexibility. In addition, the disposal or collateralisation of ownership can help secure liquidity, especially in uncertain structural changing times. Regardless of which advantages or disadvantages prevail, the far-sighted planning already described as a key element for CREM by Tay and Liow (2006) gains even more importance. This leads to the assumption that countries with average CRE ownership ratios in international comparison are suitable as test laboratories to observe an increase or decrease of ownership. According to older studies, especially German non-property companies, with a cross-sector average ownership ratio of

70% (Hartmann *et al.*, 2007), exhibit higher ratios compared with the average values in the US with 30% or 20% in Asia (Nappi-Choulet, 2002). In a newer comparison of the six largest European economies, Seger and Pfnür (2019) show that German companies have average ownership intensity. If not globally, then Germany at least represents average European CRE ownership conditions. The study, therefore, concentrates on Germany as a suitable and representative test laboratory.

Beyond initial vague assumptions, the effects of structural change on ownership strategy in research and practice have yet to be investigated. The first goal is to theoretically understand the impact of changes caused by structural change in the corporate environment on the importance of real estate ownership. This should serve as a starting point for a deeper analysis of individual trends of structural change and the changed role of ownership. In the third and final step, a case study will empirically demonstrate that companies manage their real estate holdings according to how they are affected. The study, therefore, pursues two research questions:

1. How does structural change alter the overall demand for CRE in terms of holding them in ownership?
2. Do corporates adjust their ownership in response to structural change?

To answer the first research question, Chapter 6.2 gives a literature review and provides initial explanations to the altering demand for CRE ownership under business environmental changes. For this purpose the chapter incorporates existing literature dealing with external conditions and their influence on the role of real estate ownership. It should also be noted that the focus in the following rests more on corporate real estate management than on general business literature. Although the latter is briefly outlined, it cannot be considered in its entirety due to the breadth of the subject matter. In this context, readers are referred to the work of Pfnür and Wagner (2020). Afterwards, the research design and methodology are presented in Chapter 6.3, subdivided into a preliminary and an empirical study. Chapter 6.4 shows and discusses the empirical findings with regard to the second research question, if corporates adjust their ownership in response to structural changes. The paper ends with a conclusion in last chapter.

6.2 Literature review

6.2.1 Modelling the alignment of space provision to structural change

The following model describes the continuous alignment of corporate real estate decisions with structural changes in the business environment. In general, a structure is understood to be a permanently existing relationship pattern among a set of elements. Elements can be “persons, things, behaviour patterns of persons and aggregates of economic subjects” (Picot, 1981). Through their relationship to each other, elements span economically relevant substructures such as supply and demand for products, technology, norms, infrastructure and sociological–demographic structures. If changes occur in this structure, however, this cannot

be automatically described as structural change. Picot (1981) suggests two criteria that must be fulfilled. First, the changes must be relatively unexpected and not within the normal expectation range of the decision-makers. The consequence is a long-term discontinuity in the existing structure. This does not necessarily mean that decision-makers have no knowledge about structural changes. Rather, there is a lack of clarity about how individual companies will be affected and what consequences will arise for them. Second, the change must be relevant to the achievement of the decision-makers' objectives.

Structural changes are triggered by megatrends, which originate from the technological, socio-cultural, political-legal and economic environment and affect companies and their decision-makers both directly and indirectly (Schehl, 1994). Ultimately, it is very difficult to define the extent to which single trends are responsible for structural changes. This is illustrated by the fact that megatrends and the resulting structural changes have a long-term effect and overlap with regular and cyclical influences. For this reason, regular and cyclical influences should, therefore, be considered separately from structural changes (Picot, 1981).

Following market-based approaches (e.g. Hitt *et al.*, 2014), the above-mentioned external business environmental conditions determine the contribution of business activities and resources on firm success and their importance for the firm. To secure the long-term success of the company, activities such as the CRE provision must be realigned to new conditions. This can be explained by a continuous reweighting of corporate objectives and strategy (Schehl, 1994) and corresponding adjustments in terms of business models, structures, processes and products (Pfnür and Wagner, 2020). As a result, the demand for space is changing. These organisational changes are ideally the basis for CREM's objectives, strategy and decisions (Nourse and Roulac, 1993). The provision of CRE resources, whether through ownership or alternative forms, influences finally the organisation's success.

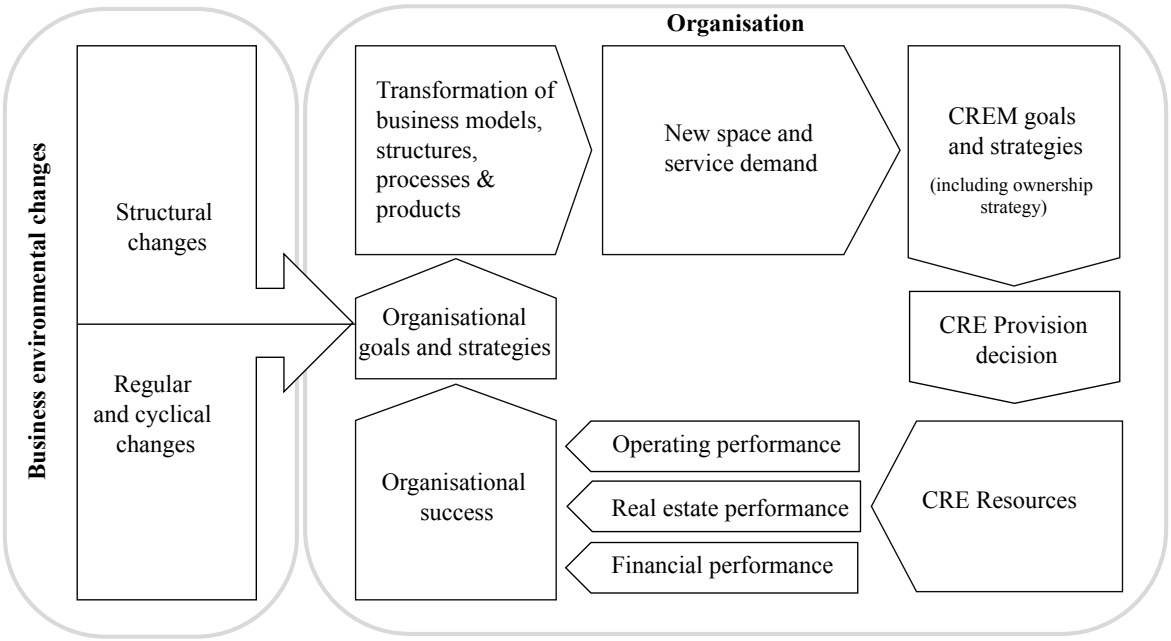
The holistic model proposed by Pfnür *et al.* (2019) for mapping the CREM influence on corporate success provides possible guidance of how the role of ownership changes.[16] Changes in the corporate environment can influence the importance of ownership by changing the relevance of the underlying success mechanisms and factors contained in the framework. This can be easily understood by looking at regular or cyclical changes and corresponding changed roles of ownership. Following a widespread assumption, ownership-intensive companies are more vulnerable to business cycles and the associated quantitative space demand due to lower flexibility, capital adjustment costs and risk-adjusted costs of capital (Tuzel, 2010; Zhao and Sing, 2011, 2016). As a result, ownership is associated with a higher cost of capital risk premium in negative than in positive phases of the economy. The influence on capital market performance can thus be described as countercyclical (Rochdi, 2015). Positive real estate cycles and changing values directly increase the success of a firm and indirectly make it possible to borrow more on property as collateral. Borrowing capacity, borrowing costs and leverage are adaptable (Gan, 2007a, 2007b; Chaney *et al.*, 2012). This can be

[16] A criticism of Heywood and Arkesteijn (2017) regarding models for describing the contribution of CREMs to corporate success lies in their lack of empirical confirmation. To counter this, the framework of Pfnür *et al.* (2019) was chosen.

continued with respect to further regular changes like in taxation (Alvayay *et al.*, 1995) or with respect to new accounting standards (e.g. Baltussen *et al.*, 2014).

The success impact then closes the cycle shown in Figure 25 and the reorientation of the company based on the corporate environment begins again. Mintzberg and Water (1985) describe these business adjustments not as unique, but rather as a continuous and iterative process. Following Cooke *et al.* (2019: p. 172), 'CRE managers need the ability to dynamically realign their CRE portfolio in response to planned and unforeseen changes'.

Figure 25: CRE provision as a process of alignment to the business environment



6.2.2 The changing role of ownership due to structural changes

As explained above, structural change is triggered by megatrends. To identify relevant trends that influence the real estate provision decision, a combination of expert interviews and a literature review was conducted.[17] This preliminary study has led to the identification of five megatrends increasing competition, globalisation, the offer of integrated solutions, digitalisation and demographic change that could influence the real estate provision. The influence of the megatrends on the future role of ownership is explained in the following.

An important driver of structural change currently is the increasing intensity of competition. Diop and Ambrose show the high relevance of the intensity of competition in product markets for corporate real estate holdings (Ambrose *et al.*, 2017; Diop, 2013, 2018). Where competition is low, high shares of CRE overcapacity can help non-property companies expand their production and reduce the potential profits of companies considering market entry. Accordingly, real estate property can be used strategically as a deterrent to entering a

[17] The procedure for the preliminary study is explained in more detail in Section 6.2.2.

market ('entry deterrence effect'). At the same time, higher pricing power in less-competitive product markets means that the higher costs associated with ownership can be passed on to customers. Diop (2018) is also able to show that companies in an environment of low competition have a declining beta value with increasing ownership intensity and, thus, improve their financial performance and achieve a positive effect on operating performance. The opposite effect can be seen in competition-intensive markets. In such an environment, competitors have no pricing power, so higher costs cannot be passed on through price adjustments and cost pressure increases. If competition grows due to increasing globalisation, then the importance of real estate ownership for a company's success would also have to change.

In close interaction with the increasing intensity of competition, globalisation is currently acting as a driver of structural change. In a global market environment, costs are incurred when developing new markets. Only companies with sufficient liquidity can cover these market entry costs. For instance, Chaney (2016) shows that companies with high liquidity in particular are increasingly exporting goods, whereas companies with lower liquidity are prevented from engaging in profitable exports. The high amount of capital tied up in real estate property reduces liquidity and, thus, makes it difficult to enter new markets. To avoid this, non-property companies can preferably lease or rent and use the funds in their core business (Zhao and Sing, 2011) especially to cover market entry costs.

A further key driver of structural change in the developed industrial nations is the trend towards the aggregation of products and services in the direction of integrated solutions. For example, traditional automobile manufacturers such as Daimler are becoming mobility service providers by offering additional financing or car-sharing services, which in turn should have an impact on their CRE portfolio. Pfnür and Seger (2017) show that the space demand for industrial real estate (light industrial) therefore shifts towards service and office space. At the same time, numerous studies show that office space is less frequently owned than industrial space due to its third-party usability (Pfnür, 2014). Similarly, generic space, such as office space, is mostly associated with lower strategic competitive advantages than specific space, which also argues against retaining property within company boundaries and for a decreasing importance of ownership.

Digitalisation as a structural change driver exerts a dual effect on real estate ownership. First, the range of products and services in the real estate provision is changing as a result of digitalisation. In the course of digital transformations of the real estate industry, new business models based on real estate as a service are emerging that can be used to better utilise real estate resources that were previously underutilised (Dabson and McAllister, 2014; Pfnür and Seger, 2017). The resulting rental models on a workstation basis provide companies with significantly greater flexibility and strategic options. On the one hand, temporary space can be provided instead of conventional rental solutions, leasing and ownership. On the other hand, rental models provide the strategic option of short-term renting in the event of market entry if uncertainty is high (Byrne *et al.*, 2002; Gibson and Lizieri, 1999a). The disadvantages of serviced office provision are the high costs and the risk of losing the space in

the short term, e.g. if the occupier is forced out by rent increases or the serviced space is closed due to a poor business model of the operator. Nevertheless, studies have shown that the financial industry, insurance companies and real estate companies in sectors of the growing tertiary sector in particular are increasingly demanding serviced real estate (Gibson and Lizieri, 1999a, 2000). It can, therefore, be assumed that the proportion of real estate ownership among companies will also decline as a result of alternative offers from the real estate industry.

The second effect of digitalisation as a driver of structural change on the ownership rate as discussed in the literature to date lies in the very nature of the matter. In line with the above-mentioned consequences for the decline in ownership rates due to the greater marketability of office and logistics space, the relative share of office and logistics space will increase due to the increasing economic significance of the quaternary information and communication technology sector (Sing, 2005; Wheaton, 1996).

Demographic change and its associated urbanisation intensify the trend of light industrial production and logistics shifting towards urban and densely populated regions in order to benefit from the proximity of the sales and labour markets (Weber and Scheunemann, 2018; Ratcliffe, 2001). However, as proximity to urban spaces rises, competition with other types of use also increases. Due to the sustainability trend and additional regulations to avoid land use, industrial sites represent an increasingly scarce and strategic resource. Accordingly, it can be assumed that with the increase in strategic relevance, location and customer proximity will in future have to be secured by ownership in the future, in a similar manner to the retail sector (Liow and Nappi-Choulet, 2008). In addition to the regional market dynamics of economic growth, there is also positive correlation between population development and, in particular, regional immigration with the serviced real estate offering (Byrne *et al*., 2002). The increase in alternatives to ownership associated with demographic change is likely to further diminish its importance in provision. The connection between the trends of structural change and the contribution of ownership is described in Table 27.

Table 27: Interrelationship between structural change and the changing role of ownership

Business environment	Mechanism	Driver	Ownership-related implications for success
Competition	Operating performance Financial performance	Strategic opportunities Risk-adjusted cost of capital	As competition increases in volatile markets, there are fewer opportunities to pass on to customers the excess capacity costs arising from the low adaptability of ownership. This is accompanied by a higher risk valuation by the capital market
Globalisation	Financial performance	Liquidity	In more global markets, the need for liquidity to cover market entry costs is increasing. Ownership ties up capital and, thus, is in conflict with the new liquidity requirements
Integrated solutions	Operating performance	Strategic opportunities	As a result of integrated solution offerings, the share of usually rented office space is increasing compared with strategic and usually owned industrial space. Ownership is becoming less important in the overall portfolio
Digitalisation	Operating performance	Flexibility Strategic opportunities	Digitisation allows working in serviced real estate as an alternative to ownership, which offers strategic opportunities and greater flexibility for the user. Due to improved and digitised inventory management systems, demand is shifting from more owned industrial properties to predominantly rented office space
Demography	Operating performance	Flexibility Strategic opportunities	Ownership offers the opportunity to secure the location and, thus, the proximity to customers in areas that are becoming denser due to demographic change and urbanisation. At the same time, population size and especially immigration are positively correlated with alternatives to ownership like the offer of 'serviced real estate', which opens up strategic options and flexibility

The above explanations show how changes in the corporate environment can alter the role of real estate ownership. As a consequence, companies affected by structural change must adjust their ownership strategy. This leads to the overriding hypothesis that the ownership strategy differs depending on the structural change situation. However, because the ownership strategy is strongly dependent on the respective type of use (Ambrose *et al.*, 2017), Table 28 distinguishes the hypotheses based on type of use.

Table 28: Hypothesis 1–Differences in CRE ownership by type of use & structural change

H1a	*The ownership strategy for office properties differs depending on structural change influences*
H1b	*The ownership strategy for manufacturing properties differs depending on structural change influences*
H1c	*The ownership strategy for R&D properties differs depending on structural change influences*
H1d	*The ownership strategy for logistic properties differs depending on structural change influences*
H1e	*The ownership strategy for selling properties differs depending on structural change influences*

According to Gibson and Lizieri (1999b), the corporate real estate portfolio comprises a core portfolio held in ownership and peripherally leased, or an 'as a service' solution provided at short notice. A reduction of ownership would have to be reflected in a varying demand for sale-and-rent-back transactions, rental models or 'as a service' solutions.[18] The question of sale-and-rent-back transactions in contrast to the general question of rent models or serviced solutions also provides insight into whether ownership adjustments are implemented in the existing portfolio (e.g. by the SLB) or only when new demand occurs. The following Table 29 outlines the corresponding hypotheses.

Table 29: Hypothesis 2–Differences in ownership-reducing solutions by structural change

H2a	*The demand for sale-and-rent back differs depending on structural change influences*
H2b	*The demand for rental models differs depending on structural change influences*
H2c	*The demand for as-a-service solutions differs depending on structural change influences*

Unlike the above hypotheses, it is not only a question of differences, but also of the directional tendency. Taken together, the explanations above lead to the assumption that the megatrends of structural change lead to a reduction rather than to an increase in ownership shares. This implies that more affected companies are more willing to reduce ownership than companies less affected by structural change, which results in the third and last hypothesis posited in Table 30.

Table 30: Hypothesis 3–More affected corporates tend to a lower level of ownership

H3	*Corporates that are highly affected by structural change have a higher willingness to reduce ownership than non-affected corporates*

The following chapter describes the empirical examination of the hypotheses presented and connections between structural change drivers and the ownership strategy.

[18] We selected rental solutions only as there is the risk that leases would be considered in the light of IFRS16 regulations. These regulations make long-term leases less attractive because they are accounted in the balance sheet (e.g. Baltussen *et al.*, 2014).

6.3 Research design and methodology

6.3.1 Preliminary study

To answer the research questions, it was first necessary to choose an appropriate research design. The study is organised in two methodological parts: a preliminary part and an empirical part. The focus in this article is on the empirical part, whereas the preliminary part is only briefly described as follows. Germany serves as the test laboratory for both parts of the study. This can be justified by the average ownership structure in a European comparison and the corresponding to presumed international representativeness (Seger and Pfnür, 2019). In the first part, a qualitative exploratory study was conducted to gain initial insight into the still unexplored relationship between structural change and the provision of real estate. Mayer (2004) suggests such an explorative setting as a suitable instrument to gain first insights into largely unexplored research questions. The aim was to identify megatrends of structural change that would lead to significant adjustments in the ownership strategy. The procedure in the preliminary study is similar to that of Pfnür and Wagner (2020). Using a semi-structured questionnaire, 25 interviews were conducted with selected decision-makers and experts. The survey was based on an initial literature search on general relationships between structural change and the provision of real estate. The interview participants were asked about possible megatrends that in their opinion change the role of real estate ownership for non-property companies. Following further literature research, participants' statements were coded and discussed, and a common understanding and terminology were developed. For reasons of clarity, the number was limited to five megatrends. The number of interviews ended at 25 as it became evident after 20 interviews that no further megatrends were added and data saturation had been reached. According to the German WZ2008 industry classification, for each of the eight sectors (A–H), three strategic decision-makers from the CREM were selected and interviewed. Four interviews were held for the manufacturing industry due to its high importance in Germany. Finally the interviews revealed the trends of increasing competition, globalisation, the offer of integrated solutions, digitalisation and demographic change to be the most relevant. Other relevant but not further considered trends are sustainability and climate change. These insights served as a basis for the literature review and the development of hypotheses (see Chapter 6.1.2), which are tested empirically in the second part of the study.

6.3.2 Data selection and procedure of the empirical study

Research of CRE ownership is usually based on balance sheet data. However, these data are somewhat inaccurate as firms are allowed to use different approaches to account for real estate assets. In order to counter this and to gain new insights through an alternative approach, a survey data collection format was chosen. The population of the empirical survey presented below comprises all enterprises that had more than 3.000 employees[19] in 2016

[19] The 3.000-employee level is in line with our experience in Central Europe that professional corporate real estate management can be expected in companies of this size and above. In exceptional cases, of course, this can also be the case for smaller companies.

and at least one of the keys A–H in the German classification scheme of economic activities called WZ2008.[20] The sample is divided according to the number of employees into those with more than 10.000 (large companies) and those with between 9.999 and 3.000 employees (SMEs). The Hoppenstedt company database recorded 313 firms as large companies as of April 2016. Adjusted for group networks and operations without their own real estate management, 155 companies remain whose officers are responsible for corporate real estate management (mostly Head of Corporate Real Estate Management). These individuals were identified manually and questioned as part of a complete survey using computer-assisted telephone interviews. This resulted in 52 interviews with large companies. Simultaneously the Hoppenstedt database recorded 918 companies from the Mittelstand (German small to medium-sized enterprises) as of the reporting date. Due to the large number and the considerable effort involved in identifying contact persons and arranging and conducting telephone interviews, a random sample of 157 companies was drawn. The persons responsible for corporate real estate management (mostly Finance Director or Head of Corporate Real Estate Management) were identified and interviewed by telephone. In this way, 17 interview partners for smaller companies could be realised. The utilisation rates were 34% for large companies and 11% for SMEs. This results in a total number of 69 interviews with a net sample of 312 and, thus, a 22% utilisation rate. These rates are within the usual range for such surveys. Following Armstrong and Averton (1977), the response behaviour of the first third of the respondents was compared with that of the last third in order to exclude a non-response bias. No significant differences could be found, which indicates with a high probability that there is no non-response bias. Based on the information in the Hoppenstedt company database, the sector distribution among large and medium-sized companies is only partly representative of the distribution in Germany. There is an overproportion of large companies compared with medium-sized companies. Simultaneously, the manufacturing industry is slightly over-represented in terms of the number of questionnaires returned by the 52 large companies (> 10.000 employees) participating. To ensure better representation and interpretability, a distinction is made in the following between the manufacturing industry, service providers, trade and infrastructure (transport, communication and energy) in terms of sector affiliation. The ownership rates were reported metrically as percentage values. The importance of the drivers of structural change is of decisive interest for further analysis. These drivers are competition, globalisation, digitalisation, integrated solutions and demography, and their relevance for the real estate economy was measured with the aid of a Likert scale ranging from 6 (‘fully agree’) to 1 (‘do not agree at all’). The same scaling was used for questions relating to the acceptance of sale-and-rent back, rental models and complete solutions (‘as a service’). This also allows conclusions to be drawn about the ownership strategy. At the same time, it is possible to determine which of the three solutions is favoured in the event of a reduction in ownership.

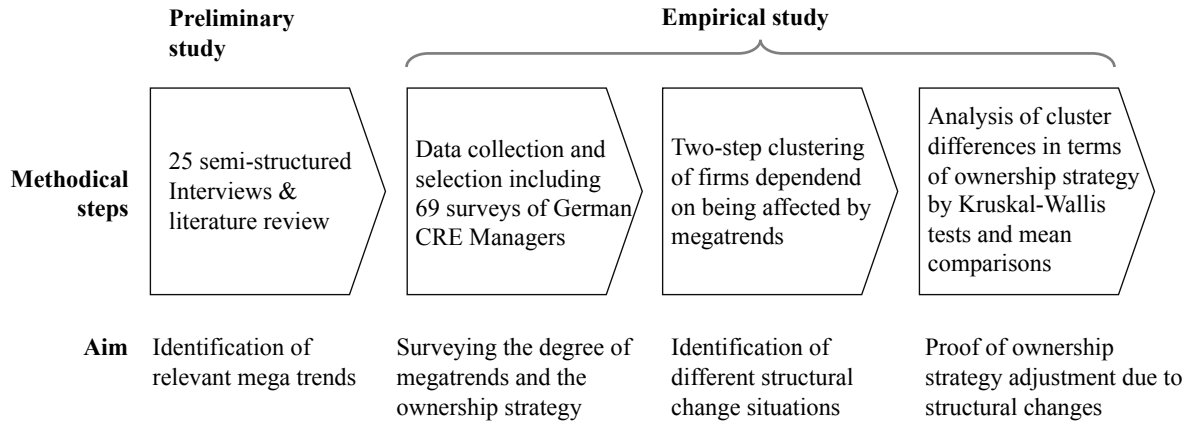
An initial descriptive evaluation of current and forecast ownership shares is used as the starting point for first identifying possible changes and tendencies in the ownership strategy. It

[20] Including the sectors of manufacturing, trade, services and infrastructure with transport, communication and energy.

is difficult to make a final decision on the basis of the data obtained here whether changes in the ownership strategy are attributable to evolutionary or cyclical changes in the corporate strategy or to structural change. The partly stable and partly gradually decreasing ownership rates do not seem to be caused by regular or cyclical changes. In such cases, a cyclical increase and decrease in ownership ratios over time would be expected. The published long-term ownership ratios, e.g. for the US or Europe, do not indicate such a pattern (Ghent *et al.*, 2019; Diop, 2018; Seger and Pfnür, 2019). In contrast, the recognisably slow and long-term process of ownership adjustments supports more the theory that they are caused by changing structural conditions.

To address the problem in the best possible way and establish a connection to structural change, the survey results are subjected to a two-step cluster analysis of the relevance of the five identified drivers. The resulting clusters represent differently affected situations. To demonstrate a connection between structural change and ownership strategy, the identified clusters are examined with regard to the industries they contain, company size, their assessment of ownership shares and their approval of the sale-and-rent-back model, rental model and complete solutions ('as a service'). The cluster differences are investigated by mean value comparisons and Kruskal–Wallis tests. The aim is to make clear that the ownership strategies of companies are actually affected by structural change. The entire research design is summarised in Figure 26.

Figure 26: Visualisation of research design and methodology



6.4 Analysis and findings

Table 31 and Figure 27 illustrate the first descriptive results to the development over time of average property ownership rates by use type. The high standard deviations (with values of 22.22 to 45.28) of ownership rates between enterprises are worthy of note. The high standard deviation may initially appear problematic in the light of the following mean comparisons. However, it can also be concluded from this that the ownership strategy is probably influenced by a wide variety of situational influences. Chapter 6.1 has already provided an overview of potential influences of the business environment on ownership strategy.

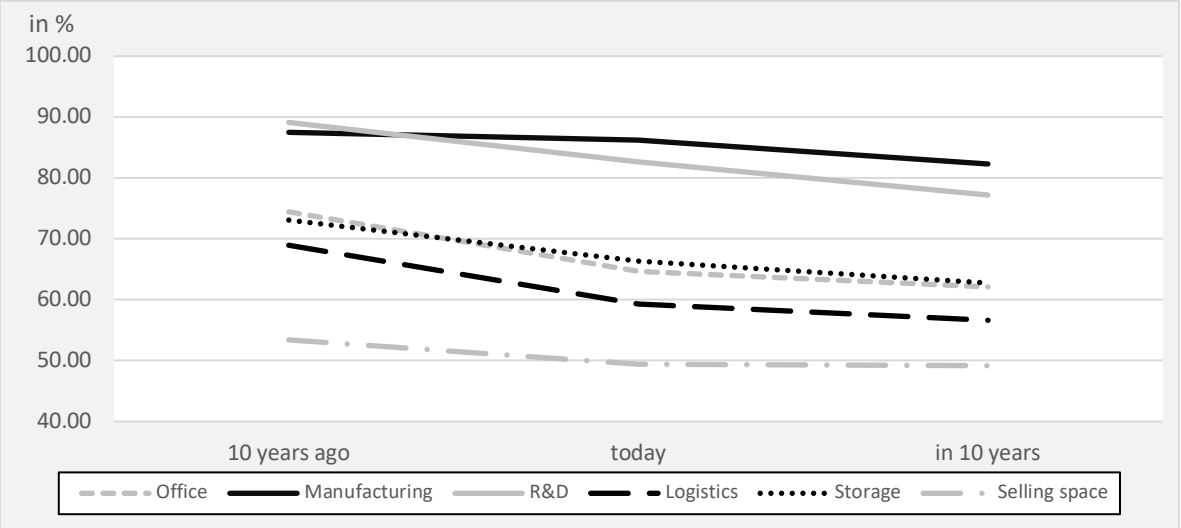
Whether structural change is one of these determinants is the subject of this paper. Nevertheless, the overall level of ownership ratios determined corresponds roughly to the ownership ratios for Germany described in Introduction. The results can therefore be considered reliable.

Table 31: Descriptive statistics of ownership ratios differentiated in use type and over time

	Office			Manufacturing			R&D			Logistics			Storage			Selling space		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
10 years ago	61	74.44	30.06	48	87.50	22.22	34	89.12	19.48	38	68.95	35.95	39	73.08	30.38	17	53.41	45.28
today	65	64.66	34.27	51	86.27	23.51	36	82.64	31.09	42	59.29	38.45	41	66.34	32.56	18	49.44	45.14
in 10 years	63	62.11	35.23	50	82.30	27.03	35	77.20	33.59	40	56.63	42.16	40	62.75	35.37	18	49.17	45.06

Note: For *n* observations, the table shows the average ownership rates (mean) and the corresponding standard deviation (S.D.) per time and use type.

Figure 27: Ownership ratios differentiated over time and according to use type



Note: Average and percentage shares of the property portfolio owned for each use type. 'Today' stands for the survey year 2016, with ownership rates also being surveyed for the period 10 years before and 10 years after this date.

In general, it can be stated that production and R&D properties are comparatively often held in ownership. In contrast, less specific and strategically relevant types of use, such as offices, logistics and warehouses, have significantly lower ownership rates.

The adjustment forecast for the next 10 years will vary depending on the type of use. Across all types of use, respondents expect a decrease ranging from a low 0.27% for sales to 5.44% for the R&D segment. Figure 27 shows the adjustments to real estate portfolios in asset classes, such as offices, retail, logistics and warehouses, are less pronounced than in previous years. These are instead third-party usable properties for which a market has already developed in Germany. Thus, disposal of properties in these segments can be realised more quickly than with more specific and less established asset classes. Adjustments to the structural change may therefore have started earlier. By contrast, ownership of production properties is adjusted substantially later. The reason for the lagged adjustment compared with the other asset classes could be the delayed establishment of the market for production real estate in

Germany. Investors have only recently begun to offer rental and leasing solutions on a small scale.

A first descriptive evaluation of the influence of structural change drivers on space requirements indicates that all respondents attach the highest relevance to increasing competition (Table 32). On a Likert scale ranging from 6 ('fully agree') to 1 ('do not agree at all'), increasing competition has the highest value, with an average value of 5.04. Following this, the companies surveyed see two trends with similar potential for change in globalisation and digitalisation, with averages of 4.13 and 4.12, respectively. On the other hand, the influence of integrated solutions and demography on space requirements is estimated to be lower, with means of 3.88 and 3.61, respectively. However, dependencies between the drivers could turn out to be problematic. Digitalisation, for example, favours globalisation, which in turn leads to increased competition. The correlation coefficients between the drivers do not exceed the proposed limit value of r = 0.5 (Backhaus *et al.*, 1996). Accordingly, the five drivers can be included in the analysis as cluster variables.

Table 32: Descriptive evaluation of the relevance of the drivers of structural change

Competition		Globalisation		Digitalisation		Integrated solutions		Demography	
Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
5.04	1.25	4.13	1.39	4.12	1.53	3.88	1.36	3.61	1.38

Note: For $n = 68$ observations, the table shows the average agreement and standard deviation (S.D.) to the individual megatrends. The agreement can be low (1) to high (6).

Neither the Kolmogorov–Smirnova nor Shapiro–Wilk test indicates a normal distribution. Accordingly, the cluster solutions are examined later using the non-parametric Kruskal–Wallis test. To avoid statistical inaccuracies, a hierarchical cluster analysis using the single-linkage algorithm identified two outliers due to their high distance measure, which have been excluded from further analysis.

The following two-step cluster analysis contains in the first step a hierarchical–agglomerative method, Ward algorithm and the squared Euclidean distance measure. The optimal number of clusters is identified by using the so-called 'elbow criterion' (Appendix C1). Afterwards, the solution is used as the starting solution for the second partitioning procedure with k-means algorithm. This results in an optimal four-cluster solution. An ANOVA test and a discriminant analysis were performed once to check the internal homogeneity and heterogeneity of cluster quality among the clusters. Both methods confirm the quality of the four-cluster solution.[21] Accordingly, the following four clusters are represented as line plots of the mean values in Figure 28. In addition, differences between the clusters in terms of sector composition and company size can be identified using chi-squared tests and contingency tables (Appendix C2).

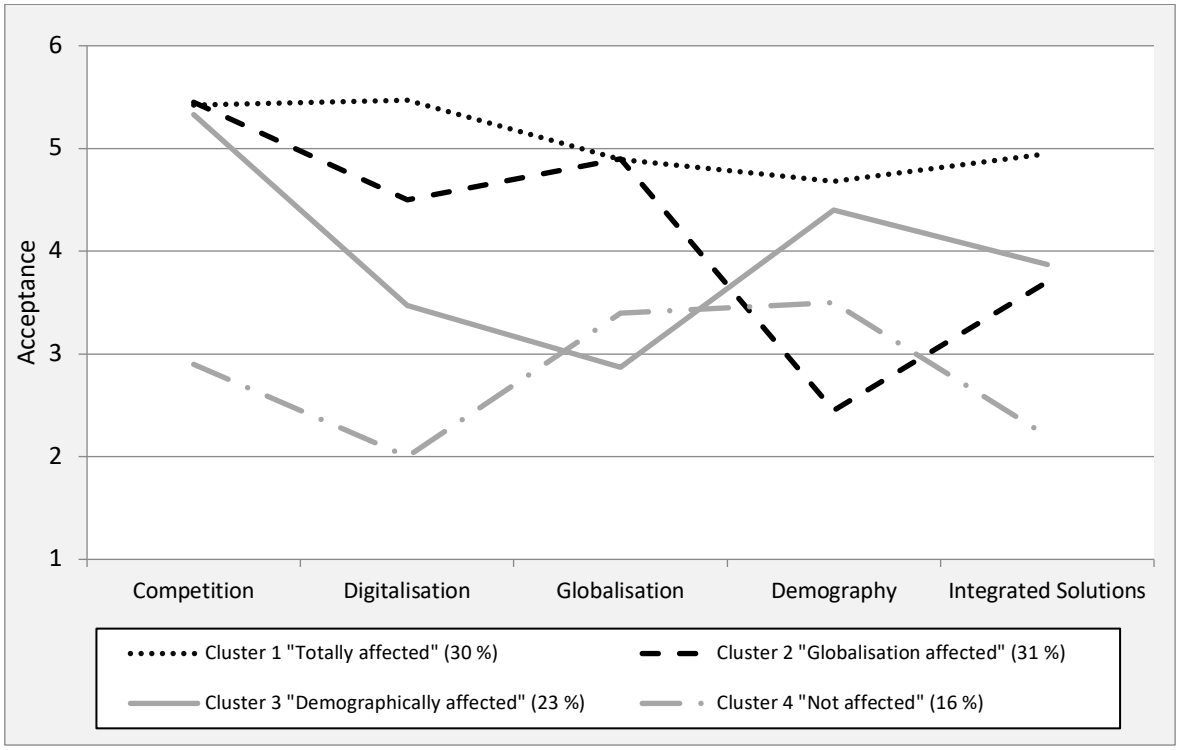
[21] The meaningfulness of tests on differences between groupings obtained by cluster analysis with the same variables is, in fact, limited but does serve as a first indication of stable cluster solutions.

In the first cluster of 'totally affected', approximately 30% of the CREM managers surveyed attach the highest importance to all five drivers in the cluster. A significant chi-squared test also indicates that the clusters differ in firm size (chi-squared (3, n = 64) = 8.581, p = .035). The cluster consists mainly of large companies with more than 20.000 employees.[22] There are no significant differences with regard to the industry composition, which is partly due to the insufficient sample in relation to the number of clusters and industries. Graphically, however, it can be seen that the 'totally affected' group comprises an above-average number of manufacturing companies. The second cluster of 'globalisation affected' comprises 31% of the total sample of firms. The cluster is exposed to competition, globalisation and, in some cases, digital change. Demography, on the other hand, plays only a subordinate role. The industry composition and size of the companies roughly correspond to the sample distribution. As a result, no statement can be made as to whether a particular industry or company of a certain size can be assessed as 'globalisation affected'. In the third cluster, the 'demographically affected', comprising approximately 23% of the total sample, the surveyed managers evaluate the competition and demographic change very high. Globalisation, on the other hand, plays a minor role. The companies in this cluster have fewer than 20.000 employees. The cluster is characterised by firms from the transport, communications and energy sectors. Represented by the fourth cluster, the 'not affected', only one-sixth of the companies (16% of the sample) see their real estate management as largely unaffected by the drivers of structural change. Trends such as digitalisation and integrated solutions are particularly rejected. The companies in this cluster rarely have more than 20.000 employees and are increasingly active in the service sector.

It can thus be summarised that companies are exposed to different contextual situations as a result of structural change. As theoretically explained previously CREM goals and strategies, including the ownership strategy, need to be aligned in order to meet the new requirements.

[22] The chi-square test for cluster inequality in terms of company size is not possible due to the small number of SMEs and the number of clusters. To address this, for both the test and the graphs shown in the Appendix, the entire sample was subdivided into < 20.000 employees and very large companies > 20.000.

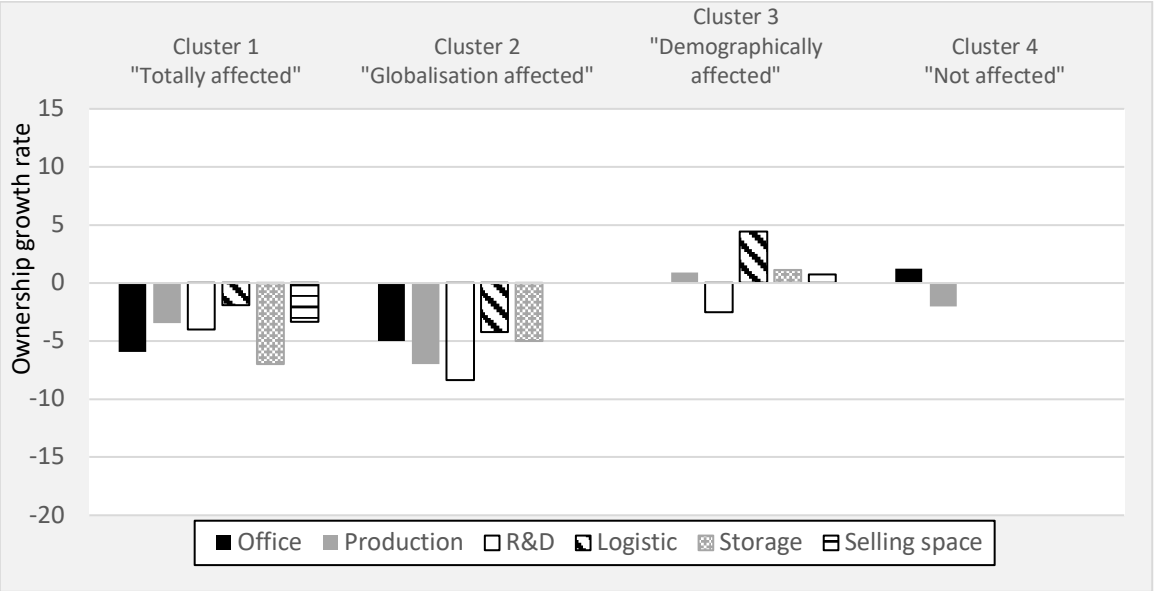
Figure 28: Affected situations of CREM in structural change as a cluster solution



Note: For n = 64 observations, the four identified clusters are presented as average profiles per megatrend of structural change. The agreement can be low (1) to high (6).

As shown in Figure 27, the proportion of corporate real estate owned by companies in Germany has declined slightly. According to the results of the survey, this trend will continue over the next 10 years. To reveal a possible connection between structural change and ownership strategy, the current ownership rates are deducted from the forecast ownership rates for each use type. The resulting rate of change is then plotted per cluster and allows a comparison between the clusters (see Figure 29). This provides insights if the ownership strategy differs between structural change situations.

Figure 29: Ownership growth rates by structural change situation and use type



Note: Expected ownership growth rates between today and in 10 years shown as an average value for each cluster and use type.

Graphically, the grouped companies show significant differences in their ownership growth rates. The two clusters of companies most affected by structural change 'totally affected' and 'globalisation affected' show clear signs of increased interest after divestments compared with the fewer and unaffected clusters of companies 'demographically affected' and 'not affected'. It should be noted that in four out of six use types, companies not affected do not expect any adjustment of ownership, expect a slight increase in the office segment and plan a slight decline in production real estate. The lack of willingness to sell off property indicates a first negative connection between structural change and property ownership. In line with this argument, the cluster of 'demographically affected' companies with high approval ratings for the drivers of competition and demography should also show a tendency towards disinvestment. However, the opposite is the case and the grouped companies are forecasting an increasing share of ownership in the use types of production, logistics, storage and selling space. This confirms the assumption that not all drivers of structural change are pushing companies towards an 'asset-light' strategy. For example, the connection between demographic changes in the form of increased urbanisation, with greater proximity to customers and, thus, increasing relevance of the location as a reason for real estate ownership, was already mentioned. This is confirmed by two observations. On the one hand, ownership increases in precisely those use types in which proximity to the sales market plays a role or will play an increasing role. Second, this also explains why in Cluster 1, the 'totally affected' with a high degree of approval in demography, does not decrease as much as in Cluster 2 with very low demographic challenges. It would have been obvious to assume that Cluster 1 has the highest approval for disinvestments; instead, the use types of production and logistics have a lower proportion of ownership compared with Cluster 2.

The cluster differences found can only be detected to a limited extent using the Kruskal–Wallis test. Thus, significant differences between the clusters can only be determined in the office segment and only Hypothesis H1a can be confirmed, whereas Hypotheses H1b–H1f cannot be confirmed statistically (Table 34). If only the significant average property adjustments and the average office segment ranks between the clusters are compared, then it becomes clear that clusters more affected by structural change tend toward a property reduction ('totally affected' = 6%) more so than companies less affected ('globalisation affected' = 5%; 'demographically affected' = 0%; 'not affected' = +2%). This confirms Hypothesis H3 that highly structural change-affected corporates have a higher willingness to reduce ownership than non-affected corporates. However, a subsequent post-hoc Dunn–Bonferroni test was not able to show any significant difference in pairs between the clusters, which is the reason why it is not possible to conclusively clarify empirically which of the individual clusters actually differ and are tending to reduce their real estate ownership (Table 35).

Table 33: Kruskal–Wallis statistic using structural change clusters as grouping variable

	Forecast ownership adjustment for office	Forecast ownership adjustment for production	Forecast ownership adjustment for R&D	Forecast ownership adjustment for logistics	Forecast ownership adjustment for storage	Forecast ownership adjustment for retail
Chi-squared	9.183	3.927	1.258	4.219	3.577	1.951
df	3	3	3	3	3	3
Asymp. Sig.	0.027	0.27	0.739	0.239	0.311	0.583

Note: The table shows test statistics of the global Kruskal–Wallis test. The test examined whether there are any differences between the forecast property adjustments per affected situation of Corporate Real Estate Management. A distinction was made between the usage types per column (office, production, R&D space, logistics, storage and retail). It is a chi-squared-distributed test statistic with *df* degrees of freedom.

Table 34: Pairwise cluster comparison by Dunn–Bonferroni test

Sample 1 – Sample 2	Test statistic	Std. Error	Std. Test statistic	Sig.	Adj. Sig.
2 – 1	0.938	4.775	0.196	0.844	1.000
2 – 3	–11.208	4.863	–2.305	0.021	0.127
2 – 4	–13.062	5.956	–2.193	0.028	0.170
1 – 3	–10.271	5.117	–2.007	0.045	0.268
1 – 4	–12.125	6.165	–1.967	0.049	0.295
3 – 4	–1.854	6.233	–0.297	0.766	1.000

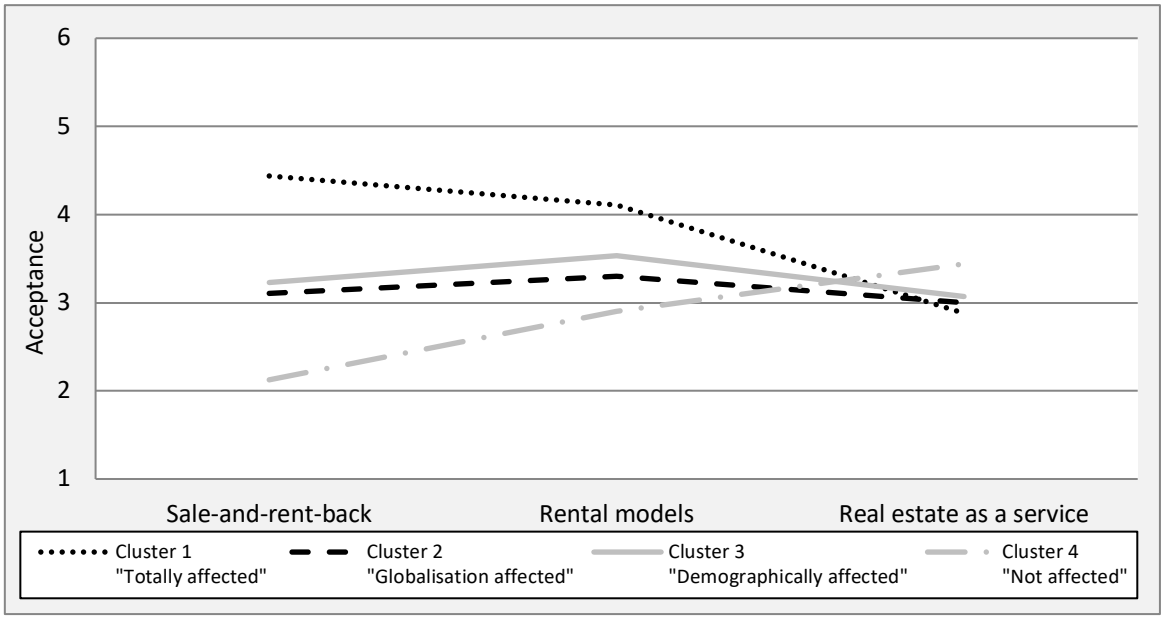
Note: The table shows test statistics of the cluster solutions compared office ownership adjustments pairwise. The first column shows six possible pair comparisons. The significance levels were adjusted (adj. sig.) to avoid a cumulative alpha error due to multiple testing.

Furthermore, numerous studies have shown that ownership strategy is strongly dependent on the industry. In this context, it should be noted that despite of some weak industry differences in the contingency table (Appendix C2), no statistically significant differences could be observed by conducting a chi-squared test. This ensures that the ownership strategies, which differ from cluster to cluster, are not due to the differing composition of industries within the clusters.

In a further step, the clustered companies were examined with regard to their approval of ownership-reducing measures. A higher level of approval would confirm the above findings and provide insight into preferred ownership reduction measures. As explained in Chapter 6.2.2, the indicators used are the levels of approval for sale-and-rent-back transactions,

rental models and ‘real estate as a service’. The average agreement per cluster and measure is shown in Figure 30. It is striking that the general tendency towards property-reducing measures increases with affectedness. For companies in the cluster of ‘not affected’, rental models hardly come into consideration and sale-and-rent-back transactions do not feature at all. By contrast, the values for the other clusters are significantly higher. The measures are rated nearly the highest by the companies in the cluster of ‘totally affected’, which supports the results to date. This only applies to ‘real estate as a service’ to a limited extent. Here, the values are nearly at the same level across the clusters. It also becomes clear that sale-and-rent-back transactions are gaining in importance with increasing concern and are ultimately weighted slightly more heavily in the ‘totally affected’ cluster than rental models. From this, it can be concluded that lesser-affected companies are gradually adjusting their ownership share in the course of new requirements, whereas companies in a state of flux are actively reducing their holdings through sale-and-rent-back transactions.

Figure 30: Acceptance to selected measures to pursue an ownership-reducing strategy



Note: For n = 65 observations, the agreement within the four identified clusters is presented as an average profile of the respective property-reducing measures. The agreement can be low (1) to high (6).

The differences described between the clusters turn out to be partially statistically significant after execution of the Kruskal–Wallis test. In the case of sale-and-rent-back transactions, the test performed globally on all clusters indicates differences between the clusters (Table 36). On the other hand, no significant differences can be empirically proven with regard to the approval of rental models or ‘as a service’ solutions. Accordingly, Hypothesis 2a can be confirmed while Hypotheses 2b and 2c do not apply.

Table 35: Kruskal–Wallis test statistic using structural change clusters

	Sale-and-rent-back	Rental models	Real estate -as-a-service
Chi-squared	17.444	4.506	2.738
df	3	3	3
Asymp. Sig.	0.001	0.212	0.434

Note: The table shows test statistics of the global Kruskal–Wallis test. The test examined whether there are any differences between ownership-reducing measures per affected situation of corporate real estate management. It is a chi-squared-distributed test statistic with *df* degrees of freedom.

At the same time, it is interesting to see whether the identified significant differences also include differences in their consent to sale-and-rent-back transactions in a pairwise comparison. This makes it possible to determine whether companies more affected by structural change tend to take ownership-reducing measures rather than companies less affected (H3). The post-hoc Dunn–Bonferroni test showed significant differences between the clusters of 'totally affected' and 'not affected' and between 'globalisation affected' and 'not affected' (Table 37). A comparison of mean values between the clusters clearly shows that the first cluster of totally affected (4.438) companies has a significantly higher agreement to sale-and-rent-back transactions than the clusters of 'globalisation affected' (3.105) or 'not affected' (2.125). Empirically, as well as with the help of graphical evaluations of mean value profiles, the results suggest that non-property companies are increasingly reducing ownership in response to structural change and, thus, are tending towards an 'asset-light' strategy. Hypothesis 3 can therefore be confirmed in a rudimentary way. Nevertheless, further causal analyses are required to confirm this relation with absolute certainty. It should also be noted that the overall sample has a higher proportion of large companies compared with the actual corporate landscape in Germany. Thus, the results are only partially representative and, therefore, apply more to large companies and only to a limited extent to small ones.

Table 36: Pairwise cluster comparison using Dunn–Bonferroni test

Sample 1 – Sample 2	Test statistic	Std. Error	Std. Test statistic	Sig.	Adj. Sig.
2 – 1	12.168	6.699	1.816	0.069	0.416
2 – 3	13.486	7.143	1.888	0.059	0.354
2 – 4	27.312	6.883	3.968	0.000	0.000
1 – 3	–1.318	5.721	–0.230	0.818	1.000
1 – 4	15.145	5.394	2.808	0.005	0.03
3 – 4	13.827	5.935	2.338	0.020	0.119

Note: The table shows test statistics of the cluster solutions compared in pairs. The first column shows six possible pair comparisons. The significance levels were adjusted (adj. sig.) to avoid a cumulative alpha error due to multiple testing.

6.5 Conclusion

Overall, the empirical results show that the ownership rates in the portfolios of German companies are projected to decrease. However, it is doubtful whether they will fall from the current average of about 75% in medium-sized companies and about 66% in large companies to the usual level of 20–30% in America and Asia. Due to the study design, it cannot be said with ultimate certainty; however, there is much to suggest that the cause of decline in corporate real estate ownership lies more in structural change than in evolutionary and cyclical changes in the corporate environment. Even though we have not conducted any

empirical studies on this, there is much evidence to suggest that this is a general mechanism that is also found in other European countries and in other regions of the world. This is particularly worthy of note because the current state of research postulates that property ownership has a negative impact on financial performance due, for example, to higher capital adjustment costs, whereas 'asset-light' strategies are seen as more advantageous. The empirical results suggest that the cause for the planned decrease in real estate ownership will continue to lie less in the interdependency of financial performance than in operating performance and real estate performance. As shown theoretically, the reasons for a changed role of ownership lie in its changed strategic importance and the possibility of influencing business flexibility. However, this requires proactive, far-sighted CREM that is focused on creating a holistic contribution to success. Accordingly, the role of real estate ownership must not only be considered from the perspective of corporate finance, but also from the user's perspective. This alignment to business operations ultimately represents the greatest contribution of CREM to the firm's success (Kenley and Heywood, 2000). A short-term-oriented management approach to occupancy cost reduction must be aware of the long-term importance of ownership. Especially in the light of structural change, ownership must be considered from the user's perspective in terms of its strategic importance and flexibility effects. This also means that there must be an intensive exchange between the units whose success is influenced by real estate-related decisions (corporate finance, core business and CREM). If this does not happen, then inefficiencies are the result and the successful management of structural change is questionable.

The results show that depending on the structural change situation, companies focus particularly on reducing office ownership. The hurdles seem to be possibly lowest here due to most properties being generic and third-party usable space, which is why non-property companies and investors in this segment are most likely to converge. Reduction in the ownership ratio is not only achieved in the case of new demand by providing space via rental models. The pressure to act appears to be so great that portfolio holdings are actively disposed of via sale-and-rent-back transactions.

A general examination of ownership ratios per type of use over time also suggests that considerable adjustments have already been made, particularly in the segment of established asset classes such as office, retail, logistics and selling space (retail), and these are continuing in a weaker form. On the other hand, companies are considering adjustments in production and R&D for the first time. This has implications for other players in the real estate industry. For example, it opens up new market segments for real estate service providers such as property and asset managers as property is more likely to be outsourced with the corresponding management services. Investors also gain access to a poorly developed market segment with a different risk–return profile and critical mass. For example, the market volume for light industrial real estate in Germany is estimated at 600 billion Euro, which is similar to the market volume for office real estate (Pfnür and Seger, 2017).

Of course, there are other possible reasons for a change in the importance of real estate ownership that have not yet been discussed in the literature but should be addressed in the future. Real estate is increasingly being used as an instrument to enhance corporate identity. The high specificity of such real estate forces companies to hold them on their own. However, even in times of great uncertainty and a possible loss of use, this could mean an increased risk of sunk costs. This first consideration and analysis of the above context should be used as a starting point for deeper analyses of the causal relationships. In addition to the survey conducted here, balance sheet data could also provide further information on the interrelationships.

7 Conclusion and contributions

7.1 General conclusion

This thesis aimed to investigate the importance of real estate ownership in the context of a changing and uncertain business environment. Previous research has mainly focused on the relationship between the holding of corporate real estate and capital market performance. The fact that the ownership strategy and its importance for corporate success depend significantly on the corporate environment has only rarely been the subject of studies. This research gap becomes particularly apparent in a changing business environment such as exists today. However, an understanding of adjustments in the CRE portfolio and the provision of space require an understanding of its role in the success of the company. Maximising this success is ultimately the guiding motive for CREM to rethink its provisioning strategy. In order to close the research gaps, two overarching research questions were formulated. The first question, "Through which mechanisms does real estate provision affect corporate success and what empirical relationships can be revealed?" is answered primarily in Chapter 2 and partially through Chapters 3–5. The second research question concentrates on "How does a changing and increasingly uncertain business environment alter the real estate ownership strategy and what are the empirical implications for business success?" Chapters 3–5 and especially Chapter 6 provide those answers.

With reference to the first research question, a theoretical understanding about the influence of CRE provision on corporate success is conceptualised in Chapter 2. Using multidimensional scaling of a dataset from a survey of CREM management decision makers, a framework for the contribution of CREM to corporate success is developed and empirically tested. The mechanisms and performance drivers identified in this framework provide initial explanations of the extent to which ownership could have an impact on corporate success. In Chapters 3–5, the empirical influence of holding CRE is revealed on the basis of balance sheet and capital market datasets. Across all studies, a relationship between holding ownership and company success as measured by capital market performance can be demonstrated. Consistently, the studies show that property ownership has a negative effect on a firm's abnormal return, especially in the short run. In the medium term, however, this effect seems to reverse and turn positive in some cases. The results are less clear with regard to the impact on a company's systematic risk. If property is priced with a risk premium in the UK (Article 3), then a partly negative relation emerges in Germany (Article 2) as well as in the overall European context (Article 4). A clear relationship between the provision by ownership and the success of the company can be empirically revealed, although no clear link to systematic risk can be demonstrated. This also reflects the partly unclear study situation in the literature. These discrepancies could also be the result of changes and uncertainties in the business environment, which were not included in the first analysis and could, fundamentally, change the role of holding property. Whether this is the case was addressed by the second research question.

With reference to the second research question, Chapters 3–6 have in common that as a first step they investigate the ownership strategy on the basis of balance sheet figures on real estate assets or via company surveys and they provide an initial overview of how ownership strategy has changed. The picture that emerges over a period of the last 20 years is almost identical across all the investigations. Ownership is declining and therefore seems to be gradually losing importance in Europe. However, the holding of CRE is subject to its own dynamics in each sector or for each type of use. This general trend toward a decline in CRE ownership is being halted in specific phases and even reversed. The findings suggest, for example, that there are precise times of crisis, such as during the global economic crisis or the European debt crisis and has led to a short-term rethinking of the ownership strategy. A similar picture emerges for some industries in the UK after the BREXIT vote. In the long-term, however, companies seem to be following the path of ownership reduction again. A differentiated look at the types of use gives an idea of which properties have been disposed of so far and which are planned to be further reduced in the future. In the past, for example, companies in the offices, retail, logistics and warehouse segments have reduced their ownership levels. These are properties that can be used by third parties and for which real estate markets have already developed. However, this momentum is expected to slow down in the coming years as potentials that are apparently easy to realise have been raised here. The situation is different in the industrial real estate segment. In this segment, only little ownership has been reduced so far. However, the reduction trend seems to pick up speed in the next 10 years. Just looking at the developments of ownership ratios, there is growing evidence that its documented adjustments can be explained by real estate-related, company-related and changing business environmental factors.

Chapter 3 shows that the contribution of real estate ownership to business success is strongly dependent on the business context, especially on the industry to which the company belongs. In this context, it can be shown that not only primary business activities should be considered, but also additional business activities appear to influence the relevance of ownership. This is of particular interest because companies are increasingly expanding their core business activities by offering integrated solutions. Accordingly, it will become more important in the future to consider additional business areas with partly completely different provisioning requirements and ownership strategies.

In Chapter 4, business environmental conditions, especially economic fluctuations, are taken into account. Here, depending on the current upswing or downswing, it is shown that real estate ownership is priced anti-cyclically. This confirms that real estate ownership in a dynamic environment proves to be problematic for corporate success, especially in the event of downturns. This suggests a certain inflexibility associated with ownership as it is difficult to dispose of property in the event of a reduced demand for space.

Chapter 5 followed similar argumentation. The assumption that increased uncertainty could have a general impact on ownership strategy is not initially confirmed. However, the results suggest that this may be related to property-related characteristics such as real estate

specificity. Thus, mostly long-term ownership investments are not problematic in general, but only when they are highly specific. If these spaces are no longer needed, then the investment decision is difficult to revise because the spaces have low third-party usability and can only be sold at a discount. The analyses show that in light of increasing specificity, companies operating under certainty also hold more property. In the case of uncertain conditions, this relationship is reversed and companies avoid investing in property because they want to avoid sunk costs or postpone the investment to the future.

In this case, owning mostly specific property in an uncertain corporate context would therefore appear to be disadvantageous. Simultaneously, the anecdotal opinion in CREM still prevails that real estate ownership is suitable as a backup through which capitalisation can stabilise a company's liquidity in the event of a financial distress. However, the results show a clear relationship that holding property under low uncertainty initially has a positive effect on a firm's abnormal return. In contrast, the assumption that holding property under uncertainty reduces the abnormal return is confirmed. Thus, ownership can act as ballast during times of uncertainty.

Chapter 6, the final chapter, investigated the importance of ownership in terms of structural change. Here it can be observed that CREM feels highly challenged, for example, in the provision of space by trends of structural change such as increasing competition, digitalisation, integrated solution offerings, demographic change and globalisation. A clustering of companies based on their estimated affectedness by these trends shows that particularly challenged companies are more likely to reduce ownership. It can thus be seen that overall structural changes in the economy are reducing the importance of ownership. For companies whose pressure is high, sale-and-lease-back transactions are seen as an effective way to reduce ownership.

With regard to the second research question, it can be concluded that ownership is declining in a changing environment. The continued provision of CRE via ownership can lead to reduced corporate success in the course of economic downturns or in light of uncertainty.

7.2 Theoretical contributions

Overall, the cumulative thesis provides an answer to the question of what role real estate ownership plays for non-property companies in an increasingly dynamic and uncertain business environment. In doing so, the thesis refers to two research fields of CREM: first, research on control concepts, performance measurement tools and the identification of value drivers, and second, research on corporate real estate finance. At the same time, the thesis ties in with considerations from the still young general real estate transformation literature and challenges them by questioning the significance of real estate ownership in a changing corporate environment.

Understanding the importance of real estate ownership in an increasingly dynamic corporate environment characterised by uncertainty requires a deep and holistic understanding of the CREM contribution and provision in general to success. Only this can allow an understanding

of the motives of CREM decision makers to adapt their current ownership strategy in whole. While the research field on control concepts, performance measurement tools and the identification of value drivers provides first hints, it falls short of providing a framework that both works holistically for theory and practice alike and is empirically robust (Arkjestein 2018). This gap is closed with the development and empirical confirmation of a holistic framework to explain the contribution of CREM to corporate success. The overall picture that emerges highlights the multi-layered and complex nature of CREM's contribution to success. Thus, it becomes apparent that real estate management decisions such as ownership decisions have to be taken into account by weighing their contribution to corporate success across partly conflicting success mechanisms and their short- to long-term and their organisational effectiveness from the individual workplace up to the corporate level. Furthermore, the framework is ideal as a holistic classification of different CREM research directions.

After creating a holistic understanding of success by CREM, the further studies in Chapters 3–5 tie in with studies from the research area of corporate real estate finance. In this strand of literature, there has been a determined attempt to examine the impact of holding property on corporate success, specifically capital market performance. However, a review of previous studies shows that they are mainly focused on the U.S. and Asian region. However, the transferability of the results to European markets is doubtful due to different conditions. European countries have been the subject of only occasional studies, some of which are very outdated or based on inaccurate data. The investigation of the two largest European economies, Germany and the UK, and the extension to the European market should close this gap. The inclusion of more precise ratios should also give a more accurate picture of the importance of real estate assets in the balance sheet than previously achieved. In this context, the studies show that holding property has a negative effect on corporate performance in the short-term, but then a more positive effect in the long-term. This is one possible explanation why European companies hold on to ownership more than U.S. and Asian companies. At the same time, however, the studies also reveal contradictions, which are also reflected in the literature. Thus, the different analyses show both a positive and a partly negative influence on the systematic risk of a company. These differences lead to the assumption that the importance of ownership is co-determined by factors external to real estate, to the company and especially to the company itself (e.g. significant dynamics and uncertainties). The inclusion of some of these factors was intended to clarify this relationship, which has hardly been empirically investigated in the literature to date. The first indications already emerged from a simple review of past and forecast ownership strategies, which are subject to dynamics in general but also in light of times of crisis. At the same time, it was possible for the first time to compare the property assets of all listed European countries. The resulting differences are in some cases considerable. For example, real estate assets as a percentage of total corporate assets range from 8% for Norway to 45% for Croatia. These country differences again underline the business context in light of the discussion about the right form of provision.

At the same time, the results of Chapter 3 suggest that in light of investigations about the influence of ownership on capital market performance, not only the industry affiliation of

the core business but also additional business segments need to be included. The exclusion may have led to biases and sometimes contradictory results in past studies.

In addition, adopting the methodological approach of Rochdi (2015) and applying it to the UK confirms that holding property is priced counter-cyclically into capital market performance. This is further evidence that especially during economic downturns, holding property turns out to be problematic and, therefore, has a negative impact on corporate performance.

This idea was taken up again in Chapter 5. Thus, it is obvious that in light of the long-term nature of a real estate investment and the simultaneous difficulty of revising it, ownership is avoided under uncertainty. This fact, which was already taken up by Zhao and Sing (2016) and Ambrose *et al.* (2017), could not be confirmed. The thesis has extended this fact by showing in a more differentiated view that just specific investments are avoided. At the same time, the dissertation shows for the first time that holding the often-specific property has a negative effect on capital market performance especially under uncertainty, while under low uncertainty a more positive relationship emerges.

In a final step, the thesis ties in with research on the transformation of the real estate industry as a result of the current broad structural change. In doing so, the thesis deepens the previous discussion by Pfnür and Wagner (2020) by not looking at overall real estate industry changes, but instead focusing on non-property companies and their ownership strategy as a result of structural change. The results indicate for a first time in the discourse on ownership a connection between structural change and a decreasing importance of ownership.

In sum, the thesis expands the previous discussion on the importance of ownership by a stronger consideration of the corporate context, especially of dynamics and uncertainties. The newly gained insights indicate a decreasing importance of ownership.

7.3 Practical contributions

In addition to theoretical contributions, this dissertation provides valuable implications and contributions especially for decision makers in corporate real estate management.

The initially developed framework for explaining the relationship between CREM and corporate success provides novel support for the institutionalisation of the CREM function in companies. The framework clarifies that real estate-related decisions have a direct impact on success through different mechanisms, in the short- to long-term, and at different organisational levels from the individual workplace to the group level. CREM decisions, therefore, must be made holistically and with simultaneous consideration of all possible influences. This illustrates the necessity of organising CREM into a central function rather than, as is so often the case, into decentralised functions such as construction management, facility management, real estate financing and workplace management. Operational and tactical tasks, by contrast, could still be decentralised.

It becomes clear that CREM, as a centrally organised function, must take into account internal and external stakeholders and weigh up their sometimes-conflicting interests. In the

future, CREM should not only be measured on the basis of its direct real estate-related impact but also on the basis of its indirect operating and financial impact.

With regard to the central question of how the importance of ownership is changing in an increasingly dynamic and uncertain environment, there are additional implications for CREM. To begin with, it is difficult to derive a general target ownership rate from the analyses according to which CREM should follow in the future. Rather, it becomes apparent that CREM must derive the optimal ownership strategy based on its individual situation from both internal and external contexts. This can already be seen in the mere industry affiliation of the respective business areas in which a company operates.

In addition, CREM is required to include dynamics and uncertainty in the course of providing ownership. For example, the anti-cyclical impact of ownership as a result of economic upturns and downturns suggests that timing determines the benefits of ownership. CREM must anticipate this by constantly evaluating the overall situation and adjusting investment behaviour accordingly. The aim is to dispose of future surplus ownership in good time before downturns begin.

Likewise, CREM has to deal with possible uncertainties in light of the ownership provision. If the future demand for space can be clearly estimated and is subject to few uncertainties, then it is important to make specific space available through ownership. In this way, long-term strategic competitive advantages can be developed with firm-specific space, which have to be "locked-in" through ownership. It only becomes problematic if their long-term use is uncertain. In the event of a decline in space demand, a resale would be associated with loss-making discounts and sunk costs. Thus, CREM is advised to distance itself from the still frequently prevailing opinion that ownership in uncertain times is beneficial as a backup to stabilise liquidity through its sale when, in fact, the opposite is the case. Property in uncertain times represents a kind of ballast and has a negative impact on the company's success.

Against the backdrop of an increasingly dynamic and uncertain corporate environment, it is thus reasonable to assume that the importance of real estate ownership is declining. This is confirmed by the fact that companies affected by structural change in particular are increasingly reducing ownership. The identified response strategy patterns allow conclusions on how the CREM of companies facing a transformation of their real estate portfolio can adapt their ownership strategy. In this context, it is worth noting that German non-property companies, for example, expect to have to adjust almost 50% of their portfolios over the next 10 years (Pfnür, 2019). The reduction of ownership of initially generic types of use that can be used by third parties, such as office, retail or logistics, appears to be a high advantageous reaction. Once the "low hanging fruit" has been removed, ownership of less third-party-useable CRE, such as light industrial real estate, can also be reduced. Overall, depending on the type of use, non-property companies are forecast to reduce their ownership by up to 5.5% over the next 10 years.

This significant reduction in ownership as a result of an increasingly dynamic and uncertain business environment represents a paradigm shift for European companies. The reduction of

ownership ultimately triggers a user-driven structural change in the real estate industry, which offers opportunities and challenges for investors and service providers.

Investors are challenged to adapt their supply quantitatively as well as qualitatively to the "asset light" strategy of non-property companies. This means that the capital market volume of investment vehicles (REITs, funds etc.) must generally be expanded. At the same time, the supply must be aligned with the new user requirements in terms of shorter availability of space (e.g. serviced spaces) and should also include solutions for asset classes that have not yet been established (e.g. light industrial real estate). Especially by offering light industrial space, investors could benefit from the attractive risk–return ratio that exists in this segment.

Simultaneously, service providers are also challenged. If, for example, non-property companies want to reduce their ownership via sale-and-lease-back transactions, then they also want to get rid of space management at the same time (Pfnür and Seger, 2017). Furthermore, service providers are required to expand the range of management services for still young asset classes such as light industrial real estate.

In summary, it can be stated that non-property companies should hold less property in the future due to increasing change and uncertainties. If European companies in particular continue to maintain their high ownership rates, then this will have a negative impact on their corporate success. A corresponding reduction in ownership is therefore necessary. At the same time, this can only succeed in a joint effort with investors and service providers.

7.4 Limitations and further research

This dissertation offers valuable contributions for research and corporate practice, but is also not free of some limitations. Although these have already been addressed in the individual contributions, they will be presented in the following in order to provide new starting points for future research projects.

One limitation that affects all studies included in the thesis is the selection of the companies considered in the analyses. Only decision makers from large or medium-sized companies were interviewed in the management surveys. A similar problem arises in light of the analyses carried out on the relationship between real estate assets reported on the balance sheet and capital market performance. Due to the availability of data, only stock exchange-listed companies could be included. The fact that the importance of CREM in general and real estate ownership can differ depending on the size of the company and its capital market orientation has already been demonstrated in the literature. Therefore, the generated results are only of limited general applicability. At the same time, future research projects could address this limitation.

Further limitations arise from the fact that the framework development for mapping the relationship between CREM and corporate success refers to a pluralistic understanding of success, according to which the company success of a results from the fulfilment of all

stakeholder interests. However, only CREM managers were surveyed. Accordingly, it would be interesting in future research efforts to survey not only CREM, but also users, corporate finance, HR or IT. In parallel, the article suggests including financial, user-oriented or real estate performance-based aspects in real estate-related decisions at the same time as this could otherwise lead to inefficient solutions. Future research might take this up and prove it on the basis of the company's success.

In addition, in the studies of this thesis, real estate assets are measured in terms of their impact on the fulfilment of shareholder interests in the sense of maximising the market value of the equity employed. Here a conflict could be assumed to the interest pluralistic approach mentioned before. However, this is only partly the case because the thesis follows the assumption that in the end, all CREM activities relevant for success have to be reflected in the capital market performance of a company, which is why this was finally used as a proxy for the overall company success. Nevertheless, a repetition of the investigations with the help of alternative performance indicators would be interesting.

The choice of other proxies should also be critically scrutinised. First and foremost, the real estate assets reported on the balance sheet only represent the ownership intensity of a company to a limited extent. The proxy only indicates the real estate assets as a proportion of total assets and is still subject to a certain degree of inaccuracy. Thus, real estate values on the balance sheet can be reported both according to historical construction costs and according to actual market value. Compared to earlier studies, which very often refer to the much less accurate PP&E (property, plant and equipment) balance sheet ratio, the ratios used here are nevertheless considered to be more accurate. Nevertheless, future studies could try to work around this problem. One possibility for this could be the new IFRS regulations, which necessitate the reporting of rental or leasing liabilities in the balance sheet in the future and therefore provide a more detailed insight. Equally critical is the attempt to approximate the specificity of the real estate portfolio using ratios such as research and development expenditures or advertising costs. Even though this approach has been adopted from capital structure theory studies to measure asset specificity, the accuracy of the proxies can only be assumed.

Ultimately, the moment-related collection of data in light of the survey conducted with the (above-mentioned) CREM managers on structural change and its influence on provision also turns out to be a constraint. Structural changes fluctuate and can be more intense in some periods and less intense in others. In order to incorporate this into the study design, a longitudinal data set would have been useful, which would have considered the adjustment pressure on CREM over a period of time. At the same time, the explorative study design via cluster analysis does not represent a causal relationship between structural change and the reduction of ownership, but only provides initial indications for this.

The limitations outlined above are not the only starting point for scientific research. Rather, scientists can start directly from the thesis by going into more detail on possible megatrends, drivers and dynamics in the corporate environment and their effects on the significance of

real estate ownership. In addition to a more differentiated identification of possible trends, the resulting new requirements for the provision of space could also be addressed. This could be used to examine whether the pressure to adapt is more likely to be due to new user requirements (e.g. as a result of greater demand for flexibility) or as in the past due to the bottleneck factor of capital. The knowledge gained from this could then be used to derive suitable provisioning alternatives particularly in the respective company situation. In addition, a further examination of possible trends in the reduction of ownership could also reveal possible counter-trends. In this context, it should be remembered that numerous non-property companies do invest in property in order to present an image of its corporate ethos or power through its specific building design. Also, in light of the high rental costs in urban centres, large German companies redevelop former sites to residential properties. These spaces are then cheaply let to employees in order to gain an advantage in the competition for skilled workers. However, these developments are likely to play only a minor role. A significant impact can be expected from the Covid-19 pandemic, which has accelerated structural change processes and likely also long-term investment decisions. This is where the most urgent need for further research becomes apparent.

To conclude, this cumulative dissertation addresses the question of how the importance of real estate ownership for non-property companies is changing against the background of an increasingly dynamic and uncertain business environment. It is shown that both structural and economic changes with all the resulting uncertainties should be included in the ownership strategy. Overall, the investigations indicate that as a result of the changes mentioned, ownership represents a kind of ballast and should be reduced. This is of particular interest in light of the fact that European companies still have a comparatively high level of ownership, which is likely to have a negative impact on companies' success and competitiveness if the current strategy is maintained. However, it can be assumed that there is a growing awareness in CREM of the advantages and disadvantages of ownership in an increasingly dynamic and uncertain corporate environment.

References

Abdou, O. A. & Lorsch, H. G. (1994a). The impact of the building indoor environment on occupant productivity-part 1: recent studies, measures, and costs. *ASHRAE Transactions-American Society of Heating Refrigerating Airconditioning Engin*, 100(2), 741-749.

Abdou, O. A. & Lorsch, H. G. (1994b). The impact of the building indoor environment on occupant productivity-part 2: Effect of temperature", *ASHRAE Transactions-American Society of Heating Refrigerating Airconditioning Engin*, 100(2), 895-901.

Adams, A. T., & Clarke, R. T. (1996). Stock market reaction to sale and leaseback announcements in the UK. *Journal of Property Research*, *13*(1), 31-46.

Alvayay, J. R., Rutherford, R. C., & Smith, W. S. (1995). Tax rules and the sale and leaseback of corporate real estate. *Real Estate Economics* 23(2), 207-238.

Ambrose, B. W. (1990). Corporate real estate's impact on the takeover market. *The Journal of Real Estate Finance and Economics* 3(4), 307-322.

Ambrose, B. W., Diop, M., & Yoshida, J. (2017). Product market competition and corporate real estate investment under demand uncertainty. *Real Estate Economics* 45(3), 521-590.

Amit, R., & Schoemaker, P. J. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33-46.

Anderson, E., & Schmittlein, D. C. (1984). Integration of the sales force: An empirical examination. *The Rand Journal of Economics*, 385-395.

Appel-Meulenbroeck, R., Clippard, M. & Pfnür, A. (2018). The effectiveness of physical office environments for employee outcomes: An interdisciplinary perspective of research efforts. *Journal of Corporate Real Estate*, 20(1), 56-80.

Appel-Meulenbroek, R., & Haynes, B. (2014). An overview of steps and tools for the corporate real estate strategy alignment process. *Corporate Real Estate Journal*, *4*(1), 44-61.

Appel-Meulenbroek, R., de Vries, B., & Weggeman, M. (2017). Knowledge sharing behavior: the role of spatial design in buildings. *Environment and Behavior*, *49*(8), 874-903.

Appel-Meulenbroek, R., Havermans, D., Janssen, I., & Kempen, A. V. (2010). Corporate branding: an exploration of the influence of CRE. *Journal of Corporate Real Estate*, *12*(1), 47-59.

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.

Arnold, R., & John, T. (1991). The financing of corporate real estate: a survey. *Journal of Real Estate Research*, *6*(2), 217-240.

Backhaus, K., Erichson, B., Plinke, W., & Weiber, R. (1996). Multivariate Analysemethoden: eine anwendungsorientierte Einführung. (8th ed.). Springer, Berlin.

Bakker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International*, *13*(3), 209-223.

Baltussen, S., Schelle, T., Appel-Meulenbroek, R., Van Egmond, B., Hesselink, M, & Van Leersum, L. (2014). Lease accounting trouble looms for corporate real estate management. *Journal of Corporate Real Estate,* 16(3), 182-202.

Barkham, R., & Park, A. U. (2011). Lease versus buy decision for corporate real estate in the UK. *Journal of Corporate Real Estate*, *13*(3), 157-168.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120.

Belsley, D. A., Kuh, E., & Welsch, R. E. (2005). Regression diagnostics: Identifying influential data and sources of collinearity. John Wiley & Sons, New York.

Berger, P. G., E. Ofek. & D. L. Yermack (1997). Management entrenchment and capital structure decisions. *The Journal of Finance*, 52(4), 1411-1438.

Bhaduri, S. N. (2002). Determinants of corporate borrowing: some evidence from the Indian corporate structure. *Journal of Economics and Finance*, *26*(2), 200-215.

Bodin-Danielsson, C. & Bodin, L. (2008). Office type in relation to health, well-being, and job satisfaction among employees. *Environment and Behavior*, *40*(5), 636-668.

Booth, M. (2000). How corporate real estate affects shareholder value. *Journal of Corporate Real Estate*, *2*(1), 19-28.

Borg, I. & Staufenbiel, T. (2007). Theorien und Methoden der Skalierung, Hans Huber, Bern.

Bosch-Badia, M. T., Montllor-Serrats, J., Panosa-Gubau, A. M., & Tarrazon-Rodon, M. A. (2017). Corporate real estate, capital structure and value creation. *Journal of European Real Estate Research*, *10*(3), 384-404.

Bradley, S. J. (2002). What's working? Briefing and evaluating workplace performance improvement. *Journal of Corporate Real Estate*, *4*(2), 150-150.

Brounen, D., & Eichholtz, P. M. A. (2005). Corporate Real Estate Ownership Implications: International Performance Evidence. *The Journal of Real Estate Finance and Economics,* 30(4), 429-445.

Brounen, D., Colliander, G., & Eichholtz, P. (2005). Corporate real estate and stock performance in the international retail sector. *Journal of Corporate Real Estate*, *7*(4), 287-299.

Brown, Z., Cole, R. J., Robinson, J., & Dowlatabadi, H. (2010). Evaluating user experience in green buildings in relation to workplace culture and context. *Facilities*, *28*(3/4), 225-238.

Brückner, R., Lehmann, P., Schmidt, M. H., & Stehle, R. (2015). Fama/French factor Dataset for Germany. Humboldt University Berlin. available at: http://www.wiwi.hu-berlin.de/professuren/bwl/bb/data/fama-french-factors-germany (accessed 10 November 2019).

Bryan, A. B. (2004). The state of sale-leasebacks: What corporations can and should expect today. *Journal of Corporate Real Estate*, *6*(1), 15-23.

Budie, B., Appel-Meulenbroek, R., Kemperman, A., & Weijs-Perree, M. (2019). Employee satisfaction with the physical work environment: The importance of a need-based approach. *International Journal of Strategic Property Management*, *23*(1), 36-49.

Buliga, O., Scheiner, C. W., & Voigt, K. I. (2016). Business model innovation and organizational resilience: towards an integrated conceptual framework. *Journal of Business Economics*, *86*(6), 647-670.

Byrne, P., Lizieri, C., & Worzala, E. (2002). The location of executive suites and business centers in the United States. *Journal of Real Estate Portfolio Management,* 8(3), 255-270.

Cavanaugh, J. K., & Garen, J. (1997). Asset specificity, unionization and the firm's use of debt. *Managerial and Decision Economics*, *18*(3), 255-269.

Chaney, T. (2016). Liquidity constrained exporters. *Journal of Economic Dynamics and Control,* 72, 141-154.

Chaney, T., Sraer, D., & Thesmar, D. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review,* 102(6), 2381-2409.

Cheong, K., & Kim, C. (1997). Corporate real estate holdings and the value of the firm in Korea. *Journal of Real Estate Research*, *13*(3), 273-295.

Clements-Croome, D. & Li, B. (1997). Assesment of the Influence of Indoor Environment on the Job Stress and Productivity of Occupants in Offices. *Healthy Buildings – International Conference/IAQ'97*, 495–500.

Colliers (2021). Deutschland: Bürovermietung und Investment 2020/2021. Marktbericht.

Cooke, H., Appel-Meulenbroek, R., & Arentze, T. (2019). Adjustment of corporate real estate during a period of significant business change. *International Journal of Strategic Property Management*, 23(3), 171-186.

Crommen, M. (2001). Finanzierung von Unternehmensimmobilien: eine Shareholder-value-orientierte Analyse. Schriften zur Immobilienökonomie Vol. 17. Müller, Köln.

Cvijanovi , D. (2014). Real estate prices and firm capital structure. *The Review of Financial Studies*, *27*(9), 2690-2735.

Dabson, A., & McAllister, P. (2014). The role of serviced offices in the corporate real estate supply chain. Working Papers in Real Estate & Planning, 01/14. Working Paper. University of Reading, Reading.

Davis, G. F., Kabo, F. W. & Wineman, J. D. (2009). Spatial and social networks in organizational innovation", *Environment and Behavior*, 41(3), 427-442.

De Jonge, H. (1996). De toegevoegde waarde van concernhuisvesting. Paper presented at NSC-conference, Amsterdam.

De Vries, J. C., de Jonge, H., & van der Voordt, D. J. M. (2008). Impact of real estate interventions on organisational performance. *Journal of Corporate Real Estate*, *10*(3).

Demirer, I., Madanoglu, M., & Kizildag, M. (2018). Corporate real estate holdings and financial performance of restaurant firms. *Journal of Hospitality Financial Management*, *26*(1), 2.

Deng, X., Ong, S. E., & Qian, M. (2018). Real estate risk, corporate investment and financing choice. *The Journal of Real Estate Finance and Economics*, *57*(1), 87-113.

Deng, Y., & Gyourko, J. (1999). Real estate ownership by non-real estate firms: An estimate of the impact on firm returns. Unpublished Working Paper, Wharton School.

Devaney, S. P., & Lizieri, C. M. (2004). Sale and Leaseback, Asset Outsourcing and Capital Market Impacts. *Journal of Corporate Real Estate*, *6*(2), 118-132.

Diller, H., & Lorch, K. (1984). Strukturwandel als Herausforderung für die Wirtschafts- und Unterne menspolitik. In: Diller H. (Ed.) *Strukturwandel, innovative Unternehmenspolitik und Strukturreformen in der öffentlichen Verwaltung*. Schriften des Fachbereichs Wirtschafts- und Organisationswissenschaften der Hochschule der Bundeswehr Hamburg. Vol. 7. Heymanns Verlag KG, Berlin, Bonn, München, 7-38.

Diop, M. (2013). Product Market Competition, Real Estate and Stock Returns. Dissertation Draft, Real Estate Research Institute, Pennsylvania State University, Pennsylvania, USA.

Diop, M. (2018). Real Estate Investments, Product Market Competition and Stock Returns. *Real Estate Economics,* 46(2), 291-333.

Dong, Y., Leung, C. K. Y., & Cai, D. (2012). What Drives Fixed Asset Holding and Risk-Adjusted Performance of Corporates in China? An Empirical Analysis. *International Real Estate Review*, *15*(2), 141-164.

Du, Hongyan, & Yongkai Ma. (2012). Corporate Real Estate, Capital Structure and Stock Performance: Evidence from China. *International Real Estate Review,* 15(1), 107-126.

Du, J., Leung, C., & Chu, D. (2014). Return Enhancing, Cash-rich or simply Empire-Building? An Empirical Investigation of Corporate Real Estate Holdings. *International Real Estate Review*, *17*(3), 301-357.

Dyllick, T. (1992). Management der Umweltbeziehungen - Öffentliche Auseinandersetzungen als Herausforderungen, Gabler, Wiesbaden.

Edelhoff, D. (2013). Unternehmenswertsteigerung durch Corporate Real Estate Management. In: Poddig, T. & Schindler, F. (Ed.). *Aspekte aus der Finanz- und Immobilienwirtschaft*, Festschrift für Heinz Rehkugler, Bad Soden /Ts., 71–82.

Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., & Bauman, A. (2019). Is activity-based working impacting health, work performance and perceptions? A systematic review. *Building Research & Information*, *47*(4), 468-479.

Eugene, F., & French, K. (1992). The cross-section of expected stock returns. *Journal of Finance*, *47*(2), 427-465.

Eurostat (2019). GDP and main components. available at: https://ec.europa.eu/eurostat/web/national-accounts/data/database (accessed 10 November 2019).

Ezzell, J. R., & Vora, P. P. (2001). Leasing versus purchasing: Direct evidence on a corporation's motivations for leasing and consequences of leasing. *The Quarterly Review of Economics and Finance*, *41*(1), 33-47.

Falkenbach, H., Lindholm, A. L., & Schleich, H. (2010). Review articles: environmental sustainability: drivers for the real estate investor. *Journal of Real Estate Literature*, *18*(2), 201-223.

Farzana, F., & Murtaza, M. G. (2009). Risk and real estate ownership: empirical evidence of hotels in Singapore. *Journal of Bangladesh Institute of Planners*, *2*, 193-200.

Fisher, L. M. (2004). The wealth effects of sale and leasebacks: new evidence. *Real Estate Economics*, *32*(4), 619-643.

Fougère, D., Lecat, R., & Ray, S. (2019). Real estate prices and corporate investment: theory and evidence of heterogeneous effects across firms. *Journal of Money, Credit and Banking*, *51*(6), 1503-1546.

Funke, C., Gebken, T., Michel, G., & Johanning, L. (2010). Real estate risk in equity returns. Working paper.

Gan, J. (2007a). Collateral, debt capacity, and corporate investment: Evidence from a natural experiment. *Journal of Financial Economics,* 85(3), 709-734.

Gan, J. (2007b). The real effects of asset market bubbles: Loan-and firm-level evidence of a lending channel. *The Review of Financial Studies,* 20(6), 1941-1973.

Ghemawat, P., & del Sol, P. (1998). Commitment versus Flexibility? *California Management Review*, 40(4), 26–42.

Ghent, A. C., Torous, W. N., & Valkanov, R. I. (2019). Commercial real estate as an asset class. *Annual Review of Financial Economics*, 11, 153-171.

Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A Test of the Efficiency of a Given Portfolio. *Econometrica*, *57*(5), 1121-1152.

Gibler, K. M., & Lindholm, A. L. (2012). A test of corporate real estate strategies and operating decisions in support of core business strategies. *Journal of Property Research*, *29*(1), 25-48.

Gibler, K., Lindholm, A. L., & Anderson, M. (2010). Corporate Real Estate Strategy and office occupiers' preferences. Corenet Global.

Gibson, V. A, & Lizieri, C. M. (1999a). Change & flexibility: the role of serviced office space in corporate real estate portfolios and office markets. *Working Papers in Land Management & Development. 01/99*. Working Paper. University of Reading, Reading, 34.

Gibson, V. A., & Lizieri, C. M. (1999b). New business practices and the corporate property portfolio: how responsive is the UK property market?. *Journal of Property Research,* 16(3), 201-218.

Gibson, V. A., & Lizieri, C. M. (2000). Space or service? The role of executive suites in corporate real estate portfolios and office markets. *Real Estate Finance Journal,* 15(4), 21-21.

Gier, S. (2006). Bereitstellung und Desinvestition von Unternehmensimmobilien: Strategiefindung auf Basis eines mehrstufigen Corporate Real Estate Management-Konzeptes. Schriften zur Immobilienökonomie Vol. 35. Müller, Köln.

Glascock, J. L., Davidson, W. N., & Sirmans, C. F. (1991). The gains from corporate selloffs: the case of real estate assets. *Real Estate Economics*, *19*(4), 567-582.

Golan, M. (1999). The own vs lease decision-Myth and reality. *Journal of Corporate Real Estate*, *1*(3), 241-253.

Graham, J. E., Galbraith, C., & Stiles, C. (2014). Real estate ownership and closely-held firm value. *Journal of Property Investment and Finance*, *32*(3), 229-243.

Gregory, A., Tharyan, R., & Christidis, A. (2013). Constructing and testing alternative versions of the Fama–French and Carhart models in the UK. *Journal of Business Finance & Accounting*, *40*(1-2), 172-214.

Grönlund, T., Louko, A., & Vaihekoski, M. (2008). Corporate real estate sale and leaseback effect: empirical evidence from Europe. *European Financial Management,* 14(4), 820-843.

Harris, R., & Cooke, H. (2014). Is corporate real estate at a crossroads?. *Journal of Corporate Real Estate*, *16*(4), 275-289.

Hartmann, S. (2011). Koordination des Corporate Real Estate Management: Kontext-Koordination-Erfolg. In: Schriften des Forschungscenters Betriebliche Immobilienwirtschaft, Immobilien Manager Verlag, Köln.

Hartmann, S., Linneman, P., Pfnür, A., Moy, D. & Siperstein, B. (2010). Responsibility for and performance of corporate real estate functions. *Journal of Corporate Real Estate*, 12(1), 7-25.

Hartmann, S., Linnemann, P., Pfnür, A., & Siperstein, B. (2007). Corporate Real Estate Benchmark Study 2007. Report: Corpus Sireo Asset Management GmbH, Heusenstamm.

Hartmann, S., Lohse, M. & Pfnür, A. (2007b). 15 Jahre Corporate real estate management in Deutschland: Entwicklungsstand und Perspektiven der Bündelung immobilienwirtschaftlicher Aufgaben bei ausgewählten Unternehmen. *Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, Vol. 10, Technische Universität Darmstadt, Darmstadt.

Haynes, B., Nunnington, N., & Eccles, T. (2017). Corporate real estate asset management: strategy and implementation. Taylor & Francis, New York.

Heyden, F. (2005). Immobilien-Prozessmanagement – Gestaltung und Optimierung von immobilienwirtschaftlichen Prozessen im Rahmen eines ganzheitlichen Prozessmanagements unter Berücksichtigung einer empirischen Untersuchung, Lang, Frankfurt am Main.

Heywood, C., & Arkesteijn, M. (2017). Alignment and theory in corporate real estate alignment models. *International Journal of Strategic Property Management*, 21(2), 144-158.

Hiang, L. K. (2001b). Real estate and corporate valuation: an asset pricing perspective. *Managerial and Decision Economics*, *22*(7), 355-368.

Hitt, M. A., Ireland, R. D., & Hoskisson, R. E. (2014). Strategic management: concepts: competitiveness and globalization. (11th ed.). South-Western College Publishing.

Hodges, C., & Sekula, M. (2013). Sustainable Facility Management: The Facility Manager's Guide to Optimizing Building Performance. Vision Spots Publishing, Alexandria.

Jacobides, M. G. (2004). How capability differences, transaction costs and scalability interact to shape vertical scope. Working Paper (version 5), London Business School, London UK.

Jensen, P. A. (2010). The Facilities Management Value Map: a conceptual framework. *Facilities*, *28*(3-4), 175-188.

Jensen, P. A., & van der Voordt, T. (2016). Facilities management and corporate real estate management as value drivers: how to manage and measure adding value. Taylor & Francis, London & New York.

Joroff, M., Louargand, M., Lambert, S., & Becker, F. (1993). Managing Property Assets in a Competitive Environment. In: Site Selection Europe, 38(12), 53-61.

Just, T., Pfnür, A., & Braun, C. (2016). *Aurelis-Praxisstudie: Wie Corporates die Märkte und das Management für produktionsnahe Immobilien einschätzen. Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, Vol. 31, Technische Universität Darmstadt, Darmstadt.

Jylhä, T. E., Remøy, H., & Arkesteijn, M. H. (2019). Identification of changed paradigms in CRE research: a systematic literature review 2005-2015. *Journal of Corporate Real Estate*, *21*(1), 27-37.

Kämpf-Dern, A., & Pfnür, A. (2014). Best practice, best model, best fit: Strategic configurations for the institutionalization of corporate real estate management in Europe. *Journal of Corporate Real Estate*, *16*(2), 97-125.

Kämpf-Dern, A., Pfnür, A. and Roulac, S. (2013). Real Estate Research in the Last Decade – Real Estate Perspectives as Major Cluster Attributes of a Real Estate Research Framework. Paper presented at Annual Meeting of the American Real Estate Society 2013, Kona, HI.

Kedia, S., Ravid, S. A., & Pons, V. (2011). When do vertical mergers create value?. *Financial Management*, *40*(4), 845-877.

Khanna, C., van der Voordt, T. J., & Koppels, P. W. (2013). Corporate real estate mirrors brand: a conceptual framework and practical applications. *Journal of Corporate Real Estate*, *15*(3-4), 213-230.

Kim Hiang, L. (2001). Corporate real estate in the Singapore stock market. *Pacific Rim Property Research Journal*, *7*(4), 271-284.

Kim, J., & De Dear, R. (2013). Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology*, *36*, 18-26.

Krumm, P. J., & de Vries, J. (2003). Value creation through the management of corporate real estate. *Journal of Property Investment & Finance*, 21(1), 61-72.

Kruskal, J. B. (1964). Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. *Psychometrika*, *29*(1), 1-27.

Kruskal, J. B., & Wish, M. (1978). Multidimensional Scaling. SAGE Publications.

Laposa, S., & Charlton, M. (2002). European versus US corporations: A comparison of property holdings. *Journal of Corporate Real Estate*, *4*(1), 34-47.

Lasfer, M. (2005). Why do Companies Lease their Real Estate Assets*?*. Cass Business School Research Paper.

Lee, S. K., & Jang, S. S. (2012). The real estate risk of hospitality firms: Examining stock-return sensitivity to property values. *International Journal of Hospitality Management*, *31*(3), 695-702.

Lev, B., & Radhakrishnan, S. (2002). Structural capital. NBER Working Paper Series.

Lindholm, A. L. (2008). A constructive study on creating core business relevant CREM strategy and performance measures. *Facilities*, *26*(7/8), 343-358.

Lindholm, A. L., & Leväinen, K. I. (2006). A framework for identifying and measuring value added by corporate real estate. *Journal of Corporate Real Estate*, *8*(1), 38-46.

Lindholm, A. L., Gibler, K., & Leväinen, K. I. (2006). Modeling the value-adding attributes of real estate to the wealth maximization of the firm. *Journal of Real Estate Research*, *28*(4), 445-476.

Ling, D. C., Naranjo, A., & Ryngaert, M. (2012). Real Estate Ownership, Leasing Intensity, and Value: Do Stock Returns Reflect a Firm's Real Estate Holdings?. *The Journal of Real Estate Finance and Economics,* 44(1-2), 84-202.

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *The Journal of Finance*, *20*(4), 587-615.

Liow, K. H. (1997). An empirical investigation of UK retail companies' property asset strategies. *Journal of Property Finance*, *8*(1), 24-34.

Liow, K. H. (2004). Corporate real estate and stock market performance. *The Journal of Real Estate Finance and Economics*, *29*(1), 119-140.

Liow, K. H. (2010). Is real estate an important factor in corporate valuation? Evidence from listed retail firms. *Journal of Corporate Real Estate,* 12(4), 249-278.

Liow, K. H., & Nappi-Choulet, I. (2008). A combined perspective of corporate real estate. *Journal of Corporate Real Estate,* 10(1), 54-67.

Liow, K. H., & Ooi, J. T. L. (2004). Does corporate real estate create wealth for shareholders? *Journal of Property Investment & Finance,* 22(5), 386-400.

Louargand, M. (1999). Real estate's influence on enterprise value. *Journal of Corporate Real Estate*, *1*(3), 254-261.

Louko, A. (2004). Corporate real estate disposal impact on performance ratios. *International journal of strategic property management*, *8*(3), 131-147.

Louko, A. (2006). Corporate real estate disposal impacts on corporate performance. Helsinki University of Technology.

Lynch, R. L. and Cross, K. F. (1992). For good measure. *CMA Magazine*, 66(3), 20-23.

Manning, C. (1991). Leasing Versus Purchase of Corporate Real Property: Leases with Residual Equity Interests. *Journal of Real Estate Research*, *6*(1), 79-85.

Mansfield, J. R., & Pinder, J. (2008). Economic and functional obsolescence: their characteristics and impacts on valuation practice. *Property Management*, *26*(3), 199-206.

Mao, Y. (2017). Managing innovation: The role of collateral. Working Paper, Cornell University, Ithaca, NY.

Mayer, H. O. (2004). Interview und schriftliche Befragung: Entwicklung, Durchführung, Auswertung, 5th edn. Oldenbourg, München.

Michael, S., Arjun, C., & James, W. (2001). Real asset ownership and the risk and return to stockholders. *Journal of Real Estate Research*, *22*(1-2), 199-212.

Mintzberg, H. & Water, J.A. (1985). Of Strategies, Deliberate and Emergent. *Strategic Management Journal* 6(3), 257-272.

Miroshnychenko, I., Strobl, A., Matzler, K., & De Massis, A. (2020). Absorptive capacity, strategic flexibility, and business model innovation: Empirical evidence from Italian SMEs. *Journal of Business Research*, 130, 670-682.

Morri, G., Djukic, D. and Chiavazza, F. (2017). Corporate real estate and performance: evidence from Italian manufacturing sectors. *Journal of Corporate Real Estate*, 19(3), 168-185.

Morschett, D. (2007). Institutionalisierung und Koordination von Auslandseinheiten. Gabler, Wiesbaden.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 768-783.

Mühlroth, C., & Grottke, M. (2018). A systematic literature review of mining weak signals and trends for corporate foresight. *Journal of Business Economics*, *88*(5), 643-687.

Nappi-Choulet, I. (2002). Corporate property outsourcing in Europe: Present trends and new approach for real estate economics. IPD European Property Strategies Conference, Wiesbaden, Germany.

Nappi-Choulet, I., Missonier-Piera, F., & Cancel, M. (2009). Value creation and the impact of corporate real estate assets: An empirical investigation with French listed companies. *Journal of Corporate Real Estate,* 11(2),78-90.

Nourse, H., & Roulac, S. (1993). Linking real estate decisions to corporate strategy. *Journal of Real Estate Research*, *8*(4), 475-494.

O'mara, M. A. (1999). Strategy and place: managing corporate real estate and facilities for competitive advantage. Simon and Schuster, New York.

Omokolade, A., Eng, O. S. and Faishal, I. M. (2013). Corporate Real Estate Holdings and Firm Returns of Shariah Compliant Firms. Working Paper.

Park, A., & Glascock, J. L. (2010). The Performance Impact of Strategic Corporate Real Estate in Franchise Organizations. *Journal of Corporate Real Estate*, *12*(2), 82-95.

Penrose, E. T. (1959). The Theory of the Growth of the Firm, Oxford University Press, Oxford.

Pettengill, G. N., Sundaram, S., & Mathur, I. (1995). The Conditional Relation between Beta and Returns. *Journal of Financial and Quantitative Analysis*, *30*(1), 101-116.

Pfnür, A., & Weiland, S. (2010). CREM 2010: Welche Rolle spielt der Nutzer? *Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, Vol. 21, Technische Universität Darmstadt, Darmstadt.

Pfnür, A. (1998). Stand und Entwicklung der Organisation des Immobilienmanagements bei Großunternehmen in Deutschland. Arbeitsbereich Öffentliche Wirtschaft, Fachbereich Wirtschaftswissenschaften Universität Hamburg, Vol. 24, Hamburg.

Pfnür, A. (2002), Betriebliche Immobilienökonomie, Physica, Heidelberg.

Pfnür, A. (2011). Modernes Immobilienmanagement: Immobilieninvestment, Immobiliennutzung, Immobilienentwicklung und-betrieb. Springer-Verlag, Berlin Heidelberg.

Pfnür, A. (2014). Economic Relevance of Corporate Real Estate Management in Germany. Gutachten im Auftrag des Auftraggeberkonsortiums Zentraler Immobilienaussschuss eV. CoreNet Global Inc. Central Europe Chapter, BASF SE, Siemens AG und Eurocres Consulting GmbH.

Pfnür, A., & Armonat, S. (2004). Desinvestment von Unternehmensimmobilien unter besonderer Berücksichtigung der Vermarktungsmöglichkeiten. Arbeitsbereich Öffentliche Wirtschaft Fachbereich Wirtschaftswissenschaften Universität Hamburg, Hamburg, Vol 32.

Pfnür, A., & Hedden, N.(2002). Corporate Real Estate 2002–Institutionalisierung des betrieblichen Immobilienmanagements. Arbeitsbereich Öffentliche Wirtschaft Fachbereich Wirtschaftswissenschaften Universität Hamburg, Hamburg, Vol. 28.

Pfnür, A., & Seger, J. (2017). Produktionsnahe Immobilien - Herausforderungen und Entwicklungsperspektiven aus Sicht von Corporates, Investoren und Dienstleistern. *Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, Vol. 34, Technische Universität Darmstadt, Darmstadt.

Pfnür, A., & Seger, J. (2019). Corporate real estate specificity, ownership and its contribution to firm performance: empirical evidence from the German capital market. 26th Annual European Real Estate Society, 05.07.2019 Cergy-Pontoise Cedex, France.

Pfnür, A., & Wagner, B. (2020). Transformation of the real estate and construction industry: empirical findings from Germany. *Journal of Business Economics*, 90, 975–1019.

Pfnür, A., Gauger, F., Bachtal, Y., & Wagner, B. (2021). Homeoffice im Interessenkonflikt. *Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, Vol. 41, Technische Universität Darmstadt, Darmstadt.

Pfnür, A., Seger, J., & Appel-Meulenbroek, R. (2019). Impact of corporate real estate on the firm performance: Theoretical concept and empirical evidence, 26th Annual European Real Estate Society, 05.07.2019 Cergy-Pontoise Cedex, France.

Pfnür, A. (2019). Herausforderungen des Corporate Real Estate Managements im Strukturwandel. *Published report by Zentraler Immobilien Ausschuss (eV.)*.

Picot, A. (1981). Strukturwandel und Unternehmensstrategie Teil 1. Wirtschaftswissenschaftliches Studium, (11), 527-532.

Porter, M.E. (1985). Competitive Advantage. Free Press, New York, NY.

Rappaport, A. (1986). Creating shareholder value: the new standard for business performance. Free press, New York.

Ratcliffe, J. (2001). Imagineering global real estate: a property foresight exercise. *Foresight,* 3(5), 453-465.

Remøy, H., Rovers, S., & Nase, I. (2019). Disposal strategies in corporate real estate portfolios: Evidence from the Dutch banking sector. *Journal of Corporate Real Estate*, 21(2), 113-129.

Rochdi, K. (2015). The risk of real estate ownership: evidence from German equities. *Journal of European Real Estate Research,* 8(2), 107-129.

Rodriguez, M., & Sirmans, C. (1996). Managing corporate real estate: evidence from the capital markets. *Journal of Real Estate Literature,* 4(1), 13-33.

Roelofsen, P. (2002). The impact of office environments on employee performance: The design of the workplace as a strategy for productivity enhancement. *Journal of Facilities Management*, *1*(3), 247-264.

Roulac, S. (1999). Real estate value chain connections: tangible and transparent. *Journal of Real Estate Research*, *17*(3), 387-404.

Roulac, S. (2003). Corporate-owned real estate represents a substantial investment universe. *Journal of Real Estate Portfolio Management*, *9*(2), 167-178.

Rumelt, R. P. (1984). Towards a strategic theory of the firm. *Competitive strategic management*, *26*(3), 556-570.

Rutherford, R. C. (1990). Empirical Evidence on Shareholder Value and the Sale-Leaseback of Corporate Real Estate. *Real Estate Economics,* 18(4), 522-529.

Schäfers, W. (1997). Strategisches Management von Unternehmensimmobilien: Bausteine einer theoretischen Konzeption und Ergebnisse einer empirischen Untersuchung. Schriften zur Immobilienökonomie Vol. 3. Müller, Köln.

Scheffer, J. J., Singer, B. P., & Van Meerwijk, M. C. (2006). Enhancing the contribution of corporate real estate to corporate strategy. *Journal of Corporate Real Estate*, *8*(4), 188.

Schehl, M. (1994). Die Kostenrechnung der Industrieunternehmen vor dem Hintergrund unternehmensexterner und-interner Strukturwandlungen. Duncker & Humblot, Berlin.

Seger, J., & Pfnür, A. (2021). The impact of structural changes on corporate real estate ownership: evidence from Germany. *International Journal of Strategic Property Management*, *25* (1).

Seger, J., Li, A., & Pfnür, A. (2020). Corporate real estate holdings and the stock market performance. *Journal of European Real Estate Research*. 13(2), 181-206.

Seger, J., Pfnür, A. (2018). Impact of Structural Change on Corporate Real Estate Ownership: Evidence from the German Corporate Real Estate Market, paper presented at European Real Estate Society (ERES), 29th June 2018, Reading, UK.

Seiler, M. J., Chatrath, A., & Webb, J. R. (2001). Real Asset Ownership and the Risk and Return to Stockholders. *Journal of Real Estate Research*, *22*(1/2), 199-212.

Sharma, P., Leung, T. Y., Kingshott, R. P., Davcik, N. S., & Cardinali, S. (2020). Managing uncertainty during a global pandemic: An international business perspective. *Journal of Business Research*, *116*, 188-192.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425-442.

Simangunsong, E., Hendry, L. C., & Stevenson, M. (2012). Supply-chain uncertainty: a review and theoretical foundation for future research. *International Journal of Production Research*, *50*(16), 4493-4523.

Sing, T. F. (2005). Impact of information and communications technology on real estate space: perspective of office occupiers. *Journal of Property Investment & Finance,* 23(6), 494-505.

Sing, T. F., & Sirmans, C. F. (2008). Does real estate ownership matter in corporate governance?. *Journal of Property Research*, *25*(1), 23-43.

Smith Jr, C. W., & Wakeman, L. M. (1985). Determinants of corporate leasing policy. *The Journal of Finance*, *40*(3), 895-908.

Spence, I., & Ogilvie, J. C. (1973). A table of expected stress values for random rankings in nonmetric multidimensional scaling. *Multivariate Behavioral Research*, *8*(4), 511-517.

Statista (2019). Anteil der Wirtschaftssektoren an der Bruttowertschöpfung. Available at: https://de.statista.com/statistik/daten/studie/36846/umfrage/anteil-der-wirtschafts-bereiche-am-bruttoinlandsprodukt (accessed 02 February 2020).

Tay, L., & Liow, K. H. (2006). Corporate real estate management in Singapore: A business management perspective. *International Journal of Strategic Property Management*, 10(2), 93-111.

Teece, D., Peteraf, M., & Leih, S. (2016). Dynamic capabilities and organizational agility: Risk, uncertainty, and strategy in the innovation economy. California Management Review, 58(4), 13-35.

Ting, K. H. (2006). Impact of the Asian financial crisis on corporate real estate disposals. *Journal of Corporate Real Estate,* 8(1), 27-37.

Ting, K. H. (2007). Impact of the Asian financial crisis on corporate real estate acquisitions. *Journal of Corporate Real Estate*, *9*(4), 239-256.

Todesco, G. (1998). Efficiency through design integration. *ASHRAE journal*, *40*(6), 52.

Tregoe, B.B. & Zimmerman, J.W. (1980). Top management strategy. What it is and how to make it work. London, UK: John Martin Publishing, London.

Tuzel, S. (2010). Corporate real estate holdings and the cross-section of stock returns. *The Review of Financial Studies,* 23(6), 2268-2302.

Van der Voordt, T. (2004). Productivity and employee satisfaction in flexible workplaces. *Journal of Corporate Real Estate*, *6*(2).

Verhoeff, T. J., Arkesteijn, M., Binnekamp R. & De Jonge, H. (2014). Optimising Juridical-financial Flexibility of Corporate Real Estate. *21st Annual European Real Estate Society Conference*, Bucharest, Romania.

Weber, F., & Scheunemann, H. (2018). Logistik- und Industriemarktüberblick Deutschland 1. Quartal 2018, ed. JLL. Frankfurt a. M.

Wheaton, W. C. (1996). A perspective on telecommunications technology and real estate: office, industrial, and retail markets. *Real Estate Finance,* 13, 13-17.

Windahl, C., Andersson, P., Berggren, C., & Nehler, C. (2004). Manufacturing firms and integrated solutions:: characteristics and implications. *European Journal of Innovation Management*, *7*(3), 218-228.

Wolf, J. (1994). Internationales Personalmanagement: Kontext-Koordination-Erfolg. Gabler, Wiesbaden.

Wolfgang H.. Staehle, Conrad, P., & Sydow, J. (1999). Management: eine verhaltenswissenschaftliche Perspektive. F. Vahlen, München.

Yu, S. M., & Liow, K. H. (2009). Do retail firms benefit from real estate ownership?.*Journal of Property Research*, *26*(1), 25-60.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of management review*, *27*(2), 185-203.

Zeckhauser, S., & Silverman, R. (1983). Rediscover Your Company's Real Estate. *Harvard Business Review*, *61*(1), 111-117.

Zhao, D,, & Sing, T. F. (2011). Why do firms own and not lease corporate real estate?. IRES Working Paper Series, IRES2011-003, 42 p.

Zhao, D., & Sing, T. F. (2016). Corporate real estate ownership and productivity uncertainty. *Real Estate Economics,* 44(2), 521-547.

Zott, C., & Amit, R. (2006). How do firm specificity and asset specificity differ? Implications for the choice of firm boundaries. Working Paper.

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Appendix A – Appendix of the article "Corporate real estate holdings, business segments and the firm return"

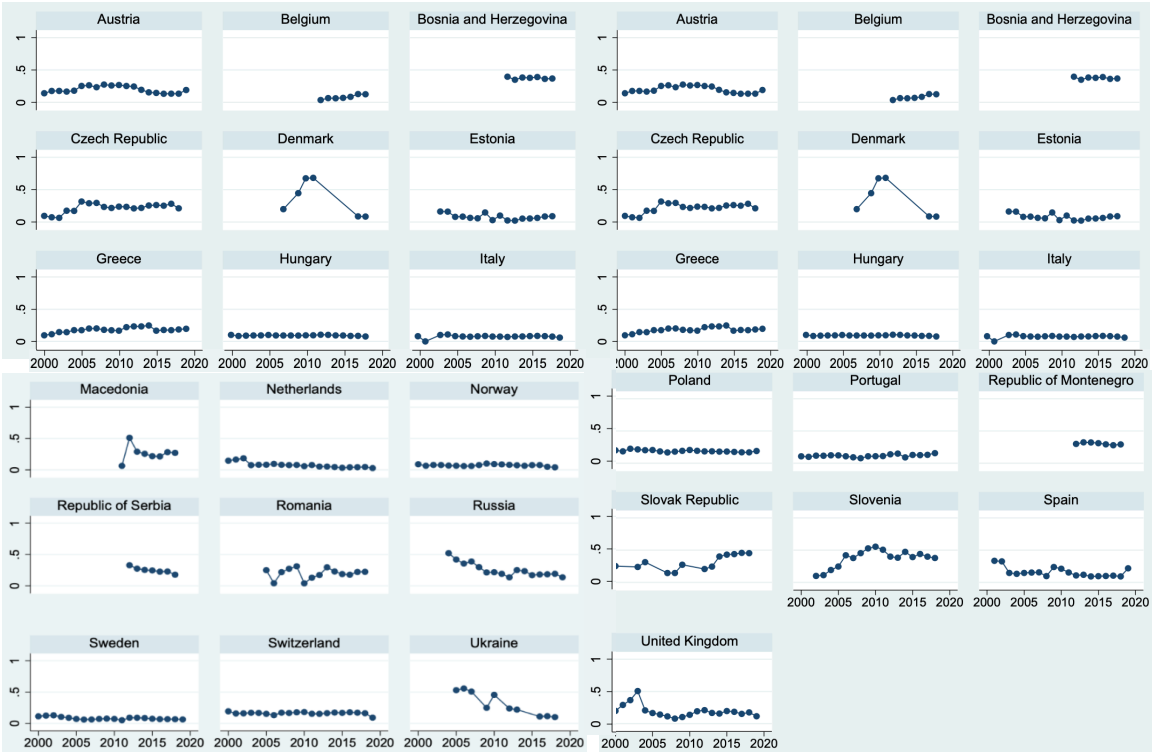
Appendix A1: Description of adopted variables

Variables	Formula	Items from Datastream
CRER1	$CRER1_{i,t} = \frac{PP\&E\ Net_{i,t}}{TA_{i,t}}$	Property Plant & Equipment Net (WC02501), Total Assets (WC02999)
CRER2	$CRER2_{i,t} = \frac{Buildings_{i,t} - AD\ Buildings_{i,t}}{TA_{i,t}}$	Buildings (WC18376), Accumulated Deprecation Buildings (WC18384), Total Assets (WC02999)
CRER3	$CRER3_{i,t} = \frac{(Land_{i,t}+Buildings_{i,t})-(AD\ Land_{i,t}+AD\ Buildings_{i,t})}{TA_{i,t}}$	Land (WC18375), Buildings (WC18376), Accumulated Deprecation Land (WC18383), Accumulated Deprecation Buildings (WC18384), Total Assets (WC02999)
Return	$R_{i,t} = \frac{RI_{i,t} - RI_{i,t-1}}{RI_{i,t-1}}$	Total return index (RI)
Alpha	/	Intercepts in the CAPM regressions
Beta	/	Slope coefficient in the CAPM regressions
Leverage	$Leverage_{i,t} = \frac{long\ term\ debt_{i,t}}{TA_{i,t}}$	Long term debt (WC03251), Total Assets (WC02999)
Size	$Size_{i,t} = Ln(Share\ price_{i,t} \cdot Outstandings_{i,t})$	Share price (p), Common shares outstanding (WC05301)
BE/ME	$BE/ME_{i,t} = \frac{SE_{i,t} - Detax_{i,t}}{Share\ price_{i,t} \cdot Outstandings_{i,t}}$	Shareholders' Equity (WC03501), Deferred taxes (WC03263)

Note: i refers to firms, i=1,2,3,…,490; t refers to year, t=1,2,3,…,17.

Appendix B – Appendix of the article "Corporate real estate ownership, business uncertainty and the firm return"

Appendix B1: Average ownership ratio by country



Appendix B2: Description of adopted variables in first study

Variables	Formula
Corporate Real Estate Ratio 1 *(e.g. Zhao and Sing., 2016)*	$CRER1_{i,t} = \frac{(Land_{i,t}+Buildings_{i,t})-(AD\ Land_{i,t}+AD\ Buildings_{i,t})}{Total\ assets_{i,t}} - \frac{1}{N_I}\sum_{1}^{N_I}\frac{(Land_{i,t}+Buildings_{i,t})-(AD\ Land_{i,t}+AD\ Buildings_{i,t})}{Total\ assets_{i,t}}$
Specificity 1 *(Kedia et al., 2011; Bhaduri, 2002)*	$SPEC1_{i,t} = \frac{R\&D\ expenditures_{i,t}}{Total\ assets_{i,t}}$
Specificity 2 (e.g. Berger *et al.;* 1997)	$SPEC2_{i,t} = \frac{SGA\ expenditures_{i,t}}{Total\ assets_{i,t}}$ *SGA stands for sales, general, and administrative expenses*
Uncertainty *(Basing on Zhao and Sing, 2016; Ambrose et al., 2017)*	$UC_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(SalesGrowth_{i,t} - \frac{1}{T}\sum_{i=1}^{T}SalesGrowth_{i,t})^2}$
Level of Debt *(e.g. Du et al., 2014)*	$Debt\ ratio_{i,t} = \frac{longtermDebt_{i,t}}{Total\ assets_{i,t}}$
Firm size *(Du et al. 2014, Ambrose et al., 2017)*	$SIZE_{i,t} = Book\ value\ of\ equity$
Growth opportunities *(Yu & Liow 2009, Zhao and Sing, 2016)*	$Growth_{i,t} = \frac{Market\ value\ of\ equity_{i,t}}{Book\ value\ of\ equity_{i,t}}$
Industry *(Du et al., 2014, Zhao and Sing, 2016)*	$Industry_{i,t} = SIC - Code\ classification$

Appendix B3: Descriptive statistics of variables in first study

Variables	Observation	Mean	Std. Dev.	Min	Max
$CRER1_{i,t}$	26,054	0.1446545	0.2093263	4.19e-07	0.9962668
$CRER2_{i,t}$	25,652	0.0000445	0.1210303	-0.7719908	0.8066761
$SPEC1_{i,t}$	11,878	.0718172	.1184047	7.60e-07	.9943125
$SPEC2_{i,t}$	34,026	0.2196121	0.2194648	2.01e-06	1
$UC_{i,t}$	34,128	2.508921	39.82626	.005898	2094.637
$Leverage_{i,t}$	37,233	.1581024	.2316301	0	0.9998462
$SIZE_{i,t}$	48,877	1292708	6281243	0	1.77e+08
$Growth_{i,t}$	39,997	2.851139	5.141247	0.0001411	49.7751

Appendix B4: Description of adopted variables in second study

Variables	Formula
Corporate Real Estate Ratio 1 *(e.g. Rochdi 2015)*	$CRER1_{i,t} = \frac{(Land_{i,t} + Buildings_{i,t}) - (AD\ Land_{i,t} + AD\ Buildings_{i,t})}{Total\ assets_{i,t}}$
Return	$R_{i,t} = \frac{RI_{i,t} - RI_{i,t-1}}{RI_{i,t-1}}$ *RI stands for total return index*
Alpha	α_{it} Intercepts in the first-step regressions
Beta	β_{it} Slope coefficient in first-step regressions
Level of Debt	$Debt\ Ratio_{it} = \frac{Total\ Debt_{i,t}}{Total\ Assets_{i,t}}$
Firm size *(e.g. Du et al., 2014)*	$size_{i,t} = ln(Share\ price_{i,t} \cdot Outstanding\ shares_{i,t})$
Growth opportunities	$Growth_{i,t} = \frac{Shareholder's\ Equity_{i,t} - Deferred\ Taxes_{i,t}}{Share\ price_{i,t} \cdot Outstanding\ shares_{i,t}} = \frac{Market\ value\ of\ equity_{i,t}}{Book\ value\ of\ equity_{i,t}}$
Uncertainty	$UC_{i,t} = \sqrt{\frac{1}{T-1} \sum_{t=1}^{T} (net\ sales_{it} - \frac{1}{T} \sum_{i=1}^{T} net\ sales_{it})^2}$

Appendix B5: Descriptive statistics of variables in second study

Variables	Observation	Mean	Std. Dev.	Min	Max
$CRER2_{i,t}$	8,875	0.146255	0.1498812	-0.2347198	1.710623
α_{it}	100,273	-0.0026967	18.44388	-1066.113	3981.132
β_{it}	100,273	0.0063916	1.750885	-301.8033	241.7443
$Debt\ Ratio_{it}$	91,209	0.3291336	11.6773	-0.0374429	3134
$size_{i,t}$	84,773	4.42e+07	3.96e+08	0	1.41e+10
$Growth_{i,t}$	66,769	13.02982	3424.041	-286005.4	829752.6
$Uncertainty_{i,t}$	86,092	1867451	7.60e+07	0	2.13e+10

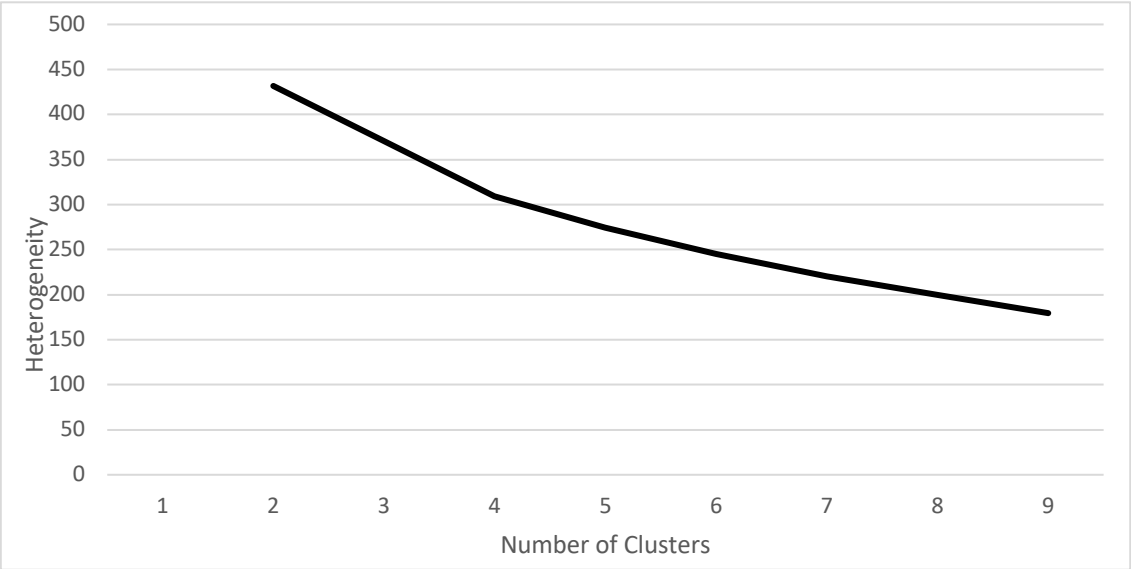
Appendix B6: Regression model on alpha with 2 year lagged independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CRER1 (-2)	0.0258***	-0.0198	0.0211	0.0230**	0.0101	0.00394	0.00638	0.00336	0.00878	0.00894
	(0.00984)	(0.0366)	(0.0129)	(0.0100)	(0.0110)	(0.00513)	(0.0112)	(0.00524)	(0.00561)	(0.00572)
Debtrat.(-2)	0.00652	0.0173	-0.00457	0.00701	0.00494	-0.00394	0.00460	-0.00386	-0.00366	-0.00386
	(0.00697)	(0.0115)	(0.00408)	(0.00702)	(0.00724)	(0.00310)	(0.00729)	(0.00311)	(0.00317)	(0.00318)
Size (-2)	-0.00161**	-0.00564**	-0.0169***	-0.00172**	-0.00159**	-0.00076**	-0.00179**	-0.00087**	-0.0017***	-0.0020***
	(0.00064)	(0.00286)	(0.00113)	(0.00067)	(0.00075)	(0.00036)	(0.00080)	(0.00037)	(0.00042)	(0.00044)
Growth (-2)	8.67e-05	1.60e-05	2.62e-05	8.07e-05	4.64e-05	2.58e-05	4.04e-05	2.43e-05	1.35e-05	9.71e-06
	(6.71e-05)	(0.000105)	(3.73e-05)	(6.73e-05)	(6.83e-05)	(2.66e-05)	(6.84e-05)	(2.67e-05)	(2.72e-05)	(2.72e-05)
Uncertainty	6.67e-11	-1.47e-10	-1.77e-10	6.96e-11	-1.13e-10	0	-1.08e-10	0	0	0
	(1.65e-10)	(3.65e-10)	(1.29e-10)	(1.65e-10)	(1.80e-10)	(7.92e-11)	(1.81e-10)	(7.94e-11)	(8.36e-11)	(8.37e-11)
Constant	-0.0672***	-0.00933	0.0839***	-0.0678***	-0.0692***	-0.125***	-0.0687***	-0.124***	-0.113***	-0.108***
	(0.00916)	(0.0397)	(0.0158)	(0.0103)	(0.0153)	(0.00598)	(0.0163)	(0.00654)	(0.00966)	(0.0101)
Company FE		Yes	Yes							
Year FE			Yes			Yes		Yes	Yes	Yes
Branche FE				Yes			Yes	Yes		Yes
Land FE					Yes		Yes		Yes	Yes
Observati-ons	7,077	7,077	7,077	7,077	7,077	7,077	7,077	7,077	7,077	7,077
Adj. R-squared	0.0356	-0.191	0.851	0.0360	0.0822	0.781	0.0816	0.782	0.788	0.790
R-squared	0.0004	0.0013	0.876	0.0005	0.0008	0.8710	0.0009	0.8711	0.8716	0.8718

Note: Standard errors in parentheses and significant at ***p<0.01, **p<0.05, *p<0.1

Appendix C – Appendix of the article "Structural changes and corporate real estate ownership"

Appendix C1: Cluster fusion process and validation of cluster solution

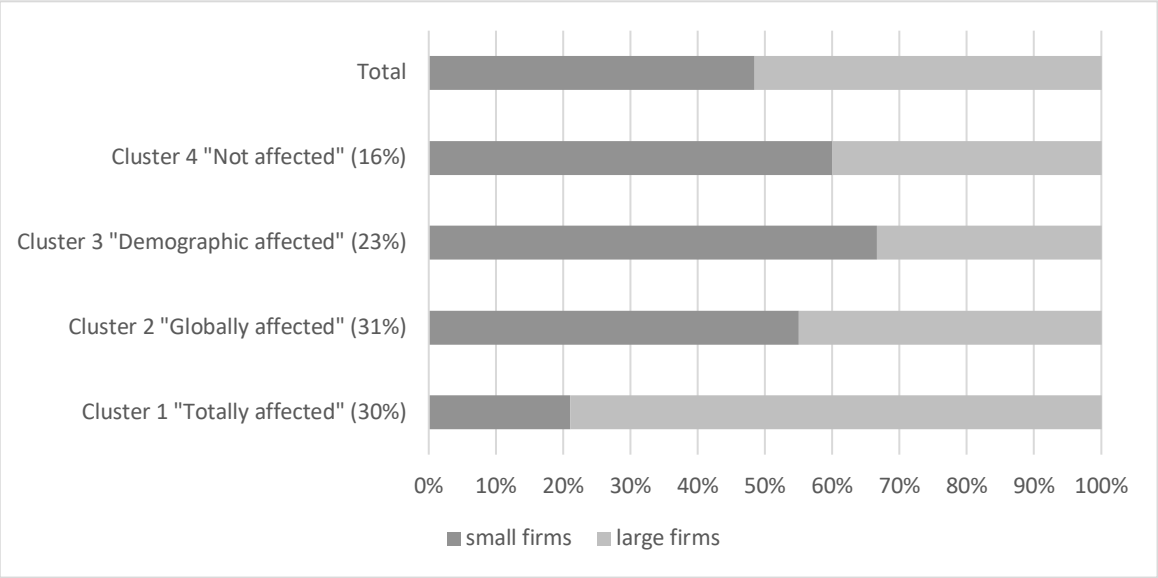


Note: Cluster heterogeneity measured by coefficients during fusion process (ordinate) and possible cluster solutions (abscissa). A break in the line represents the optimal number of clusters. Elbow criterion to determine optimal cluster count.

Appendix C2: Contingency table for cluster solutions and company size differentiated by number of employees

			< 20,000 employees	> 20,000 employees	Total
Cluster No. & Name	1 'Totally affected'	Count	4	15	19
		Expected Count	9.2	9.8	19
	2 'Globalisation affected"	Count	11	9	20
		Expected Count	9.7	10.3	20
	3 'Demographically affected'	Count	10	5	15
		Expected Count	7.3	7.7	15
	4 'Not affected'	Count	6	4	10
		Expected Count	4.8	5.2	10
Total		Count	31	33	64
		Expected Count	31	33	64

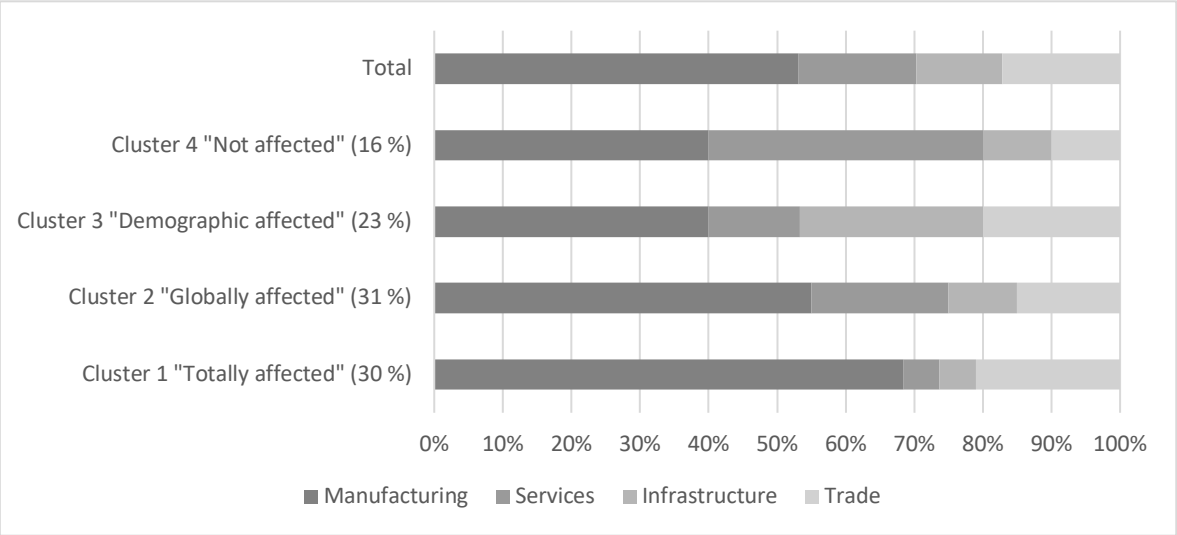
Appendix C3: Graphical representation of the contingency table according to the percentage composition of the clusters divided into companies with < 20,000 and > 20,000 employees



Appendix C4: Contingency table for the cluster solutions differentiated according to industry sector

			Manufacturing	Services	Infrastructure	Trade	Total
Cluster No. & Name	1 'Totally affected'	Count	13	1	1	4	19
		Expected Count	10.1	3.3	2.4	3.3	19
	2 'Globalisation affected'	Count	11	4	2	3	20
		Expected Count	10.6	3.4	2,5	3.4	20
	3 'Demographically affected'	Count	6	2	4	3	15
		Expected Count	8	2.6	1.9	2.6	15
	4 'Not affected'	Count	4	4	1	1	10
		Expected Count	5.3	1.7	1.3	1.7	10
Total		Count	34	11	8	11	64
		Expected Count	34	11	8	11	64

Appendix C5:: Graphical representation of the contingency table according to the percentage composition of clusters by their industry segments



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Ich versichere hiermit, dass ich die vorstehende Arbeit

Thema

„Corporate Real Estate Ownership Under a Dynamic Business Environment"

selbstständig und ohne fremde Hilfe angefertigt, und dass ich alle von anderen Autoren wörtlich übernommene Stellen wie auch die sich an die Gedankengänge anderer Autoren eng anlehnenden Ausführungen meiner Arbeit besonders gekennzeichnet und die Quellen zitiert habe.

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Ort, den *Datum* *Unterschrift*
(Vor- und Zuname)