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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 scrutinize their high ownership ratios.

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

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 & 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 & Eichholtz, 2005; Deng & Gyourko, 1999; Grönlund et al., 2008; Liow & Ooi, 2004; Nappi-Choulet et al., 2009; Ting, 2006; Liow, 2010; Ling et al., 2012; Rochdi, 2015; Rodriguez & Sirmans, 1996; Rutherford, 1990; Tuzel, 2010). As a result, for example, the long-term nature of

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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:

RQ1: How does structural change alter the overall demand for CRE in terms of holding them in ownership?

RQ2: Do corporates adjust their ownership in response to structural change?

To answer the first research question, section 1 gives a literature review and provides initial explanations to the altering demand for CRE ownership under business environmental changes. For this purpose the section 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 section 2, subdivided into a preliminary and an empirical study. Section 3 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 section.

1. Literature review

1.1. 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 & 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 & Roulac, 1993). The provision of CRE resources, whether through ownership or alternative forms, influences finally the organisation's success.

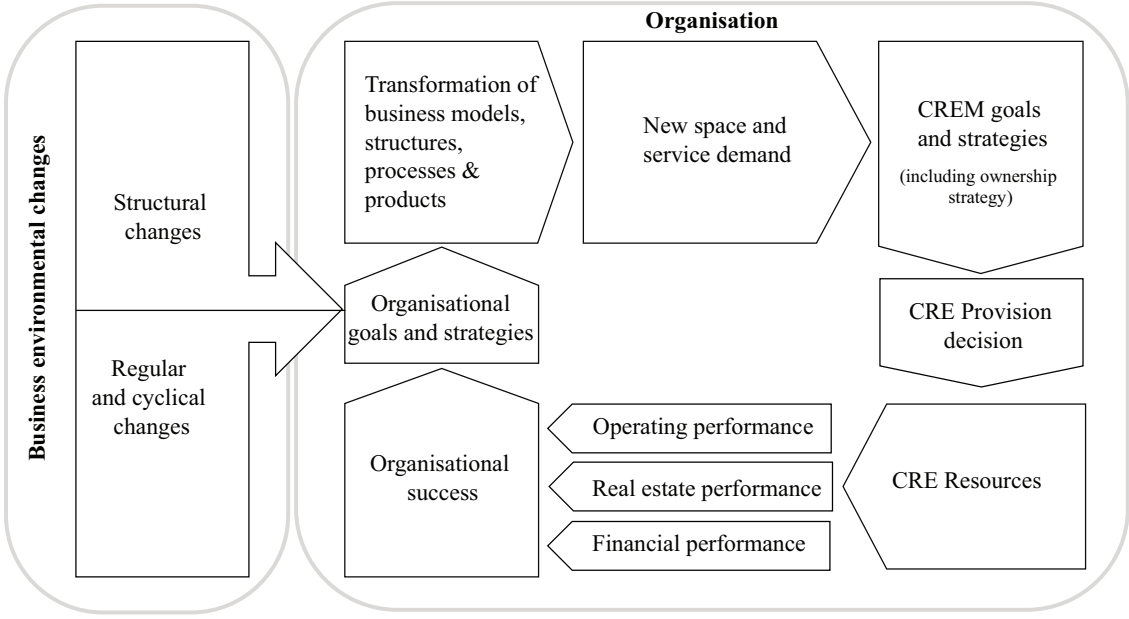


Figure 1. CRE provision as a continuous process of alignment to the business environment

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.[1] 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 & 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 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 1 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): 'CRE managers need the ability to dynamically realign their CRE portfolio in response to planned and unforeseen changes'.

1.2. 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.[2] 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 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.

[1] 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.

[2] The procedure for the preliminary study is explained in more detail in Section 2.2.

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 & 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 & McAllister, 2014; Pfnür & 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 & 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 & 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 & 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 & 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 1.

The explanations in Table 1 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 2 distinguishes the hypotheses based on type of use.

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

Table 1. 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

Table 2. Hypothesis 1 – Differences in ownership strategy by type of use and situation of 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*

Table 3. Hypothesis 2 – Differences in the demand for ownership-reducing solutions by situation of 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*

Table 4. Hypothesis 3 – More highly affected corporates tend to exhibit 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*

a service' solutions.[3] 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. Table 3 outlines the corresponding hypotheses.

[3] 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).

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 4.

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

2. Research design and methodology

2.1. 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 & 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 Section 1.2), which are tested empirically in the second part of the study.

2.2. 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[4] in 2016 and at least one of the keys A–H in the German classification scheme of economic activities called WZ2008.[5] 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

[4] 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.

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

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 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 & 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 2.

3. Analysis and findings

Table 5 and Figure 3 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

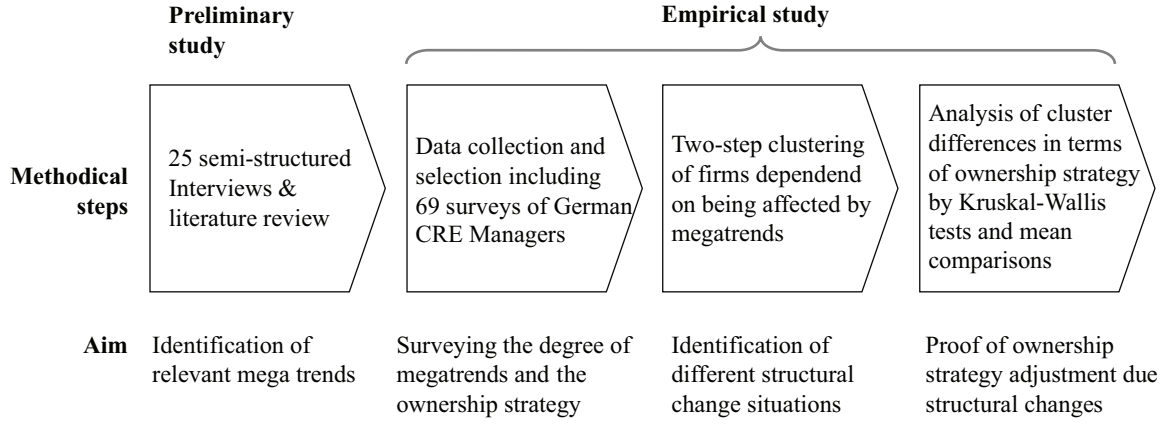
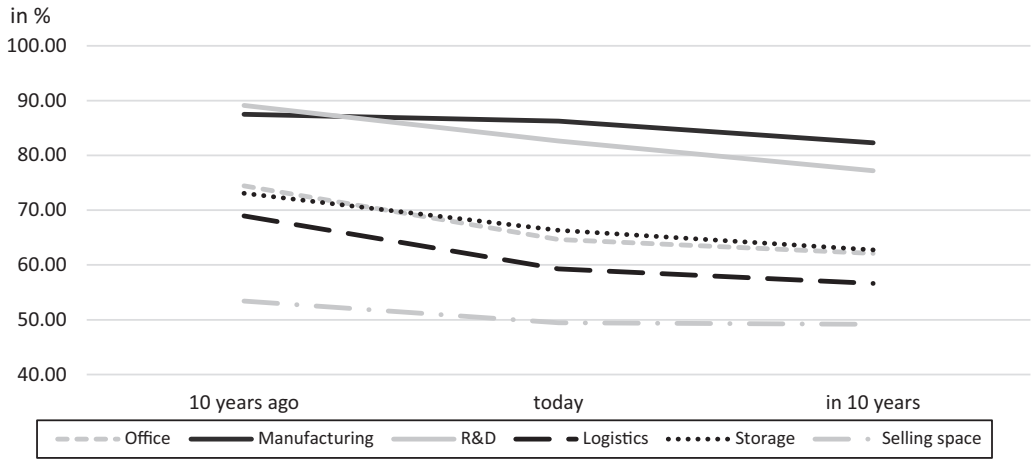


Figure 2. Visualisation of research design and methodology

Table 5. 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.



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.

Figure 3. Ownership ratios differentiated over time and according to use type

Table 6. Descriptive evaluation of the relevance of the drivers of structural change to the real estate economy

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).

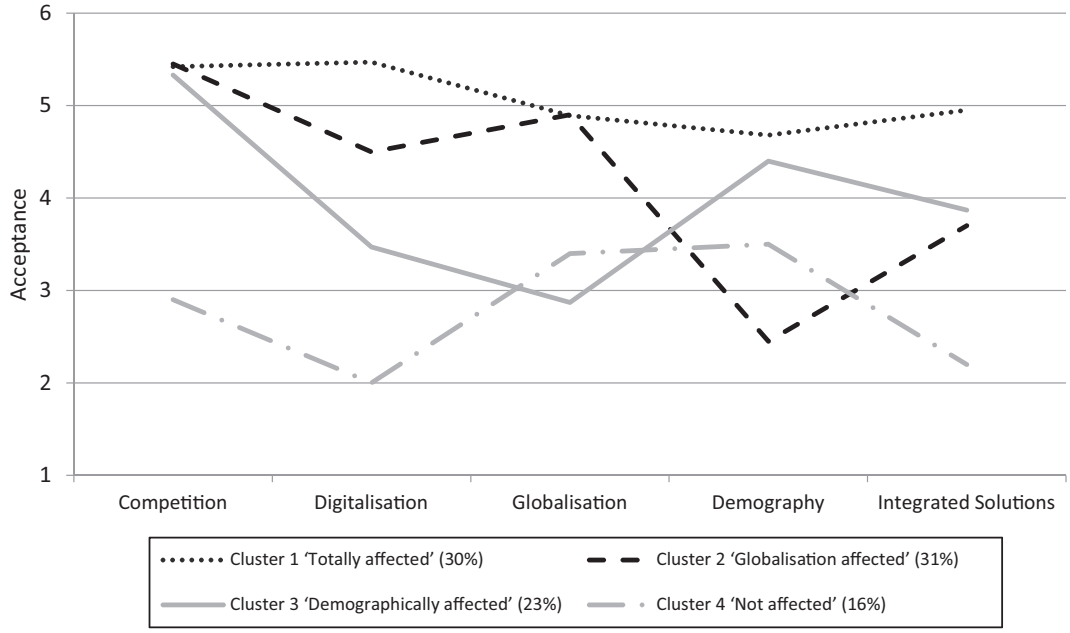
also be concluded from this that the ownership strategy is probably influenced by a wide variety of situational influences. Section 1 has already provided an overview of potential influences of the business environment on ownership strategy. Whether structural change is one of these determinants is the 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.

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 3 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 6). 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.

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.



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).

Figure 4. Affected situations of corporate real estate management in structural change as a cluster solution

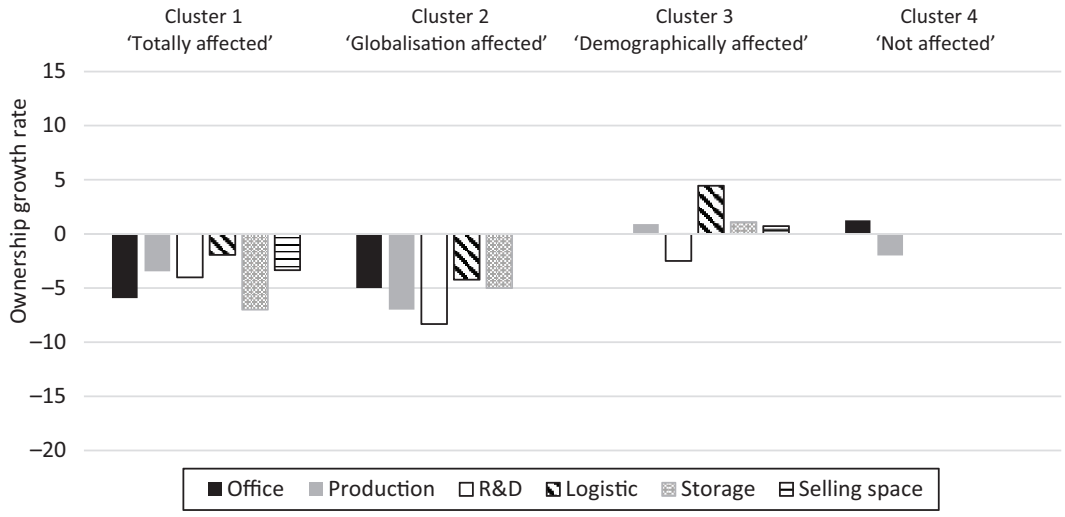
The following two-step cluster analysis contains in the first step a hierarchical–agglomerative method, Ward algorithm and the squared Euclidean distance measure. The optimal number of clusters is identified by using the so-called 'elbow criterion' (Appendix A). Afterwards, the solution is used as the 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.[6] Accordingly, the following four clusters are represented as line plots of the mean values in Figure 4. 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 B).

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.[7] 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.

[6] 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.

[7] 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.



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

Figure 5. Ownership growth rates by structural change situation and use type

As shown in Figure 3, 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 5). This provides insights if the ownership strategy differs between structural change situations.

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 7). 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 8).

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

Table 7. Kruskal–Wallis test statistic using structural change clusters as the 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 8. Pairwise cluster comparison for differences in office ownership adjustments using 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

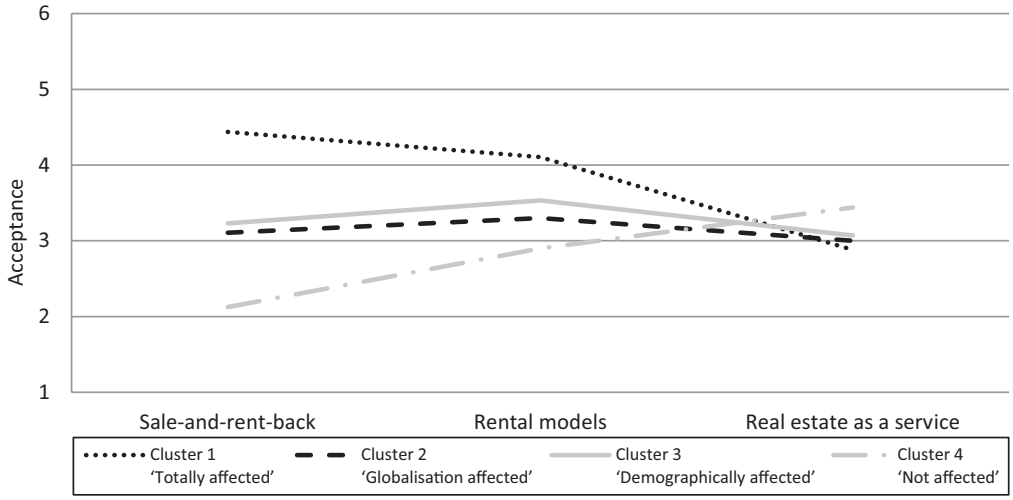
Note: The table shows test statistics of the cluster solutions compared in pairs. The first column shows six possible pair comparisons. The significance levels were adjusted (adj. sig.) to avoid a cumulative alpha error due to multiple testing.

weak industry differences in the contingency table (Appendix B), 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 Section 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 6. 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.

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 9). 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.

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 10). 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



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).

Figure 6. Acceptance to selected measures to pursue an ownership-reducing strategy

Table 9. Kruskal–Wallis test statistic using structural change clusters as the grouping variable

	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.

Table 10. 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.

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.

Conclusions

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 et al., 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 & 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.

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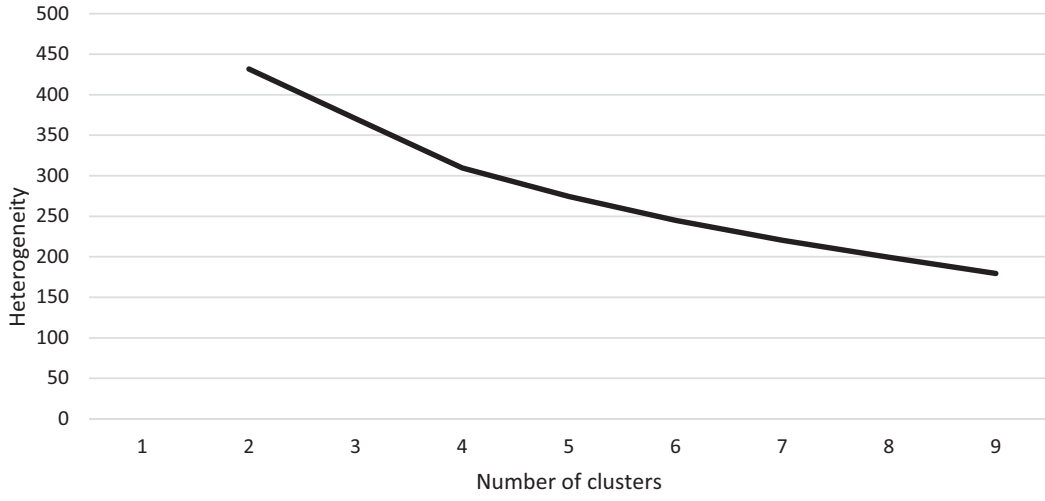
Appendix

Appendix A. 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.

Figure A1. Elbow criterion to determine optimal cluster count. Cluster heterogeneity measured by coefficients during fusion process (ordinate) and possible cluster solutions (abscissa)

Appendix B. Cluster composition according to company size and sector

Table A1. Contingency table for cluster solutions and company size differentiated by number of employees (<20.000 and >20.000)

			<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

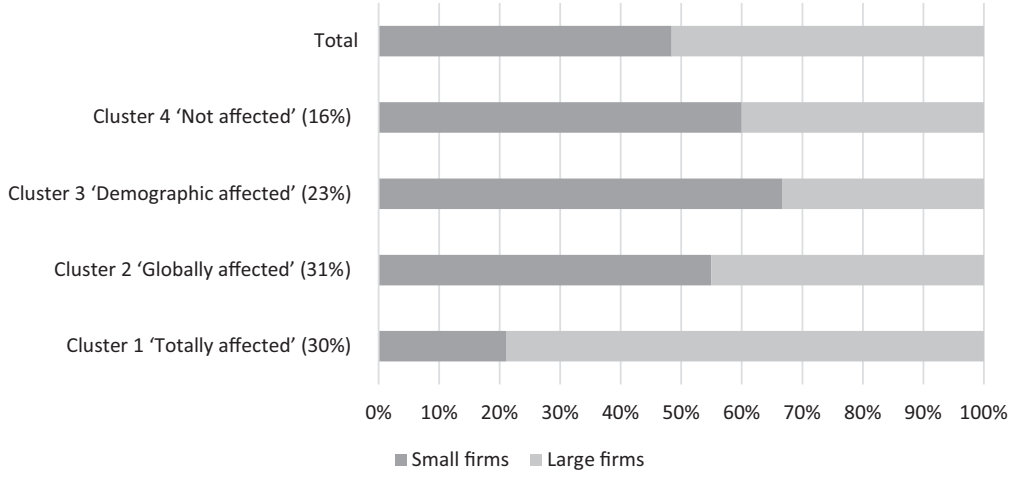


Figure A2. Graphical representation of the contingency table according to the percentage composition of the clusters divided into companies with <20.000 and >20.000 employees

Table A2. 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

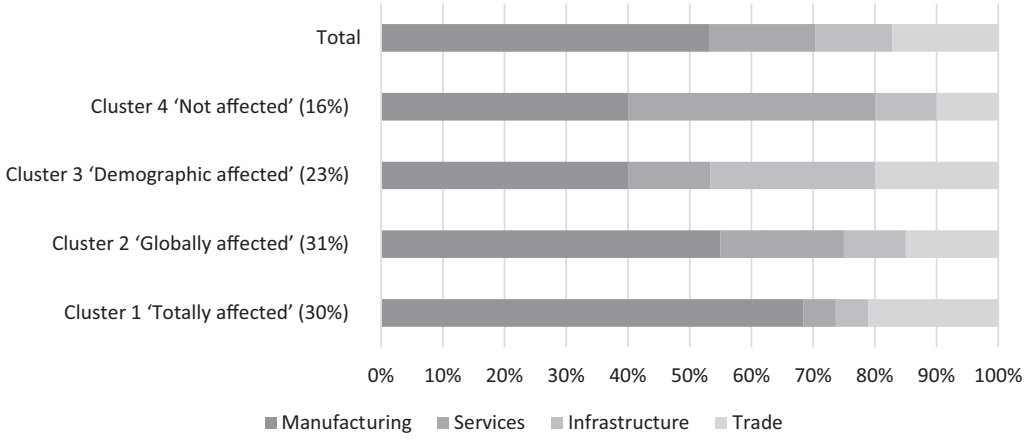


Figure A3. Graphical representation of the contingency table according to the percentage composition of clusters by their industry segments